

# Package ‘RemixAutoML’

December 6, 2021

**Title** Remix Automated Machine Learning

**Version** 0.6.0

**Date** 2021-10-26

**Maintainer** Adrian Antico <adrianantico@gmail.com>

**Description** R package for the automation of machine learning, forecasting, feature engineering, model evaluation, model interpretation, data generation, and recommenders. Built using data.table for all tabular data-related tasks.

**License** MPL-2.0 | file LICENSE

**URL** <https://github.com/AdrianAntico/RemixAutoML>

**BugReports** <https://github.com/AdrianAntico/RemixAutoML/issues>

**Depends** R (>= 3.5.0)

**Imports** arules, bit64, data.table, doParallel, foreach, lubridate, timeDate

**Suggests** knitr, rmarkdown, gridExtra

**VignetteBuilder** knitr

**Contact** Adrian Antico

**Encoding** UTF-8

**Language** en-US

**LazyData** true

**NeedsCompilation** no

**RoxygenNote** 7.1.1

**SystemRequirements** Java (>= 7.0)

**Author** Adrian Antico [aut, cre], Douglas Pestana [ctb]

**ByteCompile** TRUE

## R topics documented:

RemixAutoML-package . . . . .	4
AppsPlotting . . . . .	5
ArgNullCheck . . . . .	7
ArgNullCheck2 . . . . .	8
AssignData . . . . .	8
AutoArfima . . . . .	9

AutoBanditNNet . . . . .	11
AutoBanditSarima . . . . .	13
AutoCatBoostCARMA . . . . .	16
AutoCatBoostClassifier . . . . .	25
AutoCatBoostFunnelCARMA . . . . .	30
AutoCatBoostFunnelCARMAScoring . . . . .	37
AutoCatBoostHurdleCARMA . . . . .	40
AutoCatBoostHurdleModel . . . . .	48
AutoCatBoostHurdleModelScoring . . . . .	53
AutoCatBoostMultiClass . . . . .	56
AutoCatBoostRegression . . . . .	61
AutoCatBoostScoring . . . . .	67
AutoCatBoostVectorCARMA . . . . .	72
AutoClustering . . . . .	79
AutoClusteringScoring . . . . .	81
AutoDataDictionaries . . . . .	83
AutoDataPartition . . . . .	84
AutoDiffLagN . . . . .	85
AutoETS . . . . .	87
AutoH2OCARMA . . . . .	89
AutoH2oDRFClassifier . . . . .	97
AutoH2oDRFHurdleModel . . . . .	101
AutoH2oDRFMultiClass . . . . .	103
AutoH2oDRFRegression . . . . .	107
AutoH2oGAMClassifier . . . . .	111
AutoH2oGAMMultiClass . . . . .	116
AutoH2oGAMRegression . . . . .	120
AutoH2oGBMClassifier . . . . .	125
AutoH2oGBMHurdleModel . . . . .	129
AutoH2oGBMMultiClass . . . . .	131
AutoH2oGBMRegression . . . . .	135
AutoH2oGLMClassifier . . . . .	140
AutoH2oGLMMultiClass . . . . .	144
AutoH2oGLMRegression . . . . .	148
AutoH2oMLClassifier . . . . .	153
AutoH2oMLMultiClass . . . . .	156
AutoH2oMLRegression . . . . .	158
AutoH2OMLScoring . . . . .	161
AutoHierarchicalFourier . . . . .	164
AutoInteraction . . . . .	165
AutoLagRollMode . . . . .	167
AutoLagRollStats . . . . .	170
AutoLagRollStatsScoring . . . . .	173
AutoLightGBMCARMA . . . . .	176
AutoLightGBMClassifier . . . . .	187
AutoLightGBMFunnelCARMA . . . . .	195
AutoLightGBMFunnelCARMAScoring . . . . .	205
AutoLightGBMHurdleCARMA . . . . .	210
AutoLightGBMHurdleModel . . . . .	223
AutoLightGBMHurdleModelScoring . . . . .	232
AutoLightGBMMultiClass . . . . .	235
AutoLightGBMRegression . . . . .	243

AutoLightGBMScoring . . . . .	252
AutoMarketBasketModel . . . . .	255
AutoNLS . . . . .	256
AutoRecommenderDataCreate . . . . .	258
AutoRecommenderScore . . . . .	259
AutoRecommenderTrain . . . . .	260
AutoShapeShap . . . . .	261
AutoTBATS . . . . .	262
AutoTransformationCreate . . . . .	264
AutoTransformationScore . . . . .	266
AutoTS . . . . .	267
AutoWord2VecModeler . . . . .	270
AutoWord2VecScoring . . . . .	272
AutoWordFreq . . . . .	274
AutoXGBoostCARMA . . . . .	276
AutoXGBoostClassifier . . . . .	282
AutoXGBoostFunnelCARMA . . . . .	286
AutoXGBoostFunnelCARMAScoring . . . . .	293
AutoXGBoostHurdleCARMA . . . . .	295
AutoXGBoostHurdleModel . . . . .	303
AutoXGBoostHurdleModelScoring . . . . .	308
AutoXGBoostMultiClass . . . . .	310
AutoXGBoostRegression . . . . .	315
AutoXGBoostScoring . . . . .	319
Bisection . . . . .	322
BlankRow . . . . .	323
CategoricalEncoding . . . . .	323
CharNull . . . . .	326
ChartTheme . . . . .	326
CreateCalendarVariables . . . . .	327
CreateHolidayVariables . . . . .	329
CumGainsChart . . . . .	331
DateInput . . . . .	332
DummifyDT . . . . .	333
EDA_Histograms . . . . .	335
EvalPlot . . . . .	337
FakeDataGenerator . . . . .	338
FilterLogicData . . . . .	339
FilterValues . . . . .	340
GenerateEvaluationMetrics . . . . .	340
GenTSAnomVars . . . . .	341
GetFilterValueLabel . . . . .	342
GetFilterValueMultiple . . . . .	343
H2OAutoencoder . . . . .	343
H2OAutoencoderScoring . . . . .	347
H2OIsolationForest . . . . .	350
H2OIsolationForestScoring . . . . .	352
InsertSortedValue . . . . .	354
IntNull . . . . .	355
KeyVarsInit . . . . .	355
Mode . . . . .	355
ModelDataPrep . . . . .	356

ModelInsightsReport . . . . .	358
multiplot . . . . .	361
NumericInput . . . . .	363
NumNull . . . . .	364
observeEventLoad . . . . .	364
ParDepCalPlots . . . . .	365
PickerInput . . . . .	366
PickerInput_GetLevels . . . . .	367
PlotGUI . . . . .	369
PreparePlotData . . . . .	369
PrintToPDF . . . . .	370
ReactiveLoadCSV . . . . .	371
RedYellowGreen . . . . .	372
ResidualOutliers . . . . .	374
ResidualPlots . . . . .	376
ReturnParam . . . . .	377
ROCPlot . . . . .	378
RunRemixAutoML . . . . .	379
ScatterCopula . . . . .	379
SingleRowShapeShap . . . . .	381
SQL_ClearTable . . . . .	382
SQL_DropTable . . . . .	382
SQL_Query . . . . .	383
SQL_Query_Push . . . . .	384
SQL_SaveTable . . . . .	384
SQL_Server_DBConnection . . . . .	385
StoreArgs . . . . .	386
TextInput . . . . .	387
threshOptim . . . . .	388
TimeSeriesDataPrepare . . . . .	389
TimeSeriesFill . . . . .	391
UniqueLevels . . . . .	392
UserBaseEvolution . . . . .	392
withConsoleRedirect . . . . .	393

<b>Index</b>	<b>395</b>
--------------	------------

---

RemixAutoML-package	<i>Automated Machine Learning Remixed</i>
---------------------	---

---

## Description

Automated Machine Learning Remixed for real-world use-cases. The package utilizes data.table under the hood for all data wrangling like operations so it's super fast and memory efficient. All ML methods are available in R or Python. The forecasting functions are unique and state of the art. There are feature engineering functions in this package that you cannot find anywhere else.

## Details

See the github README for details and examples [www.github.com/AdrianAntico/RemixAutoML](https://www.github.com/AdrianAntico/RemixAutoML)

**Author(s)**

Adrian Antico, [adrianantico@gmail.com](mailto:adrianantico@gmail.com), Douglas Pestana

---

AppsPlotting

*AppsPlotting*


---

**Description**

Simple shiny app for viewing time series plots with box plots or line plots. You can use up to 3 categorical variables to filter by and one additional variable to filter as a bonus. You'll need to have shiny, shinyWidgets, htmltools

**Usage**

```
AppsPlotting(
  data,
  XVariable = NULL,
  YVariable = NULL,
  DateName = NULL,
  GroupVariables = NULL,
  FilterVariable = NULL,
  HeaderColor = "black",
  AppWidth = 12L,
  LogoWidth = "1000px",
  LogoHeight = "100px",
  GroupVarsBoxColor = "navy",
  VarsBoxColor = "purple",
  FilterBoxColor = "blue",
  PlotBoxColor = "aqua",
  CreatePlotButtonColor = "primary",
  UpdatePlotButtonColor = "primary",
  ResetPlotButtonColor = "primary",
  Debug = FALSE
)
```

**Arguments**

<code>data</code>	Source data.table
<code>XVariable</code>	Starter column name for x-variable. Not needed if x-axis is the DateName column
<code>YVariable</code>	Starter column name for y-variable
<code>DateName</code>	Starter column name for date-variable
<code>GroupVariables</code>	Starter column name for group-variables
<code>FilterVariable</code>	Starter column name for filter-variable
<code>HeaderColor</code>	'black', 'blue', 'purple', 'green', 'red', 'yellow'
<code>AppWidth</code>	Width of boxes
<code>GroupVarsBoxColor</code>	Choose from 'red', 'yellow', 'aqua', 'blue', 'light-blue', 'green', 'navy', 'teal', 'olive', 'lime', 'orange', 'fuchsia', 'purple', 'maroon', 'black'

VarsBoxColor	Choose from 'red', 'yellow', 'aqua', 'blue', 'light-blue', 'green', 'navy', 'teal', 'olive', 'lime', 'orange', 'fuchsia', 'purple', 'maroon', 'black'
FilterBoxColor	Choose from 'red', 'yellow', 'aqua', 'blue', 'light-blue', 'green', 'navy', 'teal', 'olive', 'lime', 'orange', 'fuchsia', 'purple', 'maroon', 'black'
PlotBoxColor	Choose from 'red', 'yellow', 'aqua', 'blue', 'light-blue', 'green', 'navy', 'teal', 'olive', 'lime', 'orange', 'fuchsia', 'purple', 'maroon', 'black'
CreatePlotButtonColor	Choose from 'default', 'primary', 'warning', 'danger', 'success', 'royal'
UpdatePlotButtonColor	Choose from 'default', 'primary', 'warning', 'danger', 'success', 'royal'
ResetPlotButtonColor	Choose from 'default', 'primary', 'warning', 'danger', 'success', 'royal'
Debug	FALSE

**Author(s)**

Adrian Antico

**See Also**

Other GUI: [RunRemixAutoML\(\)](#)

**Examples**

```
## Not run:
# Pull Data
data <- data.table::fread(system.file('tests/QA_DataSets/ThreeGroup-FC-Walmart-XREG3.csv', package = "RemixAutoML"),
  data[, Date := as.Date(Date)]

# Run App
RemixAutoML::AppsPlotting(
  data,
  XVariable = NULL,
  YVariable = 'XREG1',
  DateName = 'Date',
  GroupVariables = names(data)[seq_len(3L)],
  FilterVariable = 'XREG1',
  HeaderColor = 'black',
  AppWidth = 12L,
  LogoWidth = '1000px',
  LogoHeight = '100px',
  GroupVarsBoxColor = 'navy',
  VarsBoxColor = 'purple',
  FilterBoxColor = 'blue',
  PlotBoxColor = 'aqua',
  CreatePlotButtonColor = 'default',
  UpdatePlotButtonColor = 'default',
  ResetPlotButtonColor = 'default',
  Debug = FALSE)

# XVariable = 'Date'
# YVariable = 'XREG1'
# DateName = 'Date'
# GroupVariables = names(data)[seq_len(3L)]
```

```

# FilterVariable = 'XREG1'
# Debug = TRUE
# HeaderColor = 'black'
# AppWidth = 12L,
# LogoWidth = '1000px',
# LogoHeight = '100px',
# GroupVarsBoxColor = 'navy',
# VarsBoxColor = 'purple',
# FilterBoxColor = 'blue'
# PlotBoxColor = 'aqua',
# CreatePlotButtonColor = 'default',
# UpdatePlotButtonColor = 'default',
# ResetPlotButtonColor = 'default',
# Debug = TRUE

## End(Not run)

```

---

ArgNullCheck

*ArgNullCheck*


---

## Description

ArgNullCheck

## Usage

```
ArgNullCheck(Input, InputID, Default)
```

## Arguments

Input	input
InputID	inputId
Default	Default value

## Author(s)

Adrian Antico

## See Also

Other Shiny: [ArgNullCheck2\(\)](#), [BlankRow\(\)](#), [DateInput\(\)](#), [GenerateEvaluationMetrics\(\)](#), [NumericInput\(\)](#), [PickerInput\\_GetLevels\(\)](#), [PickerInput\(\)](#), [PreparePlotData\(\)](#), [ReactiveLoadCSV\(\)](#), [ReturnParam\(\)](#), [StoreArgs\(\)](#), [TextInput\(\)](#), [observeEventLoad\(\)](#)

## Examples

```

## Not run:
ArgValue <- RemixAutoML::ArgNullCheck(Input = input, InputID = "TS_Value", Default = 2)

## End(Not run)

```

ArgNullCheck2

*ArgNullCheck2*

---

**Description**

ArgNullCheck2

**Usage**

```
ArgNullCheck2(Input, InputID, Default, Type = "numeric")
```

**Arguments**

Input	input
InputID	inputId
Default	Default value
Type	numeric character logical

**Author(s)**

Adrian Antico

**See Also**

Other Shiny: [ArgNullCheck\(\)](#), [BlankRow\(\)](#), [DateInput\(\)](#), [GenerateEvaluationMetrics\(\)](#), [NumericInput\(\)](#), [PickerInput\\_GetLevels\(\)](#), [PickerInput\(\)](#), [PreparePlotData\(\)](#), [ReactiveLoadCSV\(\)](#), [ReturnParam\(\)](#), [StoreArgs\(\)](#), [TextInput\(\)](#), [observeEventLoad\(\)](#)

**Examples**

```
## Not run:
ArgValue <- RemixAutoML::ArgNullCheck2(Input = input, InputID = "TS_Value", Default = 2, Type = "numeric")

## End(Not run)
```

---

AssignData*Assign a data.table by name from an environment*

---

**Description**

Assign a data.table by name from an environment

**Usage**

```
AssignData(data, env = globalenv())
```

**Arguments**

env	an environment
df	character, name of the object



**Value**

the object

---

AutoArfima	<i>AutoArfima</i>
------------	-------------------

---

**Description**

AutoArfima is a multi-armed bandit model testing framework for AR and SAR NNets. Randomized probability matching is the underlying bandit algorithm. Model evaluation is done by blending the training error and the validation error from testing the model on out of sample data. The bandit algorithm compares the performance of the current build against the previous builds which starts with the classic nnetar model from the forecast package. Depending on how many lags, seasonal lags, and fourier pairs you test the number of combinations of features to test begins to approach 10,000 different combinations of settings. The function tests out transformations, differencing, and variations of the lags, seasonal lags, and fourier pairs. The parameter space is broken up into various buckets that are increasing in sophistication. The bandit algorithm samples from those buckets and based on many rounds of testing it determines which buckets to generate samples from more frequently based on the models performance coming from that bucket. All of the models have performance data collected on them and a final rebuild is initiated when a winner is found. The rebuild process begins by retraining the model with the settings that produced the best performance. If the model fails to build, for whatever reason, the next best buildable model is rebuilt.

**Usage**

```
AutoArfima(
  data,
  FilePath = NULL,
  TargetVariableName,
  DateColumnName,
  TimeAggLevel = "week",
  EvaluationMetric = "MAE",
  NumHoldOutPeriods = 5L,
  NumFCPeriods = 5L,
  MaxLags = 5L,
  MaxMovingAverages = 5L,
  TrainWeighting = 0.5,
  MaxConsecutiveFails = 12L,
  MaxNumberModels = 100L,
  MaxRunTimeMinutes = 10L,
  NumberCores = max(1L, min(4L, parallel::detectCores() - 2L))
)
```

**Arguments**

data	Source data.table
FilePath	NULL to return nothing. Provide a file path to save the model and xregs if available
TargetVariableName	Name of your time series target variable

DateColumnName	Name of your date column
TimeAggLevel	Choose from "year", "quarter", "month", "week", "day", "hour"
EvaluationMetric	Choose from MAE, MSE, and MAPE
NumHoldOutPeriods	Number of time periods to use in the out of sample testing
NumFCPeriods	Number of periods to forecast
MaxLags	A single value of the max number of lags to use in the internal auto.arima of tbats
MaxMovingAverages	A single value of the max number of moving averages to use in the internal auto.arima of arfima
TrainWeighting	Model ranking is based on a weighted average of training metrics and out of sample metrics. Supply the weight of the training metrics, such as 0.50 for 50 percent.
MaxConsecutiveFails	When a new best model is found MaxConsecutiveFails resets to zero. Indicated the number of model attempts without a new winner before terminating the procedure.
MaxNumberModels	Indicate the maximum number of models to test.
MaxRunTimeMinutes	Indicate the maximum number of minutes to wait for a result.
NumberCores	Default max(1L, min(4L, parallel::detectCores()-2L))

**Author(s)**

Adrian Antico

**See Also**

Other Automated Time Series: [AutoBanditNNet\(\)](#), [AutoBanditSarima\(\)](#), [AutoETS\(\)](#), [AutoTBATS\(\)](#), [AutoTS\(\)](#)

**Examples**

```
## Not run:
# Create fake data
data <- RemixAutoML::FakeDataGenerator(TimeSeries = TRUE, TimeSeriesTimeAgg = "days")

# Build model
Output <- RemixAutoML::AutoArfima(
  data,
  FilePath = NULL,
  TargetVariableName = "Weekly_Sales",
  DateColumnName = "Date",
  TimeAggLevel = "weeks",
  EvaluationMetric = "MAE",
  NumHoldOutPeriods = 5L,
  NumFCPeriods = 5L,
  MaxLags = 5L,
  MaxMovingAverages = 5L,
```

```

    TrainWeighting = 0.50,
    MaxConsecutiveFails = 12L,
    MaxNumberModels = 100L,
    MaxRunTimeMinutes = 10L,
    NumberCores = max(1L, min(4L, parallel::detectCores()-2L)))

# Output
Output$ForecastPlot
Output$Forecast
Output$PerformanceGrid

## End(Not run)

```

---

AutoBanditNNet

*AutoBanditNNet*


---

## Description

AutoBanditNNet is a multi-armed bandit model testing framework for AR and SAR NNets. Randomized probability matching is the underlying bandit algorithm. Model evaluation is done by blending the training error and the validation error from testing the model on out of sample data. The bandit algorithm compares the performance of the current build against the previous builds which starts with the classic nnetar model from the forecast package. Depending on how many lags, seasonal lags, and fourier pairs you test the number of combinations of features to test begins to approach 10,000 different combinations of settings. The function tests out transformations, differencing, and variations of the lags, seasonal lags, and fourier pairs. The parameter space is broken up into various buckets that are increasing in sophistication. The bandit algorithm samples from those buckets and based on many rounds of testing it determines which buckets to generate samples from more frequently based on the models performance coming from that bucket. All of the models have performance data collected on them and a final rebuild is initiated when a winner is found. The rebuild process begins by retraining the model with the settings that produced the best performance. If the model fails to build, for whatever reason, the next best buildable model is rebuilt.

## Usage

```

AutoBanditNNet(
  data,
  FilePath = NULL,
  TargetVariableName,
  DateColumnName,
  TimeAggLevel = "week",
  EvaluationMetric = "MAE",
  NumHoldOutPeriods = 5L,
  NumFCPeriods = 5L,
  MaxLags = 5L,
  MaxSeasonallags = 1L,
  MaxFourierPairs = 2L,
  TrainWeighting = 0.5,
  MaxConsecutiveFails = 12L,
  MaxNumberModels = 100L,
  MaxRunTimeMinutes = 10L,
  NumberCores = max(1L, min(4L, parallel::detectCores() - 2L)),

```

```

    Debug = FALSE
)

```

### Arguments

<code>data</code>	Source data.table
<code>FilePath</code>	NULL to return nothing. Provide a file path to save the model and xregs if available
<code>TargetVariableName</code>	Name of your time series target variable
<code>DateColumnName</code>	Name of your date column
<code>TimeAggLevel</code>	Choose from "year", "quarter", "month", "week", "day", "hour"
<code>EvaluationMetric</code>	Choose from MAE, MSE, and MAPE
<code>NumHoldOutPeriods</code>	Number of time periods to use in the out of sample testing
<code>NumFCPeriods</code>	Number of periods to forecast
<code>MaxLags</code>	A single value of the max number of lags to test
<code>MaxSeasonalLags</code>	A single value of the max number of seasonal lags to test
<code>MaxFourierPairs</code>	A single value of the max number of fourier pairs to test
<code>TrainWeighting</code>	Model ranking is based on a weighted average of training metrics and out of sample metrics. Supply the weight of the training metrics, such as 0.50 for 50 percent.
<code>MaxConsecutiveFails</code>	When a new best model is found MaxConsecutiveFails resets to zero. Indicated the number of model attempts without a new winner before terminating the procedure.
<code>MaxNumberModels</code>	Indicate the maximum number of models to test.
<code>MaxRunTimeMinutes</code>	Indicate the maximum number of minutes to wait for a result
<code>NumberCores</code>	Default max(1L, min(4L, parallel::detectCores()-2L))
<code>Debug</code>	Set to TRUE to print some steps

### Author(s)

Adrian Antico

### See Also

Other Automated Time Series: [AutoArfima\(\)](#), [AutoBanditSarima\(\)](#), [AutoETS\(\)](#), [AutoTBATS\(\)](#), [AutoTS\(\)](#)

## Examples

```
## Not run:
# Create fake data
data <- RemixAutoML::FakeDataGenerator(TimeSeries = TRUE, TimeSeriesTimeAgg = "days")

# Build models
Output <- RemixAutoML::AutoBanditNNet(
  data = data,
  FilePath = NULL,
  TargetVariableName = "Weekly_Sales",
  DateColumnName = "Date",
  TimeAggLevel = "day",
  EvaluationMetric = "MAE",
  NumHoldOutPeriods = 5L,
  NumFCPeriods = 5L,
  MaxLags = 5L,
  MaxSeasonalLags = 1L,
  MaxFourierPairs = 2L,
  TrainWeighting = 0.50,
  MaxConsecutiveFails = 12L,
  MaxNumberModels = 100L,
  MaxRunTimeMinutes = 10L,
  NumberCores = max(1L, min(4L, parallel::detectCores()-2L)),
  Debug = FALSE)

# Output
Output$ForecastPlot
Output$Forecast
Output$PerformanceGrid

## End(Not run)
```

---

AutoBanditSarima

*AutoBanditSarima*


---

## Description

AutoBanditSarima is a multi-armed bandit model testing framework for SARIMA. Randomized probability matching is the underlying bandit algorithm. Model evaluation is done by blending the training error and the validation error from testing the model on out of sample data. The bandit algorithm compares the performance of the current build against the previous builds which starts with the classic `auto.arima` from the `forecast` package. Depending on how many lags, moving averages, seasonal lags and moving averages you test the number of combinations of features to test begins to approach 100,000 different combinations of settings. The function tests out transformations, differencing, and variations of the lags and moving averages. The parameter space is broken up into various buckets that are increasing in sophistication. The bandit algorithm samples from those buckets and based on many rounds of testing it determines which buckets to generate samples from more frequently based on the models performance coming from that bucket. All of the models have performance data collected on them and a final rebuild is initiated when a winner is found. The rebuild process begins by retraining the model with the settings that produced the best performance. If the model fails to build, for whatever reason, the next best buildable model is rebuilt.

**Usage**

```

AutoBanditSarima(
  data,
  FilePath = NULL,
  ByDataType = TRUE,
  TargetVariableName,
  DateColumnName,
  TimeAggLevel = "week",
  EvaluationMetric = "MAE",
  NumHoldOutPeriods = 5L,
  NumFCPeriods = 5L,
  MaxLags = 5L,
  MaxSeasonalLags = 0L,
  MaxMovingAverages = 5L,
  MaxSeasonalMovingAverages = 0L,
  MaxFourierPairs = 2L,
  TrainWeighting = 0.5,
  MaxConsecutiveFails = 25L,
  MaxNumberModels = 100L,
  MaxRunTimeMinutes = 10L,
  NumberCores = max(1L, min(4L, parallel::detectCores() - 2L)),
  DebugMode = FALSE
)

```

**Arguments**

<code>data</code>	Source data.table
<code>FilePath</code>	NULL to return nothing. Provide a file path to save the model and xregs if available
<code>ByDataType</code>	TRUE returns the best model from the four base sets of possible models. FALSE returns the best model.
<code>TargetVariableName</code>	Name of your time series target variable
<code>DateColumnName</code>	Name of your date column
<code>TimeAggLevel</code>	Choose from "year", "quarter", "month", "week", "day", "hour"
<code>EvaluationMetric</code>	Choose from MAE, MSE, and MAPE
<code>NumHoldOutPeriods</code>	Number of time periods to use in the out of sample testing
<code>NumFCPeriods</code>	Number of periods to forecast
<code>MaxLags</code>	A single value of the max number of lags to test
<code>MaxSeasonalLags</code>	A single value of the max number of seasonal lags to test
<code>MaxMovingAverages</code>	A single value of the max number of moving averages to test
<code>MaxSeasonalMovingAverages</code>	A single value of the max number of seasonal moving averages to test
<code>MaxFourierPairs</code>	A single value of the max number of fourier pairs to test

TrainWeighting	Model ranking is based on a weighted average of training metrics and out of sample metrics. Supply the weight of the training metrics, such as 0.50 for 50 percent.
MaxConsecutiveFails	When a new best model is found MaxConsecutiveFails resets to zero. Indicated the number of model attempts without a new winner before terminating the procedure.
MaxNumberModels	Indicate the maximum number of models to test.
MaxRunTimeMinutes	Indicate the maximum number of minutes to wait for a result.
NumberCores	Default max(1L, min(4L, parallel::detectCores()-2L))
DebugMode	Set to TRUE to get print outs of particular steps helpful in tracing errors

**Value**

data.table containing historical values and the forecast values along with the grid tuning results in full detail, as a second data.table

**Author(s)**

Adrian Antico

**See Also**

Other Automated Time Series: [AutoArfima\(\)](#), [AutoBanditNNet\(\)](#), [AutoETS\(\)](#), [AutoTBATS\(\)](#), [AutoTS\(\)](#)

**Examples**

```
## Not run:
# Create fake data
data <- RemixAutoML::FakeDataGenerator(TimeSeries = TRUE, TimeSeriesTimeAgg = "days")

# Build models
Output <- RemixAutoML::AutoBanditSarima(
  data = data,
  FilePath = NULL,
  ByDataType = FALSE,
  TargetVariableName = "Weekly_Sales",
  DateColumnName = "Date",
  TimeAggLevel = "1min",
  EvaluationMetric = "MAE",
  NumHoldOutPeriods = 12L,
  NumFCPeriods = 16L,
  MaxLags = 10L,
  MaxSeasonalLags = 0L,
  MaxMovingAverages = 3L,
  MaxSeasonalMovingAverages = 0L,
  MaxFourierPairs = 2L,
  TrainWeighting = 0.50,
  MaxConsecutiveFails = 50L,
  MaxNumberModels = 100L,
  MaxRunTimeMinutes = 10L,
  NumberCores = Default max(1L, min(4L, parallel::detectCores()-2L)),
```

```

    DebugMode = FALSE)

# Output
Output$ForecastPlot
Output$Forecast
Output$PerformanceGrid
Output$errorLagMA2x2

## End(Not run)

```

---

AutoCatBoostCARMA

*AutoCatBoostCARMA*


---

## Description

AutoCatBoostCARMA Multivariate Forecasting with calendar variables, Holiday counts, holiday lags, holiday moving averages, differencing, transformations, interaction-based categorical encoding using target variable and features to generate various time-based aggregated lags, moving averages, moving standard deviations, moving skewness, moving kurtosis, moving quantiles, parallelized interaction-based fourier pairs by grouping variables, and Trend Variables.

## Usage

```

AutoCatBoostCARMA(
  data,
  TimeWeights = NULL,
  NonNegativePred = FALSE,
  RoundPreds = FALSE,
  TrainOnFull = FALSE,
  TargetColumnName = "Target",
  DateColumnName = "DateTime",
  HierarchGroups = NULL,
  GroupVariables = NULL,
  FC_Periods = 30,
  TimeUnit = "week",
  TimeGroups = c("weeks", "months"),
  PDFOutputPath = NULL,
  SaveDataPath = NULL,
  NumOfParDepPlots = 10L,
  TargetTransformation = FALSE,
  Methods = c("BoxCox", "Asinh", "Log", "LogPlus1", "Sqrt", "Asin", "Logit"),
  AnomalyDetection = NULL,
  XREGS = NULL,
  Lags = c(1L:5L),
  MA_Periods = c(2L:5L),
  SD_Periods = NULL,
  Skew_Periods = NULL,
  Kurt_Periods = NULL,
  Quantile_Periods = NULL,
  Quantiles_Selected = c("q5", "q95"),
  Difference = TRUE,
  FourierTerms = 6L,

```



```

CalendarVariables = c("minute", "hour", "wday", "mday", "yday", "week", "isoweek",
  "month", "quarter", "year"),
HolidayVariable = c("USPublicHolidays", "EasterGroup", "ChristmasGroup",
  "OtherEcclesticalFeasts"),
HolidayLookback = NULL,
HolidayLags = 1L,
HolidayMovingAverages = 1L:2L,
TimeTrendVariable = FALSE,
ZeroPadSeries = NULL,
DataTruncate = FALSE,
SplitRatios = c(0.7, 0.2, 0.1),
PartitionType = "timeseries",
TaskType = "GPU",
NumGPU = 1,
DebugMode = FALSE,
Timer = TRUE,
EvalMetric = "RMSE",
EvalMetricValue = 1.5,
LossFunction = "RMSE",
LossFunctionValue = 1.5,
GridTune = FALSE,
PassInGrid = NULL,
ModelCount = 100,
MaxRunsWithoutNewWinner = 50,
MaxRunMinutes = 24L * 60L,
Langevin = FALSE,
DiffusionTemperature = 10000,
NTrees = 1000,
L2_Leaf_Reg = NULL,
LearningRate = NULL,
RandomStrength = 1,
BorderCount = 254,
Depth = 6,
RSM = 1,
BootStrapType = "Bayesian",
GrowPolicy = "SymmetricTree",
ModelSizeReg = 0.5,
FeatureBorderType = "GreedyLogSum",
SamplingUnit = "Group",
SubSample = NULL,
ScoreFunction = "Cosine",
MinDataInLeaf = 1
)

```

### Arguments

<code>data</code>	Supply your full series data set here
<code>TimeWeights</code>	Supply a value that will be multiplied by the time trend value
<code>NonNegativePred</code>	TRUE or FALSE
<code>RoundPreds</code>	Rounding predictions to an integer value. TRUE or FALSE. Defaults to FALSE
<code>TrainOnFull</code>	Set to TRUE to train on full data

TargetColumnName	List the column name of your target variables column. E.g. 'Target'
DateColumnName	List the column name of your date column. E.g. 'DateTime'
HierarchGroups	Vector of hierachy categorical columns.
GroupVariables	Defaults to NULL. Use NULL when you have a single series. Add in GroupVariables when you have a series for every level of a group or multiple groups.
FC_Periods	Set the number of periods you want to have forecasts for. E.g. 52 for weekly data to forecast a year ahead
TimeUnit	List the time unit your data is aggregated by. E.g. '1min', '5min', '10min', '15min', '30min', 'hour', 'day', 'week', 'month', 'quarter', 'year'.
TimeGroups	Select time aggregations for adding various time aggregated GDL features.
PDFOutputPath	NULL or a path file to output PDFs to a specified folder
SaveDataPath	NULL Or supply a path. Data saved will be called 'ModelID'_data.csv
NumOfParDepPlots	Supply a number for the number of partial dependence plots you want returned
TargetTransformation	TRUE or FALSE. If TRUE, select the methods in the Methods arg you want tested. The best one will be applied.
Methods	Choose from 'YeoJohnson', 'BoxCox', 'Asinh', 'Log', 'LogPlus1', 'Sqrt', 'Asin', or 'Logit'. If more than one is selected, the one with the best normalization pearson statistic will be used. Identity is automatically selected and compared.
AnomalyDetection	NULL for not using the service. Other, provide a list, e.g. AnomalyDetection = list('tstat_high' = 4, 'tstat_low' = -4)
XREGS	Additional data to use for model development and forecasting. Data needs to be a complete series which means both the historical and forward looking values over the specified forecast window needs to be supplied.
Lags	Select the periods for all lag variables you want to create. E.g. c(1:5,52) or list('day' = c(1:10), 'weeks' = c(1:4))
MA_Periods	Select the periods for all moving average variables you want to create. E.g. c(1:5,52) or list('day' = c(2:10), 'weeks' = c(2:4))
SD_Periods	Select the periods for all moving standard deviation variables you want to create. E.g. c(1:5,52) or list('day' = c(2:10), 'weeks' = c(2:4))
Skew_Periods	Select the periods for all moving skewness variables you want to create. E.g. c(1:5,52) or list('day' = c(2:10), 'weeks' = c(2:4))
Kurt_Periods	Select the periods for all moving kurtosis variables you want to create. E.g. c(1:5,52) or list('day' = c(2:10), 'weeks' = c(2:4))
Quantile_Periods	Select the periods for all moving quantiles variables you want to create. E.g. c(1:5,52) or list('day' = c(2:10), 'weeks' = c(2:4))
Quantiles_Selected	Select from the following 'q5', 'q10', 'q15', 'q20', 'q25', 'q30', 'q35', 'q40', 'q45', 'q50', 'q55', 'q60', 'q65', 'q70', 'q75', 'q80', 'q85', 'q90', 'q95'
Difference	Puts the I in ARIMA for single series and grouped series.
FourierTerms	Set to the max number of pairs. E.g. 2 means to generate two pairs for by each group level and interations if hierarchy is enabled.

CalendarVariables	NULL, or select from 'minute', 'hour', 'wday', 'mday', 'yday', 'week', 'isoweek', 'month', 'quarter', 'year'
HolidayVariable	NULL, or select from 'USPublicHolidays', 'EasterGroup', 'ChristmasGroup', 'OtherEcclesticalFeasts'
HolidayLookback	Number of days in range to compute number of holidays from a given date in the data. If NULL, the number of days are computed for you.
HolidayLags	Number of lags to build off of the holiday count variable.
HolidayMovingAverages	Number of moving averages to build off of the holiday count variable.
TimeTrendVariable	Set to TRUE to have a time trend variable added to the model. Time trend is numeric variable indicating the numeric value of each record in the time series (by group). Time trend starts at 1 for the earliest point in time and increments by one for each success time point.
ZeroPadSeries	NULL to do nothing. Otherwise, set to 'maxmax', 'minmax', 'maxmin', 'minmin'. See <a href="#">TimeSeriesFill</a> for explanations of each type
DataTruncate	Set to TRUE to remove records with missing values from the lags and moving average features created
SplitRatios	E.g c(0.7,0.2,0.1) for train, validation, and test sets
PartitionType	Select 'random' for random data partitioning 'timeseries' for partitioning by time frames
TaskType	Default is 'GPU' but you can also set it to 'CPU'
NumGPU	Defaults to 1. If CPU is set this argument will be ignored.
DebugMode	Defaults to FALSE. Set to TRUE to get a print statement of each high level comment in function
Timer	Set to FALSE to turn off the updating print statements for progress
EvalMetric	Select from 'RMSE', 'MAE', 'MAPE', 'Poisson', 'Quantile', 'LogLinQuantile', 'Lq', 'NumErrors', 'SMAPE', 'R2', 'MSLE', 'MedianAbsoluteError'
EvalMetricValue	Used when EvalMetric accepts an argument. See <a href="#">AutoCatBoostRegression</a>
LossFunction	Used in model training for model fitting. Select from 'RMSE', 'MAE', 'Quantile', 'LogLinQuantile', 'MAPE', 'Poisson', 'PairLogitPairwise', 'Tweedie', 'QueryRMSE'
LossFunctionValue	Used when LossFunction accepts an argument. See <a href="#">AutoCatBoostRegression</a>
GridTune	Set to TRUE to run a grid tune
PassInGrid	Defaults to NULL
ModelCount	Set the number of models to try in the grid tune
MaxRunsWithoutNewWinner	Default is 50
MaxRunMinutes	Default is 60*60
Langevin	Enables the Stochastic Gradient Langevin Boosting mode. If TRUE and TaskType == 'GPU' then TaskType will be converted to 'CPU'
DiffusionTemperature	Default is 10000

NTrees	Select the number of trees you want to have built to train the model
L2_Leaf_Reg	L2 reg parameter
LearningRate	Defaults to NULL. Catboost will dynamically define this if L2_Leaf_Reg is NULL and RMSE is chosen (otherwise catboost will default it to 0.03). Then you can pull it out of the model object and pass it back in should you wish.
RandomStrength	Default is 1
BorderCount	Default is 254
Depth	Depth of catboost model
RSM	CPU only. If TaskType is GPU then RSM will not be used
BootStrapType	If NULL, then if TaskType is GPU then Bayesian will be used. If CPU then MVS will be used. If MVS is selected when TaskType is GPU, then BootStrapType will be switched to Bayesian
GrowPolicy	Default is SymmetricTree. Others include Lossguide and Depthwise
ModelSizeReg	Defaults to 0.5. Set to 0 to allow for bigger models. This is for models with high cardinality categorical features. Values greater than 0 will shrink the model and quality will decline but models won't be huge.
FeatureBorderType	Defaults to 'GreedyLogSum'. Other options include: Median, Uniform, UniformAndQuantiles, MaxLogSum, MinEntropy
SamplingUnit	Default is Group. Other option is Object. if GPU is selected, this will be turned off unless the loss_function is YetiRankPairWise
SubSample	Can use if BootStrapType is neither Bayesian nor No. Pass NULL to use Catboost default. Used for bagging.
ScoreFunction	Default is Cosine. CPU options are Cosine and L2. GPU options are Cosine, L2, NewtonL2, and NewtomCosine (not available for Lossguide)
MinDataInLeaf	Defaults to 1. Used if GrowPolicy is not SymmetricTree

**Value**

See examples

**Author(s)**

Adrian Antico

**See Also**

Other Automated Panel Data Forecasting: [AutoCatBoostHurdleCARMA\(\)](#), [AutoCatBoostVectorCARMA\(\)](#), [AutoH2OCARMA\(\)](#), [AutoLightGBMCARMA\(\)](#), [AutoLightGBMHurdleCARMA\(\)](#), [AutoXGBoostCARMA\(\)](#), [AutoXGBoostHurdleCARMA\(\)](#)

**Examples**

```
## Not run:

# Set up your output file path for saving results as a .csv
Path <- 'C:/YourPathHere'

# Run on GPU or CPU (some options in the grid tuning force usage of CPU for some runs)
TaskType = 'GPU'
```

```

# Define number of CPU threads to allow data.table to utilize
data.table::setDTthreads(percent = max(1L, parallel::detectCores()-2L))

# Load data
data <- data.table::fread('https://www.dropbox.com/s/2str3ek4f4cheqi/walmart_train.csv?dl=1')

# Ensure series have no missing dates (also remove series with more than 25% missing values)
data <- RemixAutoML::TimeSeriesFill(
  data,
  DateColumnName = 'Date',
  GroupVariables = c('Store','Dept'),
  TimeUnit = 'weeks',
  FillType = 'maxmax',
  MaxMissingPercent = 0.25,
  SimpleImpute = TRUE)

# Set negative numbers to 0
data <- data[, Weekly_Sales := data.table::fifelse(Weekly_Sales < 0, 0, Weekly_Sales)]

# Remove IsHoliday column
data[, IsHoliday := NULL]

# Create xregs (this is the include the categorical variables instead of utilizing only the interaction of them)
xregs <- data[, .SD, .SDcols = c('Date', 'Store', 'Dept')]

# Change data types
data[, ':= ' (Store = as.character(Store), Dept = as.character(Dept))]
xregs[, ':= ' (Store = as.character(Store), Dept = as.character(Dept))]

# Subset data so we have an out of time sample
data1 <- data.table::copy(data[, ID := 1L:.N, by = c('Store','Dept')][ID <= 125L][, ID := NULL])
data[, ID := NULL]

# Define values for SplitRatios and FCWindow Args
N1 <- data1[, .N, by = c('Store','Dept')][1L, N]
N2 <- xregs[, .N, by = c('Store','Dept')][1L, N]

# Setup Grid Tuning & Feature Tuning data.table using a cross join of vectors
Tuning <- data.table::CJ(
  TimeWeights = c('None',0.999),
  MaxTimeGroups = c('weeks','months'),
  TargetTransformation = c('TRUE','FALSE'),
  Difference = c('TRUE','FALSE'),
  HoldoutTrain = c(6,18),
  Langevin = c('TRUE','FALSE'),
  NTrees = c(2500,5000),
  Depth = c(6,9),
  RandomStrength = c(0.75,1),
  L2_Leaf_Reg = c(3.0,4.0),
  RSM = c(0.75,'NULL'),
  GrowPolicy = c('SymmetricTree','Lossguide','Depthwise'),
  BootstrapType = c('Bayesian','MVS','No'))

# Remove options that are not compatible with GPU (skip over this otherwise)
Tuning <- Tuning[Langevin == 'TRUE' | (Langevin == 'FALSE' & RSM == 'NULL' & BootstrapType %in% c('Bayesian','No'))]

```

```

# Randomize order of Tuning data.table
Tuning <- Tuning[order(runif(.N))]

# Load grid results and remove rows that have already been tested
if(file.exists(file.path(Path, 'Walmart_CARMA_Metrics.csv'))) {
  Metrics <- data.table::fread(file.path(Path, 'Walmart_CARMA_Metrics.csv'))
  temp <- data.table::rbindlist(list(Metrics,Tuning), fill = TRUE)
  temp <- unique(temp, by = c(4:(ncol(temp)-1)))
  Tuning <- temp[is.na(RunTime)][, .SD, .SDcols = names(Tuning)]
  rm(Metrics,temp)
}

# Define the total number of runs
TotalRuns <- Tuning[,.N]

# Kick off feature + grid tuning
for(Run in seq_len(TotalRuns)) {

  # Print run number
  for(zz in seq_len(100)) print(Run)

  # Use fresh data for each run
  xregs_new <- data.table::copy(xregs)
  data_new <- data.table::copy(data1)

  # Timer start
  StartTime <- Sys.time()

  # Run carma system
  CatBoostResults <- RemixAutoML::AutoCatBoostCARMA(

    # data args
    data = data_new,
    TimeWeights = if(Tuning[Run, TimeWeights] == 'None') NULL else as.numeric(Tuning[Run, TimeWeights]),
    TargetColumnName = 'Weekly_Sales',
    DateColumnName = 'Date',
    HierarchGroups = NULL,
    GroupVariables = c('Store','Dept'),
    TimeUnit = 'weeks',
    TimeGroups = if(Tuning[Run, MaxTimeGroups] == 'weeks') 'weeks' else if(Tuning[Run, MaxTimeGroups] == 'months'

  # Production args
  TrainOnFull = TRUE,
  SplitRatios = c(1 - Tuning[Run, HoldoutTrain] / N2, Tuning[Run, HoldoutTrain] / N2),
  PartitionType = 'random',
  FC_Periods = N2-N1,
  TaskType = TaskType,
  NumGPU = 1,
  Timer = TRUE,
  DebugMode = TRUE,

  # Target variable transformations
  TargetTransformation = as.logical(Tuning[Run, TargetTransformation]),
  Methods = c('YeoJohnson', 'BoxCox', 'Asinh', 'Log', 'LogPlus1', 'Sqrt', 'Asin', 'Logit'),
  Difference = as.logical(Tuning[Run, Difference]),
  NonNegativePred = TRUE,
  RoundPreds = FALSE,

```

```

# Calendar-related features
CalendarVariables = c('week','wom','month','quarter'),
HolidayVariable = c('USPublicHolidays'),
HolidayLookback = NULL,
HolidayLags = c(1,2,3),
HolidayMovingAverages = c(2,3),

# Lags, moving averages, and other rolling stats
Lags = if(Tuning[Run, MaxTimeGroups] == 'weeks') c(1,2,3,4,5,8,9,12,13,51,52,53) else if(Tuning[Run, MaxTimeGroups] == 'months') c(1,2,3,4,5,8,9,12,13,51,52,53) else if(Tuning[Run, MaxTimeGroups] == 'years') c(1,2,3,4,5,8,9,12,13,51,52,53)
MA_Periods = if(Tuning[Run, MaxTimeGroups] == 'weeks') c(2,3,4,5,8,9,12,13,51,52,53) else if(Tuning[Run, MaxTimeGroups] == 'months') c(2,3,4,5,8,9,12,13,51,52,53) else if(Tuning[Run, MaxTimeGroups] == 'years') c(2,3,4,5,8,9,12,13,51,52,53)
SD_Periods = NULL,
Skew_Periods = NULL,
Kurt_Periods = NULL,
Quantile_Periods = NULL,
Quantiles_Selected = NULL,

# Bonus features
AnomalyDetection = NULL,
XREGS = xregs_new,
FourierTerms = 0,
TimeTrendVariable = TRUE,
ZeroPadSeries = NULL,
DataTruncate = FALSE,

# ML grid tuning args
GridTune = FALSE,
PassInGrid = NULL,
ModelCount = 5,
MaxRunsWithoutNewWinner = 50,
MaxRunMinutes = 60*60,

# ML evaluation output
PDFOutputPath = NULL,
SaveDataPath = NULL,
NumOfParDepPlots = 0L,

# ML loss functions
EvalMetric = 'RMSE',
EvalMetricValue = 1,
LossFunction = 'RMSE',
LossFunctionValue = 1,

# ML tuning args
NTrees = Tuning[Run, NTrees],
Depth = Tuning[Run, Depth],
L2_Leaf_Reg = Tuning[Run, L2_Leaf_Reg],
LearningRate = 0.03,
Langevin = as.logical(Tuning[Run, Langevin]),
DiffusionTemperature = 10000,
RandomStrength = Tuning[Run, RandomStrength],
BorderCount = 254,
RSM = if(Tuning[Run, RSM] == 'NULL') NULL else as.numeric(Tuning[Run, RSM]),
GrowPolicy = Tuning[Run, GrowPolicy],
BootstrapType = Tuning[Run, BootstrapType],
ModelSizeReg = 0.5,
FeatureBorderType = 'GreedyLogSum',

```

```

    SamplingUnit = 'Group',
    SubSample = NULL,
    ScoreFunction = 'Cosine',
    MinDataInLeaf = 1)

# Timer End
EndTime <- Sys.time()

# Prepare data for evaluation
Results <- CatBoostResults$Forecast
data.table::setnames(Results, 'Weekly_Sales', 'bla')
Results <- merge(Results, data, by = c('Store','Dept','Date'), all = FALSE)
Results <- Results[is.na(bla)][, bla := NULL]

# Create totals and subtotals
Results <- data.table::groupingsets(
  x = Results,
  j = list(Predictions = sum(Predictions), Weekly_Sales = sum(Weekly_Sales)),
  by = c('Date', 'Store', 'Dept'),
  sets = list(c('Date', 'Store', 'Dept'), c('Store', 'Dept'), 'Store', 'Dept', 'Date'))

# Fill NAs with 'Total' for totals and subtotals
for(cols in c('Store','Dept')) Results[, eval(cols) := data.table::fifelse(is.na(get(cols)), 'Total', get(cols))]

# Add error measures
Results[, Weekly_MAE := abs(Weekly_Sales - Predictions)]
Results[, Weekly_MAPE := Weekly_MAE / Weekly_Sales]

# Weekly results
Weekly_MAPE <- Results[, list(Weekly_MAPE = mean(Weekly_MAPE)), by = list(Store,Dept)]

# Monthly results
temp <- data.table::copy(Results)
temp <- temp[, Date := lubridate::floor_date(Date, unit = 'months')]
temp <- temp[, lapply(.SD, sum), by = c('Date','Store','Dept'), .SDcols = c('Predictions', 'Weekly_Sales')]
temp[, Monthly_MAE := abs(Weekly_Sales - Predictions)]
temp[, Monthly_MAPE := Monthly_MAE / Weekly_Sales]
Monthly_MAPE <- temp[, list(Monthly_MAPE = mean(Monthly_MAPE)), by = list(Store,Dept)]

# Collect metrics for Total (feel free to switch to something else or no filter at all)
Metrics <- data.table::data.table(
  RunNumber = Run,
  Total_Weekly_MAPE = Weekly_MAPE[Store == 'Total' & Dept == 'Total', Weekly_MAPE],
  Total_Monthly_MAPE = Monthly_MAPE[Store == 'Total' & Dept == 'Total', Monthly_MAPE],
  Tuning[Run],
  RunTime = EndTime - StartTime)

# Append to file (not overwrite)
data.table::fwrite(Metrics, file = file.path(Path, 'Walmart_CARMA_Metrics.csv'), append = TRUE)

# Remove objects (clear space before new runs)
rm(CatBoostResults, Results, temp, Weekly_MAE, Weekly_MAPE, Monthly_MAE, Monthly_MAPE)

# Garbage collection because of GPU
gc()
}

```



```
## End(Not run)
```

---

```
AutoCatBoostClassifier
```

```
AutoCatBoostClassifier
```

---

## Description

AutoCatBoostClassifier is an automated modeling function that runs a variety of steps. First, a stratified sampling (by the target variable) is done to create train, validation, and test sets (if not supplied). Then, the function will run a random grid tune over N number of models and find which model is the best (a default model is always included in that set). Once the model is identified and built, several other outputs are generated: validation data with predictions (on test data), an ROC plot, evaluation plot, evaluation metrics, variable importance, partial dependence calibration plots, partial dependence calibration box plots, and column names used in model fitting. You can download the catboost package using devtools, via: `devtools::install_github('catboost/catboost', subdir = 'catboost/R-package')`

## Usage

```
AutoCatBoostClassifier(
  OutputSelection = c("Importances", "EvalPlots", "EvalMetrics", "Score_TrainData"),
  data = NULL,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = NULL,
  FeatureColNames = NULL,
  PrimaryDateColumn = NULL,
  WeightsColumnName = NULL,
  IDcols = NULL,
  TrainOnFull = FALSE,
  task_type = "GPU",
  NumGPUs = 1,
  ReturnModelObjects = TRUE,
  SaveModelObjects = FALSE,
  SaveInfoToPDF = FALSE,
  ModelID = "FirstModel",
  model_path = NULL,
  metadata_path = NULL,
  EvalMetric = "MCC",
  LossFunction = "Logloss",
  grid_eval_metric = "MCC",
  ClassWeights = c(1, 1),
  CostMatrixWeights = c(1, 0, 0, 1),
  NumOfParDepPlots = 0L,
  PassInGrid = NULL,
  GridTune = FALSE,
  MaxModelsInGrid = 30L,
  MaxRunsWithoutNewWinner = 20L,
  MaxRunMinutes = 24L * 60L,
  BaselineComparison = "default",
```

```

MetricPeriods = 10L,
Trees = 50L,
Depth = 6,
LearningRate = NULL,
L2_Leaf_Reg = 3,
RandomStrength = 1,
BorderCount = 128,
RSM = NULL,
BootStrapType = NULL,
GrowPolicy = "SymmetricTree",
langevin = FALSE,
diffusion_temperature = 10000,
model_size_reg = 0.5,
feature_border_type = "GreedyLogSum",
sampling_unit = "Object",
subsample = NULL,
score_function = "Cosine",
min_data_in_leaf = 1,
DebugMode = FALSE
)

```

## Arguments

OutputSelection	You can select what type of output you want returned. Choose from c('Importances', 'EvalPlots', 'EvalMetrics', 'PDFs', 'Score_TrainData')
data	This is your data set for training and testing your model
ValidationData	This is your holdout data set used in modeling either refine your hyperparameters. Catboost using both training and validation data in the training process so you should evaluate out of sample performance with this data set.
TestData	This is your holdout data set. Catboost using both training and validation data in the training process so you should evaluate out of sample performance with this data set.
TargetColumnName	Either supply the target column name OR the column number where the target is located, but not mixed types. Note that the target column needs to be a 0   1 numeric variable.
FeatureColNames	Either supply the feature column names OR the column number where the target is located, but not mixed types. Also, not zero-indexed.
PrimaryDateColumn	Supply a date or datetime column for catboost to utilize time as its basis for handling categorical features, instead of random shuffling
WeightsColumnName	Supply a column name for your weights column. Leave NULL otherwise
IDcols	A vector of column names or column numbers to keep in your data but not include in the modeling.
TrainOnFull	Set to TRUE to train on full data and skip over evaluation steps
task_type	Set to 'GPU' to utilize your GPU for training. Default is 'CPU'.
NumGPUs	Numeric. If you have 4 GPUs supply 4 as a value.

ReturnModelObjects	Set to TRUE to output all modeling objects. E.g. plots and evaluation metrics
SaveModelObjects	Set to TRUE to return all modeling objects to your environment
SaveInfoToPDF	Set to TRUE to save modeling information to PDF. If model_path or meta-data_path aren't defined then output will be saved to the working directory
ModelID	A character string to name your model and output
model_path	A character string of your path file to where you want your output saved
metadata_path	A character string of your path file to where you want your model evaluation output saved. If left NULL, all output will be saved to model_path.
EvalMetric	This is the metric used inside catboost to measure performance on validation data during a grid-tune. 'AUC' is the default. 'Logloss', 'CrossEntropy', 'Precision', 'Recall', 'F1', 'BalancedAccuracy', 'BalancedErrorRate', 'MCC', 'Accuracy', 'CtrFactor', 'AUC', 'BrierScore', 'HingeLoss', 'HammingLoss', 'ZeroOneLoss', 'Kappa', 'WKappa', 'LogLikelihoodOfPrediction', 'TotalF1', 'PairLogit', 'PairLogitPairwise', 'PairAccuracy', 'QueryCrossEntropy', 'QuerySoftMax', 'PFound', 'NDCG', 'AverageGain', 'PrecisionAt', 'RecallAt', 'MAP'
LossFunction	Default is NULL. Select the loss function of choice. c('Logloss','CrossEntropy','Lq','PairLogit','PairLogitPairwise')
grid_eval_metric	Case sensitive. I typically choose 'Utility' or 'MCC'. Choose from 'Utility', 'MCC', 'Acc', 'F1_Score', 'F2_Score', 'F0.5_Score', 'TPR', 'TNR', 'FNR', 'FPR', 'FDR', 'FOR', 'NPV', 'PPV', 'ThreatScore'
ClassWeights	Supply a vector of weights for your target classes. E.g. c(0.25, 1) to weight your 0 class by 0.25 and your 1 class by 1.
CostMatrixWeights	A vector with 4 elements c(True Positive Cost, False Negative Cost, False Positive Cost, True Negative Cost). Default c(1,0,0,1)
NumOfParDepPlots	Tell the function the number of partial dependence calibration plots you want to create. Calibration boxplots will only be created for numerical features (not dummy variables)
PassInGrid	Defaults to NULL. Pass in a single row of grid from a previous output as a data.table (they are collected as data.tables)
GridTune	Set to TRUE to run a grid tuning procedure. Set a number in MaxModelsInGrid to tell the procedure how many models you want to test.
MaxModelsInGrid	Number of models to test from grid options.
MaxRunsWithoutNewWinner	A number
MaxRunMinutes	In minutes
BaselineComparison	Set to either 'default' or 'best'. Default is to compare each successive model build to the baseline model using max trees (from function args). Best makes the comparison to the current best model.
MetricPeriods	Number of trees to build before evaluating intermediate metrics. Default is 10L
Trees	Bandit grid partitioned. Supply a single value for non-grid tuning cases. Otherwise, supply a vector for the trees numbers you want to test. For running grid tuning, a NULL value supplied will mean these values are tested seq(1000L, 10000L, 1000L)

Depth	Bandit grid partitioned Number, or vector for depth to test. For running grid tuning, a NULL value supplied will mean these values are tested seq(4L, 16L, 2L)
LearningRate	Bandit grid partitioned. Supply a single value for non-grid tuning cases. Otherwise, supply a vector for the LearningRate values to test. For running grid tuning, a NULL value supplied will mean these values are tested c(0.01,0.02,0.03,0.04)
L2_Leaf_Reg	Random testing. Supply a single value for non-grid tuning cases. Otherwise, supply a vector for the L2_Leaf_Reg values to test. For running grid tuning, a NULL value supplied will mean these values are tested seq(1.0, 10.0, 1.0)
RandomStrength	A multiplier of randomness added to split evaluations. Default value is 1 which adds no randomness.
BorderCount	Number of splits for numerical features. Catboost defaults to 254 for CPU and 128 for GPU
RSM	CPU only. Random testing. Supply a single value for non-grid tuning cases. Otherwise, supply a vector for the RSM values to test. For running grid tuning, a NULL value supplied will mean these values are tested c(0.80, 0.85, 0.90, 0.95, 1.0)
BootStrapType	Random testing. Supply a single value for non-grid tuning cases. Otherwise, supply a vector for the BootStrapType values to test. For running grid tuning, a NULL value supplied will mean these values are tested c('Bayesian', 'Bernoulli', 'Poisson', 'MVS', 'No')
GrowPolicy	Random testing. NULL, character, or vector for GrowPolicy to test. For grid tuning, supply a vector of values. For running grid tuning, a NULL value supplied will mean these values are tested c('SymmetricTree', 'Depthwise', 'Lossguide')
langevin diffusion_temperature	TRUE or FALSE. TRUE enables Default value is 10000
model_size_reg	Defaults to 0.5. Set to 0 to allow for bigger models. This is for models with high cardinality categorical features. Values greater than 0 will shrink the model and quality will decline but models won't be huge.
feature_border_type	Defaults to 'GreedyLogSum'. Other options include: Median, Uniform, UniformAndQuantiles, MaxLogSum, MinEntropy
sampling_unit	Default is Group. Other option is Object. if GPU is selected, this will be turned off unless the LossFunction is YetiRankPairWise
subsample	Default is NULL. Catboost will turn this into 0.66 for BootStrapTypes Poisson and Bernoulli. 0.80 for MVS. Doesn't apply to others.
score_function	Default is Cosine. CPU options are Cosine and L2. GPU options are Cosine, L2, NewtonL2, and NewtonCosine (not available for Lossguide)
min_data_in_leaf	Default is 1. Cannot be used with SymmetricTree is GrowPolicy
DebugMode	Set to TRUE to get a printout of which step the function is on. FALSE, otherwise

### Value

Saves to file and returned in list: VariableImportance.csv, Model (the model), ValidationData.csv, ROC\_Plot.png, EvaluationPlot.png, EvaluationMetrics.csv, ParDepPlots.R a named list of features with partial dependence calibration plots, GridCollect, and GridList

**Author(s)**

Adrian Antico

**See Also**

Other Automated Supervised Learning - Binary Classification: [AutoH2oDRFClassifier\(\)](#), [AutoH2oGAMClassifier\(\)](#), [AutoH2oGBMClassifier\(\)](#), [AutoH2oGLMClassifier\(\)](#), [AutoH2oMLClassifier\(\)](#), [AutoLightGBMClassifier\(\)](#), [AutoXGBoostClassifier\(\)](#)

**Examples**

```
## Not run:
# Create some dummy correlated data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 10000,
  ID = 2,
  ZIP = 0,
  AddDate = FALSE,
  Classification = TRUE,
  MultiClass = FALSE)

# Run function
TestModel <- RemixAutoML::AutoCatBoostClassifier(

  # GPU or CPU and the number of available GPUs
  task_type = 'GPU',
  NumGPUs = 1,
  TrainOnFull = FALSE,
  DebugMode = FALSE,

  # Metadata args
  OutputSelection = c('Score_TrainData', 'Importances', 'EvalPlots', 'EvalMetrics'),
  ModelID = 'Test_Model_1',
  model_path = normalizePath('./'),
  metadata_path = normalizePath('./'),
  SaveModelObjects = FALSE,
  ReturnModelObjects = TRUE,
  SaveInfoToPDF = FALSE,

  # Data args
  data = data,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = 'Adrian',
  FeatureColNames = names(data)[!names(data) %in%
    c('IDcol_1', 'IDcol_2', 'Adrian')],
  PrimaryDateColumn = NULL,
  WeightsColumnName = NULL,
  IDcols = c('IDcol_1', 'IDcol_2'),

  # Evaluation args
  ClassWeights = c(1L, 1L),
  CostMatrixWeights = c(1, 0, 0, 1),
  EvalMetric = 'AUC',
  grid_eval_metric = 'MCC',
```

```

LossFunction = 'Logloss',
MetricPeriods = 10L,
NumOfParDepPlots = ncol(data)-1L-2L,

# Grid tuning args
PassInGrid = NULL,
GridTune = FALSE,
MaxModelsInGrid = 30L,
MaxRunsWithoutNewWinner = 20L,
MaxRunMinutes = 24L*60L,
BaselineComparison = 'default',

# ML args
Trees = 1000,
Depth = 9,
LearningRate = NULL,
L2_Leaf_Reg = NULL,
model_size_reg = 0.5,
langevin = FALSE,
diffusion_temperature = 10000,
RandomStrength = 1,
BorderCount = 128,
RSM = 1,
BootStrapType = 'Bayesian',
GrowPolicy = 'SymmetricTree',
feature_border_type = 'GreedyLogSum',
sampling_unit = 'Object',
subsample = NULL,
score_function = 'Cosine',
min_data_in_leaf = 1)

## End(Not run)

```

---

AutoCatBoostFunnelCARMA

*AutoCatBoostFunnelCARMA*


---

## Description

AutoCatBoostFunnelCARMA is a forecasting model for cohort funnel forecasting for grouped data or non-grouped data

## Usage

```

AutoCatBoostFunnelCARMA(
  data,
  GroupVariables = NULL,
  BaseFunnelMeasure = NULL,
  ConversionMeasure = NULL,
  ConversionRateMeasure = NULL,
  CohortPeriodsVariable = NULL,
  CalendarDate = NULL,
  CohortDate = NULL,
  TruncateDate = NULL,

```

```

PartitionRatios = c(0.7, 0.2, 0.1),
TimeUnit = c("day"),
CalendarTimeGroups = c("day", "week", "month"),
CohortTimeGroups = c("day", "week", "month"),
TransformTargetVariable = TRUE,
TransformMethods = c("Identity", "YeoJohnson"),
AnomalyDetection = list(tstat_high = 3, tstat_low = -2),
Jobs = c("Evaluate", "Train"),
SaveModelObjects = TRUE,
ModelID = "Segment_ID",
ModelPath = NULL,
MetaDataPath = NULL,
DebugMode = FALSE,
CalendarVariables = c("wday", "mday", "yday", "week", "isoweek", "month", "quarter",
  "year"),
HolidayGroups = c("USPublicHolidays", "EasterGroup", "ChristmasGroup",
  "OtherEcclesticalFeasts"),
HolidayLookback = NULL,
CohortHolidayLags = c(1L, 2L, 7L),
CohortHolidayMovingAverages = c(3L, 7L),
CalendarHolidayLags = c(1L, 2L, 7L),
CalendarHolidayMovingAverages = c(3L, 7L),
ImputeRollStats = -0.001,
CalendarLags = list(day = c(1L, 7L, 21L), week = c(1L, 4L, 52L), month = c(1L, 6L,
  12L)),
CalendarMovingAverages = list(day = c(1L, 7L, 21L), week = c(1L, 4L, 52L), month =
  c(1L, 6L, 12L)),
CalendarStandardDeviations = NULL,
CalendarSkews = NULL,
CalendarKurts = NULL,
CalendarQuantiles = NULL,
CalendarQuantilesSelected = "q50",
CohortLags = list(day = c(1L, 7L, 21L), week = c(1L, 4L, 52L), month = c(1L, 6L,
  12L)),
CohortMovingAverages = list(day = c(1L, 7L, 21L), week = c(1L, 4L, 52L), month =
  c(1L, 6L, 12L)),
CohortStandardDeviations = NULL,
CohortSkews = NULL,
CohortKurts = NULL,
CohortQuantiles = NULL,
CohortQuantilesSelected = "q50",
PassInGrid = NULL,
GridTune = FALSE,
BaselineComparison = "default",
MaxModelsInGrid = 25L,
MaxRunMinutes = 180L,
MaxRunsWithoutNewWinner = 10L,
TaskType = "CPU",
NumGPUs = 1,
EvaluationMetric = "RMSE",
LossFunction = "RMSE",
MetricPeriods = 50L,

```

```

NumOfParDepPlots = 1L,
Trees = 3000L,
Depth = 8L,
L2_Leaf_Reg = NULL,
LearningRate = NULL,
Langevin = FALSE,
DiffusionTemperature = 10000,
RandomStrength = 1,
BorderCount = 254,
RSM = NULL,
GrowPolicy = "SymmetricTree",
BootStrapType = "Bayesian",
ModelSizeReg = 0.5,
FeatureBorderType = "GreedyLogSum",
SamplingUnit = "Group",
SubSample = NULL,
ScoreFunction = "Cosine",
MinDataInLeaf = 1
)

```

## Arguments

<code>data</code>	data object
<code>BaseFunnelMeasure</code>	E.g. "Leads". This value should be a forward looking variable. Say you want to forecast <code>ConversionMeasure</code> 2 months into the future. You should have two months into the future of values of <code>BaseFunnelMeasure</code>
<code>ConversionMeasure</code>	E.g. "Conversions". Rate is derived as conversions over leads by cohort periods out
<code>ConversionRateMeasure</code>	Conversions over Leads for every cohort
<code>CohortPeriodsVariable</code>	Numeric. Numerical value of the the number of periods since cohort base date.
<code>CalendarDate</code>	The name of your date column that represents the calendar date
<code>CohortDate</code>	The name of your date column that represents the cohort date
<code>TruncateDate</code>	NULL. Supply a date to represent the earliest point in time you want in your data. Filtering takes place before partitioning data so feature engineering can include as many non null values as possible.
<code>PartitionRatios</code>	Requires three values for train, validation, and test data sets
<code>TimeUnit</code>	Base time unit of data. "days", "weeks", "months", "quarters", "years"
<code>CalendarTimeGroups</code>	<code>TimeUnit</code> value must be included. If you want to generate lags and moving averages in several time based aggregations, choose from "days", "weeks", "months", "quarters", "years".
<code>CohortTimeGroups</code>	<code>TimeUnit</code> value must be included. If you want to generate lags and moving averages in several time based aggregations, choose from "days", "weeks", "months", "quarters", "years".



TransformTargetVariable	TRUE or FALSE
TransformMethods	Choose from "Identity", "BoxCox", "Asinh", "Asin", "Log", "LogPlus1", "Logit", "YeoJohnson"
AnomalyDetection	Provide a named list. See examples
Jobs	Default is "eval" and "train"
SaveModelObjects	Set to TRUE to return all modeling objects to your environment
ModelID	A character string to name your model and output
ModelPath	Path to where you want your models saved
MetaDataPath	Path to where you want your metadata saved. If NULL, function will try ModelPath if it is not NULL.
DebugMode	Internal use
CalendarVariables	"wday", "mday", "yday", "week", "isoweek", "month", "quarter", "year"
HolidayGroups	c("USPublicHolidays", "EasterGroup", "ChristmasGroup", "OtherEcclesticalFeasts")
HolidayLookback	Number of days in range to compute number of holidays from a given date in the data. If NULL, the number of days are computed for you.
CohortHolidayLags	c(1L, 2L, 7L),
CohortHolidayMovingAverages	c(3L, 7L),
CalendarHolidayLags	c(1L, 2L, 7L),
CalendarHolidayMovingAverages	= c(3L, 7L),
ImputeRollStats	Constant value to fill NA after running AutoLagRollStats()
CalendarLags	List of the form list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))
CalendarMovingAverages	List of the form list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))
CalendarStandardDeviations	List of the form list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))
CalendarSkews	List of the form list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))
CalendarKurts	List of the form list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))
CalendarQuantiles	List of the form list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))
CalendarQuantilesSelected	Supply a vector of "q5", "q10", "q15", "q20", "q25", "q30", "q35", "q40", "q45", "q50", "q55", "q60", "q65", "q70", "q75", "q80", "q85", "q90", "q95"

CohortLags	List of the form <code>list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))</code>
CohortMovingAverages	List of the form <code>list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))</code>
CohortStandardDeviations	List of the form <code>list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))</code>
CohortSkews	List of the form <code>list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))</code>
CohortKurts	List of the form <code>list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))</code>
CohortQuantiles	List of the form <code>list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))</code>
CohortQuantilesSelected	Supply a vector of "q5", "q10", "q15", "q20", "q25", "q30", "q35", "q40", "q45", "q50", "q55", "q60", "q65", "q70", "q75", "q80", "q85", "q90", "q95"
PassInGrid	Defaults to NULL. Pass in a single row of grid from a previous output as a <code>data.table</code> (they are collected as <code>data.tables</code> )
GridTune	Set to TRUE to run a grid tuning procedure. Set a number in <code>MaxModelsInGrid</code> to tell the procedure how many models you want to test.
BaselineComparison	Set to either "default" or "best". Default is to compare each successive model build to the baseline model using max trees (from function args). Best makes the comparison to the current best model.
MaxModelsInGrid	Number of models to test from grid options
MaxRunMinutes	Maximum number of minutes to let this run
MaxRunsWithoutNewWinner	Number of models built before calling it quits
TaskType	"GPU" or "CPU" for catboost training
NumGPUs	Number of GPU's you would like to utilize
EvaluationMetric	This is the metric used inside catboost to measure performance on validation data during a grid-tune. "RMSE" is the default, but other options include: "MAE", "MAPE", "Poisson", "Quantile", "LogLinQuantile", "Lq", "NumErrors", "SMAPE", "R2", "MSLE", "MedianAbsoluteError".
LossFunction	Used in model training for model fitting. Select from 'RMSE', 'MAE', 'Quantile', 'LogLinQuantile', 'MAPE', 'Poisson', 'PairLogitPairwise', 'Tweedie', 'QueryRMSE'
MetricPeriods	Number of trees to build before the internal catboost eval step happens
NumOfParDepPlots	Number of partial dependence plots to return
Trees	Select the number of trees you want to have built to train the model
Depth	Depth of catboost model
L2_Leaf_Reg	l2 reg parameter

LearningRate	Defaults to NULL. Catboost will dynamically define this if L2_Leaf_Reg is NULL and RMSE is chosen (otherwise catboost will default it to 0.03). Then you can pull it out of the model object and pass it back in should you wish.
Langevin	Enables the Stochastic Gradient Langevin Boosting mode. If TRUE and TaskType == 'GPU' then TaskType will be converted to 'CPU'
DiffusionTemperature	Default is 10000
RandomStrength	Default is 1
BorderCount	Default is 254
RSM	CPU only. If TaskType is GPU then RSM will not be used
GrowPolicy	Default is SymmetricTree. Others include Lossguide and Depthwise
BootstrapType	If NULL, then if TaskType is GPU then Bayesian will be used. If CPU then MVS will be used. If MVS is selected when TaskType is GPU, then BootstrapType will be switched to Bayesian
ModelSizeReg	Defaults to 0.5. Set to 0 to allow for bigger models. This is for models with high cardinality categorical features. Values greater than 0 will shrink the model and quality will decline but models won't be huge.
FeatureBorderType	Defaults to 'GreedyLogSum'. Other options include: Median, Uniform, UniformAndQuantiles, MaxLogSum, MinEntropy
SamplingUnit	Default is Group. Other option is Object. if GPU is selected, this will be turned off unless the loss_function is YetiRankPairWise
SubSample	Can use if BootstrapType is neither Bayesian nor No. Pass NULL to use Catboost default. Used for bagging.
ScoreFunction	Default is Cosine. CPU options are Cosine and L2. GPU options are Cosine, L2, NewtonL2, and NewtonCosine (not available for Lossguide)
MinDataInLeaf	Defaults to 1. Used if GrowPolicy is not SymmetricTree

**Author(s)**

Adrian Antico

**See Also**

Other Automated Funnel Data Forecasting: [AutoCatBoostFunnelCARMAScoring\(\)](#), [AutoLightGBMFunnelCARMAScoring\(\)](#), [AutoLightGBMFunnelCARMA\(\)](#), [AutoXGBoostFunnelCARMAScoring\(\)](#), [AutoXGBoostFunnelCARMA\(\)](#)

**Examples**

```
## Not run:
# Create Fake Data
data <- RemixAutoML::FakeDataGenerator(ChainLadderData = TRUE)

# Subset data for training
ModelDataBase <- data[CalendarDateColumn < '2020-01-01' & CohortDateColumn < '2020-01-01']
ModelData <- data.table::copy(ModelDataBase)

# Train Funne Model
TestModel <- RemixAutoML::AutoCatBoostFunnelCARMA(
```

```

# Data Arguments
data = ModelData,
GroupVariables = NULL,
BaseFunnelMeasure = "Leads", # if you have XREGS, supply vector such as c("Leads", "XREGS1", "XREGS2")
ConversionMeasure = "Appointments",
ConversionRateMeasure = NULL,
CohortPeriodsVariable = "CohortDays",
CalendarDate = "CalendarDateColumn",
CohortDate = "CohortDateColumn",
PartitionRatios = c(0.70, 0.20, 0.10),
TruncateDate = NULL,
TimeUnit = "days",
TransformTargetVariable = TRUE,
TransformMethods = c("Asinh", "Asin", "Log", "LogPlus1", "Sqrt", "Logit"),
AnomalyDetection = list(tstat_high = 3, tstat_low = -2),

# MetaData Arguments
Jobs = c("eval", "train"),
SaveModelObjects = FALSE,
ModelID = "ModelTest",
ModelPath = getwd(),
MetaDataPath = NULL,
DebugMode = TRUE,
NumOfParDepPlots = 1L,

# Feature Engineering Arguments
CalendarTimeGroups = c("days", "weeks", "months"),
CohortTimeGroups = c("days", "weeks"),
CalendarVariables = c("wday", "mday", "yday", "week", "month", "quarter", "year"),
HolidayGroups = c("USPublicHolidays", "EasterGroup", "ChristmasGroup", "OtherEcclesticalFeasts"),
HolidayLookback = NULL,
CohortHolidayLags = c(1L, 2L, 7L),
CohortHolidayMovingAverages = c(3L, 7L),
CalendarHolidayLags = c(1L, 2L, 7L),
CalendarHolidayMovingAverages = c(3L, 7L),

# Time Series Features
ImputeRollStats = -0.001,
CalendarLags = list("day" = c(1L, 2L, 7L, 35L, 42L), "week" = c(5L, 6L, 10L, 12L, 25L, 26L)),
CalendarMovingAverages = list("day" = c(7L, 14L, 35L, 42L), "week" = c(5L, 6L, 10L, 12L, 20L, 24L), "month" = c(6L, 12L, 24L, 36L, 48L)),
CalendarStandardDeviations = NULL,
CalendarSkews = NULL,
CalendarKurts = NULL,
CalendarQuantiles = NULL,
CalendarQuantilesSelected = "q50",
CohortLags = list("day" = c(1L, 2L, 7L, 35L, 42L), "week" = c(5L, 6L)),
CohortMovingAverages = list("day" = c(7L, 14L, 35L, 42L), "week" = c(5L, 6L), "month" = c(1L, 2L)),
CohortStandardDeviations = NULL,
CohortSkews = NULL,
CohortKurts = NULL,
CohortQuantiles = NULL,
CohortQuantilesSelected = "q50",

# ML Grid Tuning
PassInGrid = NULL,
GridTune = FALSE,
BaselineComparison = "default",

```

```

MaxModelsInGrid = 25L,
MaxRunMinutes = 180L,
MaxRunsWithoutNewWinner = 10L,

# ML Setup Parameters
MetricPeriods = 10,
LossFunction = 'MAE',
EvaluationMetric = 'MAE',
TaskType = "CPU",
NumGPUs = 1,

# ML Parameters
Trees = 3000L,
Depth = 8L,
L2_Leaf_Reg = NULL,
LearningRate = NULL,
Langevin = FALSE,
DiffusionTemperature = 10000,
RandomStrength = 1,
BorderCount = 254,
RSM = NULL,
GrowPolicy = "SymmetricTree",
BootStrapType = "Bayesian",
ModelSizeReg = 0.5,
FeatureBorderType = "GreedyLogSum",
SamplingUnit = "Group",
SubSample = NULL,
ScoreFunction = "Cosine",
MinDataInLeaf = 1)

# Separate out the Base Funnel Measures Data
LeadsData <- data[, lapply(.SD, data.table::first), .SDcols = c("Leads"), by = c("CalendarDateColumn")]
ModelData <- ModelDataBase[, Leads := NULL]

# Forecast Funnel Model
Test <- RemixAutoML::AutoCatBoostFunnelCARMAScoring(
  TrainData = ModelData,
  ForwardLookingData = LeadsData,
  TrainEndDate = ModelData[, max(CalendarDateColumn)],
  ForecastEndDate = LeadsData[, max(CalendarDateColumn)],
  TrainOutput = TestModel$ModelOutput,
  ArgsList = TestModel$ArgsList,
  ModelPath = NULL,
  MaxCohortPeriod = 15,
  DebugMode = TRUE)

## End(Not run)

```

---

AutoCatBoostFunnelCARMAScoring

*AutoCatBoostFunnelCARMAScoring*


---

## Description

AutoCatBoostFunnelCARMAScoring for generating forecasts

**Usage**

```
AutoCatBoostFunnelCARMA Scoring(
  TrainData,
  ForwardLookingData = NULL,
  TrainEndDate = NULL,
  ForecastEndDate = NULL,
  ArgsList = NULL,
  TrainOutput = NULL,
  ModelPath = NULL,
  MaxCohortPeriod = NULL,
  DebugMode = FALSE
)
```

**Arguments**

TrainData	Data utilized in training. Do not put the BaseFunnelMeasure in this data set. Put it in the ForwardLookingData object
ForwardLookingData	Base funnel measure data. Needs to cover the span of the forecast horizon
TrainEndDate	Max date from the training data
ForecastEndDate	Max date to forecast out to
ArgsList	Output list from AutoCatBoostFunnelCARMA
TrainOutput	Pass in the model object to speed up forecasting
ModelPath	Path to model location
MaxCohortPeriod	Max cohort periods to utilize when forecasting
DebugMode	For debugging issues

**Author(s)**

Adrian Antico

**See Also**

Other Automated Funnel Data Forecasting: [AutoCatBoostFunnelCARMA\(\)](#), [AutoLightGBMFunnelCARMA Scoring\(\)](#), [AutoLightGBMFunnelCARMA\(\)](#), [AutoXGBoostFunnelCARMA Scoring\(\)](#), [AutoXGBoostFunnelCARMA\(\)](#)

**Examples**

```
## Not run:
data <- RemixAutoML::FakeDataGenerator(ChainLadderData = TRUE)

# Subset data for training
ModelDataBase <- data[CalendarDateColumn < '2020-01-01' & CohortDateColumn < '2020-01-01']
ModelData <- data.table::copy(ModelDataBase)

# Train Funne Model
TestModel <- RemixAutoML::AutoCatBoostFunnelCARMA(

  # Data Arguments
  data = ModelData,
```

```

GroupVariables = NULL,
BaseFunnelMeasure = "Leads", # if you have XREGS, supply vector such as c("Leads", "XREGS1", "XREGS2")
ConversionMeasure = "Appointments",
ConversionRateMeasure = NULL,
CohortPeriodsVariable = "CohortDays",
CalendarDate = "CalendarDateColumn",
CohortDate = "CohortDateColumn",
PartitionRatios = c(0.70,0.20,0.10),
TruncateDate = NULL,
TimeUnit = "days",
TransformTargetVariable = TRUE,
TransformMethods = c("Asinh","Asin","Log","LogPlus1","Sqrt","Logit"),
AnomalyDetection = list(tstat_high = 3, tstat_low = -2),

# MetaData Arguments
Jobs = c("eval","train"),
SaveModelObjects = FALSE,
ModelID = "ModelTest",
ModelPath = getwd(),
MetaDataPath = NULL,
DebugMode = TRUE,
NumOfParDepPlots = 1L,

# Feature Engineering Arguments
CalendarTimeGroups = c("days","weeks","months"),
CohortTimeGroups = c("days", "weeks"),
CalendarVariables = c("wday","mday","yday","week","month","quarter","year"),
HolidayGroups = c("USPublicHolidays","EasterGroup","ChristmasGroup","OtherEcclesticalFeasts"),
HolidayLookback = NULL,
CohortHolidayLags = c(1L,2L,7L),
CohortHolidayMovingAverages = c(3L,7L),
CalendarHolidayLags = c(1L,2L,7L),
CalendarHolidayMovingAverages = c(3L,7L),

# Time Series Features
ImputeRollStats = -0.001,
CalendarLags = list("day" = c(1L,2L,7L,35L,42L), "week" = c(5L,6L,10L,12L,25L,26L)),
CalendarMovingAverages = list("day" = c(7L,14L,35L,42L), "week" = c(5L,6L,10L,12L,20L,24L), "month" = c(6L,12L,24L)),
CalendarStandardDeviations = NULL,
CalendarSkews = NULL,
CalendarKurts = NULL,
CalendarQuantiles = NULL,
CalendarQuantilesSelected = "q50",
CohortLags = list("day" = c(1L,2L,7L,35L,42L), "week" = c(5L,6L)),
CohortMovingAverages = list("day" = c(7L,14L,35L,42L), "week" = c(5L,6L), "month" = c(1L,2L)),
CohortStandardDeviations = NULL,
CohortSkews = NULL,
CohortKurts = NULL,
CohortQuantiles = NULL,
CohortQuantilesSelected = "q50",

# ML Grid Tuning
PassInGrid = NULL,
GridTune = FALSE,
BaselineComparison = "default",
MaxModelsInGrid = 25L,
MaxRunMinutes = 180L,

```

```

MaxRunsWithoutNewWinner = 10L,

# ML Setup Parameters
MetricPeriods = 10,
LossFunction = 'MAE',
EvaluationMetric = 'MAE',
TaskType = "CPU",
NumGPUs = 1,

# ML Parameters
Trees = 3000L,
Depth = 8L,
L2_Leaf_Reg = NULL,
LearningRate = NULL,
Langevin = FALSE,
DiffusionTemperature = 10000,
RandomStrength = 1,
BorderCount = 254,
RSM = NULL,
GrowPolicy = "SymmetricTree",
BootstrapType = "Bayesian",
ModelSizeReg = 0.5,
FeatureBorderType = "GreedyLogSum",
SamplingUnit = "Group",
SubSample = NULL,
ScoreFunction = "Cosine",
MinDataInLeaf = 1)

# Separate out the Base Funnel Measures Data
LeadsData <- data[, lapply(.SD, data.table::first), .SDcols = c("Leads"), by = c("CalendarDateColumn")]
ModelData <- ModelDataBase[, Leads := NULL]

# Forecast Funnel Model
Test <- RemixAutoML::AutoCatBoostFunnelCARMA(
  TrainData = ModelData,
  ForwardLookingData = LeadsData,
  TrainEndDate = ModelData[, max(CalendarDateColumn)],
  ForecastEndDate = LeadsData[, max(CalendarDateColumn)],
  TrainOutput = TestModel$ModelOutput,
  ArgsList = TestModel$ArgsList,
  ModelPath = NULL,
  MaxCohortPeriod = 15,
  DebugMode = TRUE)

## End(Not run)

```

---

AutoCatBoostHurdleCARMA

*AutoCatBoostHurdleCARMA*


---

## Description

AutoCatBoostHurdleCARMA is an intermittent demand, Multivariate Forecasting algorithms with calendar variables, Holiday counts, holiday lags, holiday moving averages, differencing, transfor-



mations, interaction-based categorical encoding using target variable and features to generate various time-based aggregated lags, moving averages, moving standard deviations, moving skewness, moving kurtosis, moving quantiles, parallelized interaction-based fourier pairs by grouping variables, and Trend Variables.

## Usage

```
AutoCatBoostHurdleCARMA(
  data,
  NonNegativePred = FALSE,
  Threshold = NULL,
  RoundPreds = FALSE,
  TrainOnFull = FALSE,
  TargetColumnName = "Target",
  DateColumnName = "DateTime",
  HierarchGroups = NULL,
  GroupVariables = NULL,
  TimeWeights = 1,
  FC_Periods = 30,
  TimeUnit = "week",
  TimeGroups = c("weeks", "months"),
  NumOfParDepPlots = 10L,
  TargetTransformation = FALSE,
  Methods = c("BoxCox", "Asinh", "Log", "LogPlus1", "Sqrt", "Asin", "Logit"),
  AnomalyDetection = NULL,
  XREGS = NULL,
  Lags = c(1L:5L),
  MA_Periods = c(2L:5L),
  SD_Periods = NULL,
  Skew_Periods = NULL,
  Kurt_Periods = NULL,
  Quantile_Periods = NULL,
  Quantiles_Selected = c("q5", "q95"),
  Difference = TRUE,
  FourierTerms = 6L,
  CalendarVariables = c("second", "minute", "hour", "wday", "mday", "yday", "week",
    "wom", "isoweek", "month", "quarter", "year"),
  HolidayVariable = c("USPublicHolidays", "EasterGroup", "ChristmasGroup",
    "OtherEcclesticalFeasts"),
  HolidayLookback = NULL,
  HolidayLags = 1L,
  HolidayMovingAverages = 1L:2L,
  TimeTrendVariable = FALSE,
  ZeroPadSeries = NULL,
  DataTruncate = FALSE,
  SplitRatios = c(0.7, 0.2, 0.1),
  PartitionType = "timeseries",
  Timer = TRUE,
  DebugMode = FALSE,
  TaskType = "GPU",
  NumGPU = 1,
  EvalMetric = "RMSE",
  GridTune = FALSE,
```

```

PassInGrid = NULL,
ModelCount = 100,
MaxRunsWithoutNewWinner = 50,
MaxRunMinutes = 24L * 60L,
NTrees = list(classifier = 200, regression = 200),
Depth = list(classifier = 9, regression = 9),
LearningRate = list(classifier = NULL, regression = NULL),
L2_Leaf_Reg = list(classifier = NULL, regression = NULL),
RandomStrength = list(classifier = 1, regression = 1),
BorderCount = list(classifier = 254, regression = 254),
BootstrapType = list(classifier = "Bayesian", regression = "Bayesian")
)

```

## Arguments

<code>data</code>	Supply your full series data set here
<code>NonNegativePred</code>	TRUE or FALSE
<code>Threshold</code>	Select confusion matrix measure to optimize for pulling in threshold. Choose from 'MCC', 'Acc', 'TPR', 'TNR', 'FNR', 'FPR', 'FDR', 'FOR', 'F1_Score', 'F2_Score', 'F0.5_Score', 'NPV', 'PPV', 'ThreatScore', 'Utility'
<code>RoundPreds</code>	Rounding predictions to an integer value. TRUE or FALSE. Defaults to FALSE
<code>TrainOnFull</code>	Set to TRUE to train on full data
<code>TargetColumnName</code>	List the column name of your target variables column. E.g. 'Target'
<code>DateColumnName</code>	List the column name of your date column. E.g. 'DateTime'
<code>HierarchGroups</code>	Vector of hierachy categorical columns.
<code>GroupVariables</code>	Defaults to NULL. Use NULL when you have a single series. Add in Group-Variables when you have a series for every level of a group or multiple groups.
<code>TimeWeights</code>	Timeweights creation. Supply a value, such as 0.9999
<code>FC_Periods</code>	Set the number of periods you want to have forecasts for. E.g. 52 for weekly data to forecast a year ahead
<code>TimeUnit</code>	List the time unit your data is aggregated by. E.g. '1min', '5min', '10min', '15min', '30min', 'hour', 'day', 'week', 'month', 'quarter', 'year'.
<code>TimeGroups</code>	Select time aggregations for adding various time aggregated GDL features.
<code>NumOfParDepPlots</code>	Supply a number for the number of partial dependence plots you want returned
<code>TargetTransformation</code>	Run <code>AutoTransformationCreate()</code> to find best transformation for the target variable. Tests YeoJohnson, BoxCox, and Asigh (also Asin and Logit for proportion target variables).
<code>Methods</code>	Choose from 'YeoJohnson', 'BoxCox', 'Asinh', 'Log', 'LogPlus1', 'Sqrt', 'Asin', or 'Logit'. If more than one is selected, the one with the best normalization pearson statistic will be used. Identity is automatically selected and compared.
<code>AnomalyDetection</code>	NULL for not using the service. Other, provide a list, e.g. <code>AnomalyDetection = list('tstat_high' = 4, tstat_low = -4)</code>

XREGS	Additional data to use for model development and forecasting. Data needs to be a complete series which means both the historical and forward looking values over the specified forecast window needs to be supplied.
Lags	Select the periods for all lag variables you want to create. E.g. c(1:5,52)
MA_Periods	Select the periods for all moving average variables you want to create. E.g. c(1:5,52)
SD_Periods	Select the periods for all moving standard deviation variables you want to create. E.g. c(1:5,52)
Skew_Periods	Select the periods for all moving skewness variables you want to create. E.g. c(1:5,52)
Kurt_Periods	Select the periods for all moving kurtosis variables you want to create. E.g. c(1:5,52)
Quantile_Periods	Select the periods for all moving quantiles variables you want to create. E.g. c(1:5,52)
Quantiles_Selected	Select from the following 'q5', 'q10', 'q15', 'q20', 'q25', 'q30', 'q35', 'q40', 'q45', 'q50', 'q55', 'q60', 'q65', 'q70', 'q75', 'q80', 'q85', 'q90', 'q95'
Difference	Puts the I in ARIMA for single series and grouped series.
FourierTerms	Set to the max number of pairs. E.g. 2 means to generate two pairs for by each group level and interactions if hierarchy is enabled.
CalendarVariables	NULL, or select from 'second', 'minute', 'hour', 'wday', 'mday', 'yday', 'week', 'isoweek', 'month', 'quarter', 'year'
HolidayVariable	NULL, or select from 'USPublicHolidays', 'EasterGroup', 'ChristmasGroup', 'OtherEcclesticalFeasts'
HolidayLookback	Number of days in range to compute number of holidays from a given date in the data. If NULL, the number of days are computed for you.
HolidayLags	Number of lags to build off of the holiday count variable.
HolidayMovingAverages	Number of moving averages to build off of the holiday count variable.
TimeTrendVariable	Set to TRUE to have a time trend variable added to the model. Time trend is numeric variable indicating the numeric value of each record in the time series (by group). Time trend starts at 1 for the earliest point in time and increments by one for each success time point.
ZeroPadSeries	Set to 'all', 'inner', or NULL. See TimeSeriesFill for explanation
DataTruncate	Set to TRUE to remove records with missing values from the lags and moving average features created
SplitRatios	E.g c(0.7,0.2,0.1) for train, validation, and test sets
PartitionType	Select 'random' for random data partitioning 'timeseries' for partitioning by time frames
Timer	Set to FALSE to turn off the updating print statements for progress
DebugMode	Defaults to FALSE. Set to TRUE to get a print statement of each high level comment in function

TaskType	Default is 'GPU' but you can also set it to 'CPU'
NumGPU	Defaults to 1. If CPU is set this argument will be ignored.
EvalMetric	Select from 'RMSE', 'MAE', 'MAPE', 'Poisson', 'Quantile', 'LogLinQuantile', 'Lq', 'NumErrors', 'SMAPE', 'R2', 'MSLE', 'MedianAbsoluteError'
GridTune	Set to TRUE to run a grid tune
PassInGrid	Defaults to NULL
ModelCount	Set the number of models to try in the grid tune
MaxRunsWithoutNewWinner	Default is 50
MaxRunMinutes	Default is 60*60
NTrees	Select the number of trees you want to have built to train the model
Depth	Depth of catboost model
LearningRate	learning_rate
L2_Leaf_Reg	l2 reg parameter
RandomStrength	Default is 1
BorderCount	Default is 254
BootstrapType	Select from Catboost list

### Value

Returns a data.table of original series and forecasts, the catboost model objects (everything returned from AutoCatBoostRegression()), a time series forecast plot, and transformation info if you set TargetTransformation to TRUE. The time series forecast plot will plot your single series or aggregate your data to a single series and create a plot from that.

### Author(s)

Adrian Antico

### See Also

Other Automated Panel Data Forecasting: [AutoCatBoostCARMA\(\)](#), [AutoCatBoostVectorCARMA\(\)](#), [AutoH2OCARMA\(\)](#), [AutoLightGBMCARMA\(\)](#), [AutoLightGBMHurdleCARMA\(\)](#), [AutoXGBoostCARMA\(\)](#), [AutoXGBoostHurdleCARMA\(\)](#)

### Examples

```
## Not run:

# Single group variable and xregs ----

# Load Walmart Data from Dropbox----
data <- data.table::fread(
  'https://www.dropbox.com/s/2str3ek4f4cheqi/walmart_train.csv?dl=1')

# Subset for Stores / Departments With Full Series
data <- data[, Counts := .N, by = c('Store', 'Dept')][Counts == 143][
  , Counts := NULL]

# Subset Columns (remove IsHoliday column)----
```

```

keep <- c('Store','Dept','Date','Weekly_Sales')
data <- data[, ..keep]
data <- data[Store == 1][, Store := NULL]
xregs <- data.table::copy(data)
data.table::setnames(xregs, 'Dept', 'GroupVar')
data.table::setnames(xregs, 'Weekly_Sales', 'Other')
data <- data[as.Date(Date) < as.Date('2012-09-28')]

# Add zeros for testing
data[runif(.N) < 0.25, Weekly_Sales := 0]

# Build forecast
CatBoostResults <- RemixAutoML::AutoCatBoostHurdleCARMA(

  # data args
  data = data, # TwoGroup_Data,
  TargetColumnName = 'Weekly_Sales',
  DateColumnName = 'Date',
  HierarchGroups = NULL,
  GroupVariables = c('Dept'),
  TimeWeights = 1,
  TimeUnit = 'weeks',
  TimeGroups = c('weeks','months'),

  # Production args
  TrainOnFull = FALSE,
  SplitRatios = c(1 - 20 / 138, 10 / 138, 10 / 138),
  PartitionType = 'random',
  FC_Periods = 4,
  Timer = TRUE,
  DebugMode = TRUE,

  # Target transformations
  TargetTransformation = TRUE,
  Methods = c('BoxCox', 'Asinh', 'Asin', 'Log',
    'LogPlus1', 'Sqrt', 'Logit', 'YeoJohnson'),
  Difference = FALSE,
  NonNegativePred = FALSE,
  RoundPreds = FALSE,

  # Date features
  CalendarVariables = c('week', 'wom', 'month', 'quarter'),
  HolidayVariable = c('USPublicHolidays',
    'EasterGroup',
    'ChristmasGroup', 'OtherEcclesticalFeasts'),
  HolidayLookback = NULL,
  HolidayLags = 1,
  HolidayMovingAverages = 1:2,

  # Time series features
  Lags = list('weeks' = seq(2L, 10L, 2L),
    'months' = c(1:3)),
  MA_Periods = list('weeks' = seq(2L, 10L, 2L),
    'months' = c(2,3)),
  SD_Periods = NULL,
  Skew_Periods = NULL,
  Kurt_Periods = NULL,

```

```

Quantile_Periods = NULL,
Quantiles_Selected = c('q5','q95'),

# Bonus features
AnomalyDetection = NULL,
XREGS = xregs,
FourierTerms = 2,
TimeTrendVariable = TRUE,
ZeroPadSeries = NULL,
DataTruncate = FALSE,

# ML Args
NumOfParDepPlots = 100L,
EvalMetric = 'RMSE',
GridTune = FALSE,
PassInGrid = NULL,
ModelCount = 5,
TaskType = 'GPU',
NumGPU = 1,
MaxRunsWithoutNewWinner = 50,
MaxRunMinutes = 60*60,
NTrees = 2500,
L2_Leaf_Reg = 3.0,
LearningRate = list('classifier' = seq(0.01,0.25,0.01), 'regression' = seq(0.01,0.25,0.01)),
RandomStrength = 1,
BorderCount = 254,
BootStrapType = c('Bayesian', 'Bernoulli', 'Poisson', 'MVS', 'No'),
Depth = 6)

# Two group variables and xregs

# Load Walmart Data from Dropbox----
data <- data.table::fread(
  'https://www.dropbox.com/s/2str3ek4f4cheqi/walmart_train.csv?dl=1')

# Subset for Stores / Departments With Full Series
data <- data[, Counts := .N, by = c('Store','Dept')][Counts == 143][
  , Counts := NULL]

# Put negative values at 0
data[, Weekly_Sales := data.table::fifelse(Weekly_Sales < 0, 0, Weekly_Sales)]

# Subset Columns (remove IsHoliday column)----
keep <- c('Store','Dept','Date','Weekly_Sales')
data <- data[, ..keep]
data <- data[Store %in% c(1,2)]

xregs <- data.table::copy(data)
xregs[, GroupVar := do.call(paste, c(.SD, sep = ' ')), .SDcols = c('Store','Dept')]
xregs[, c('Store','Dept') := NULL]
data.table::setnames(xregs, 'Weekly_Sales', 'Other')
xregs[, Other := jitter(Other, factor = 25)]
data <- data[as.Date(Date) < as.Date('2012-09-28')]

# Add some zeros for testing
data[runif(.N) < 0.25, Weekly_Sales := 0]

```

```

# Build forecast
Output <- RemixAutoML::AutoCatBoostHurdleCARMA(

  # data args
  data = data,
  TargetColumnName = 'Weekly_Sales',
  DateColumnName = 'Date',
  HierarchGroups = NULL,
  GroupVariables = c('Store','Dept'),
  TimeWeights = 1,
  TimeUnit = 'weeks',
  TimeGroups = c('weeks','months'),

  # Production args
  TrainOnFull = TRUE,
  SplitRatios = c(1 - 20 / 138, 10 / 138, 10 / 138),
  PartitionType = 'random',
  FC_Periods = 4,
  Timer = TRUE,
  DebugMode = TRUE,

  # Target transformations
  TargetTransformation = TRUE,
  Methods = c('BoxCox', 'Asinh', 'Asin', 'Log',
              'LogPlus1', 'Sqrt', 'Logit', 'YeoJohnson'),
  Difference = FALSE,
  NonNegativePred = FALSE,
  Threshold = NULL,
  RoundPreds = FALSE,

  # Date features
  CalendarVariables = c('week', 'wom', 'month', 'quarter'),
  HolidayVariable = c('USPublicHolidays',
                     'EasterGroup',
                     'ChristmasGroup','OtherEcclesticalFeasts'),
  HolidayLookback = NULL,
  HolidayLags = 1,
  HolidayMovingAverages = 1:2,

  # Time series features
  Lags = list('weeks' = seq(2L, 10L, 2L),
              'months' = c(1:3)),
  MA_Periods = list('weeks' = seq(2L, 10L, 2L),
                   'months' = c(2,3)),
  SD_Periods = NULL,
  Skew_Periods = NULL,
  Kurt_Periods = NULL,
  Quantile_Periods = NULL,
  Quantiles_Selected = c('q5','q95'),

  # Bonus features
  AnomalyDetection = NULL,
  XREGS = xregs,
  FourierTerms = 2,
  TimeTrendVariable = TRUE,
  ZeroPadSeries = NULL,
  DataTruncate = FALSE,

```

```
# ML Args
NumOfParDepPlots = 100L,
EvalMetric = 'RMSE',
GridTune = FALSE,
PassInGrid = NULL,
ModelCount = 5,
TaskType = 'GPU',
NumGPU = 1,
MaxRunsWithoutNewWinner = 50,
MaxRunMinutes = 60*60,
NTrees = list('classifier' = 200, 'regression' = 200),
Depth = list('classifier' = 9, 'regression' = 9),
LearningRate = list('classifier' = NULL, 'regression' = NULL),
L2_Leaf_Reg = list('classifier' = NULL, 'regression' = NULL),
RandomStrength = list('classifier' = 1, 'regression' = 1),
BorderCount = list('classifier' = 254, 'regression' = 254),
BootStrapType = list('classifier' = 'Bayesian', 'regression' = 'Bayesian'))

## End(Not run)
```

---

AutoCatBoostHurdleModel

*AutoCatBoostHurdleModel*


---

## Description

AutoCatBoostHurdleModel for generalized hurdle modeling. Check out the Readme.Rd on github for more background.

## Usage

```
AutoCatBoostHurdleModel(
  data = NULL,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  Buckets = 0L,
  TargetColumnName = NULL,
  FeatureColNames = NULL,
  PrimaryDateColumn = NULL,
  WeightsColumnName = NULL,
  IDcols = NULL,
  TransformNumericColumns = NULL,
  Methods = c("Asinh", "Asin", "Log", "LogPlus1", "Sqrt", "Logit"),
  ClassWeights = NULL,
  SplitRatios = c(0.7, 0.2, 0.1),
  task_type = "GPU",
  ModelID = "ModelTest",
  Paths = NULL,
  DebugMode = FALSE,
  MetaDataPaths = NULL,
  SaveModelObjects = FALSE,
```



```

ReturnModelObjects = TRUE,
NumOfParDepPlots = 10L,
PassInGrid = NULL,
GridTune = FALSE,
BaselineComparison = "default",
MaxModelsInGrid = 1L,
MaxRunsWithoutNewWinner = 20L,
MaxRunMinutes = 60L * 60L,
MetricPeriods = 25L,
Langevin = FALSE,
DiffusionTemperature = 10000,
Trees = list(classifier = 500, regression = 500),
Depth = list(classifier = 8, regression = 8),
RandomStrength = list(classifier = 1, regression = 1),
BorderCount = list(classifier = 254, regression = 254),
LearningRate = list(classifier = NULL, regression = NULL),
L2_Leaf_Reg = list(classifier = NULL, regression = NULL),
RSM = list(classifier = 1, regression = 1),
BootStrapType = list(classifier = "Bayesian", regression = "Bayesian"),
GrowPolicy = list(classifier = "SymmetricTree", regression = "SymmetricTree")
)

```

### Arguments

data	Source training data. Do not include a column that has the class labels for the buckets as they are created internally.
TrainOnFull	Set to TRUE to use all data
ValidationData	Source validation data. Do not include a column that has the class labels for the buckets as they are created internally.
TestData	Source test data. Do not include a column that has the class labels for the buckets as they are created internally.
Buckets	A numeric vector of the buckets used for subsetting the data. NOTE: the final Bucket value will first create a subset of data that is less than the value and a second one thereafter for data greater than the bucket value.
TargetColumnName	Supply the column name or number for the target variable
FeatureColNames	Supply the column names or number of the features (not included the Primary-DateColumn)
PrimaryDateColumn	Supply a date column if the data is functionally related to it
WeightsColumnName	Column name for weights variable
IDcols	Includes PrimaryDateColumn and any other columns you want returned in the validation data with predictions
TransformNumericColumns	Transform numeric column inside the AutoCatBoostRegression() function
Methods	Choose transformation methods
ClassWeights	Utilize these for the classifier model

SplitRatios	Supply vector of partition ratios. For example, c(0.70,0.20,0,10).
task_type	Set to 'GPU' or 'CPU'
ModelID	Define a character name for your models
Paths	The path to your folder where you want your model information saved
DebugMode	Print steps to screen by setting to TRUE
MetaDataPaths	TA character string of your path file to where you want your model evaluation output saved. If left NULL, all output will be saved to Paths.
SaveModelObjects	Set to TRUE to save the model objects to file in the folders listed in Paths
ReturnModelObjects	TRUE to return the models
NumOfParDepPlots	Set to pull back N number of partial dependence calibration plots.
PassInGrid	Pass in a grid for changing up the parameter settings for catboost
GridTune	Set to TRUE if you want to grid tune the models
BaselineComparison	= 'default',
MaxModelsInGrid	= 1L,
MaxRunsWithoutNewWinner	= 20L,
MaxRunMinutes	= 60L*60L,
MetricPeriods	= 25L,
Langevin	TRUE or FALSE
DiffusionTemperature	Default 10000
Trees	Provide a named list to have different number of trees for each model. Trees = list('classifier' = seq(1000,2000,100), 'regression' = seq(1000,2000,100))
Depth	= seq(4L, 8L, 1L),
RandomStrength	1
BorderCount	128
LearningRate	= seq(0.01,0.10,0.01),
L2_Leaf_Reg	= seq(1.0, 10.0, 1.0),
RSM	= c(0.80, 0.85, 0.90, 0.95, 1.0),
BootStrapType	= c('Bayesian', 'Bernoulli', 'Poisson', 'MVS', 'No'),
GrowPolicy	= c('SymmetricTree', 'Depthwise', 'Lossguide')
Shuffles	= 2L,

### Value

Returns AutoCatBoostRegression() model objects: VariableImportance.csv, Model, ValidationData.csv, EvaluationPlot.png, EvaluationBoxPlot.png, EvaluationMetrics.csv, ParDepPlots.R a named list of features with partial dependence calibration plots, ParDepBoxPlots.R, GridCollect, and catboost-grid

**Author(s)**

Adrian Antico

**See Also**

Other Supervised Learning - Hurdle Modeling: [AutoH2oDRFHurdleModel\(\)](#), [AutoH2oGBMHurdleModel\(\)](#), [AutoLightGBMHurdleModel\(\)](#), [AutoXGBoostHurdleModel\(\)](#)

**Examples**

```
## Not run:
# Test data.table
CatBoost_QA <- data.table::CJ(
  TOF = c(TRUE,FALSE),
  Classification = c(TRUE,FALSE),
  TaskType = c("CPU","GPU"),
  Success = "Failure",
  PartitionInFunction = c(TRUE,FALSE), sorted = FALSE
)

# Remove impossible combinations
CatBoost_QA <- CatBoost_QA[!(PartitionInFunction & TOF)]
CatBoost_QA[, RunNumber := seq_len(.N)]

# Path File
Path <- getwd()

#      TOF Classification TaskType Success PartitionInFunction RunNumber
# 1:  TRUE           TRUE      CPU Failure           FALSE          1 success
# 2:  TRUE           TRUE      GPU Failure           FALSE          2 success
# 3:  TRUE          FALSE      CPU Failure           FALSE          3 success
# 4:  TRUE          FALSE      GPU Failure           FALSE          4 success
# 5: FALSE           TRUE      CPU Failure           TRUE          5 fail
# 6: FALSE           TRUE      CPU Failure           FALSE          6 fail
# 7: FALSE           TRUE      GPU Failure           TRUE          7 fail
# 8: FALSE           TRUE      GPU Failure           FALSE          8 fail
# 9: FALSE          FALSE      CPU Failure           TRUE          9 fail
#10: FALSE          FALSE      CPU Failure           FALSE         10 fail
#11: FALSE          FALSE      GPU Failure           TRUE         11 fail
#12: FALSE          FALSE      GPU Failure           FALSE         12 fail

# AutoCatBoostHurdleModel
# run = 1
# run = 2
for(run in seq_len(CatBoost_QA[,.N])) {

  # Define values
  tasktypemode <- CatBoost_QA[run, TaskType]
  tof <- CatBoost_QA[run, TOF]
  PartitionInFunction <- CatBoost_QA[run, PartitionInFunction]
  Classify <- CatBoost_QA[run, Classification]
  Tar <- "Adrian"

  # Get data
  if(Classify) {
```

```

    data <- RemixAutoML::FakeDataGenerator(N = 15000, ZIP = 1)
  } else {
    data <- RemixAutoML::FakeDataGenerator(N = 15000, ZIP = 2)
  }

  # Partition Data
  if(!tof && !PartitionInFunction) {
    Sets <- RemixAutoML::AutoDataPartition(
      data = data,
      NumDataSets = 3,
      Ratios = c(0.7,0.2,0.1),
      PartitionType = "random",
      StratifyColumnNames = "Adrian",
      TimeColumnName = NULL)
    TTrainData <- Sets$TrainData
    VValidationData <- Sets$ValidationData
    TTestData <- Sets$TestData
    rm(Sets)
  } else {
    TTrainData <- data.table::copy(data)
    VValidationData <- NULL
    TTestData <- NULL
  }

  # Run function
  TestModel <- tryCatch({RemixAutoML::AutoCatBoostHurdleModel(

    # Operationalization
    task_type = 'GPU',
    ModelID = 'ModelTest',
    SaveModelObjects = FALSE,
    ReturnModelObjects = TRUE,

    # Data related args
    data = TTrainData,
    ValidationData = VValidationData,
    TestData = TTestData,
    WeightsColumnName = NULL,
    TrainOnFull = tof,
    Buckets = if(Classify) 0L else c(0,2,3),
    TargetColumnName = "Adrian",
    FeatureColNames = names(TTrainData)[!names(data) %in% c("Adrian","IDcol_1","IDcol_2","IDcol_3","IDcol_4",
    PrimaryDateColumn = "DateTime",
    IDcols = c("IDcol_1","IDcol_2","IDcol_3","IDcol_4","IDcol_5","DateTime"),
    DebugMode = TRUE,

    # Metadata args
    Paths = Path,
    MetaDataPaths = Path,
    TransformNumericColumns = NULL,
    Methods = c('Asinh', 'Asin', 'Log', 'LogPlus1', 'Sqrt', 'Logit'),
    ClassWeights = NULL,
    SplitRatios = if(PartitionInFunction) c(0.70, 0.20, 0.10) else NULL,
    NumOfParDepPlots = 10L,

    # Grid tuning setup
    PassInGrid = NULL,

```

```

    GridTune = FALSE,
    BaselineComparison = 'default',
    MaxModelsInGrid = 1L,
    MaxRunsWithoutNewWinner = 20L,
    MaxRunMinutes = 60L*60L,
    MetricPeriods = 25L,

    # Bandit grid args
    Langevin = FALSE,
    DiffusionTemperature = 10000,
    Trees = list('classifier' = 50, 'regression' = 50),
    Depth = list('classifier' = 4, 'regression' = 4),
    RandomStrength = list('classifier' = 1, 'regression' = 1),
    BorderCount = list('classifier' = 32, 'regression' = 32),
    LearningRate = list('classifier' = 0.01, 'regression' = 0.01),
    L2_Leaf_Reg = list('classifier' = 3.0, 'regression' = 1.0),
    RSM = list('classifier' = 0.80, 'regression' = 0.80),
    BootStrapType = list('classifier' = 'Bayesian', 'regression' = 'Bayesian'),
    GrowPolicy = list('classifier' = 'SymmetricTree', 'regression' = 'SymmetricTree'))}, error = function(x) NULL)

# Outcome
if(!is.null(TestModel)) CatBoost_QA[run, Success := "Success"]
TestModel <- NULL
gc(); Sys.sleep(5)
data.table::fwrite(CatBoost_QA, file = file.path(Path, "AutoCatBoostHurdleModel_QA.csv"))

# Outcome
if(!is.null(TestModel)) CatBoost_QA[run, Success := "Success"]
data.table::fwrite(CatBoost_QA, file = file.path(Path, "AutoCatBoostHurdleModel_QA.csv"))

# Score CatBoost Hurdle Model
Output <- tryCatch({RemixAutoML::AutoCatBoostHurdleModelScoring(
  TestData = TTrainData,
  Path = Path,
  ModelID = "ModelTest",
  Modellist = TestModel$Modellist,
  ArgsList = TestModel$ArgsList,
  Threshold = NULL)}, error = function(x) NULL)

# Outcome
if(!is.null(Output)) CatBoost_QA[run, ScoreSuccess := "Success"]
TestModel <- NULL
Output <- NULL
gc(); Sys.sleep(5)
data.table::fwrite(CatBoost_QA, file = file.path(Path, "AutoCatBoostHurdleModel_QA.csv"))
}

## End(Not run)

```

---

AutoCatBoostHurdleModelScoring

*AutoCatBoostHurdleModelScoring*


---

## Description

AutoCatBoostHurdleModelScoring can score AutoCatBoostHurdleModel() models

**Usage**

```
AutoCatBoostHurdleModelScoring(
  TestData = NULL,
  Path = NULL,
  ModelID = NULL,
  ArgsList = NULL,
  ModelList = NULL,
  Threshold = NULL,
  CARMA = FALSE
)
```

**Arguments**

TestData	scoring data.table
Path	Supply if ArgsList is NULL or ModelList is null.
ModelID	Supply if ArgsList is NULL or ModelList is null. Same as used in model training.
ArgsList	Output from the hurdle model
ModelList	Output from the hurdle model
Threshold	NULL to use raw probabilities to predict. Otherwise, supply a threshold
CARMA	Keep FALSE. Used for CARMA functions internals

**Value**

A data.table with the final predicted value, the intermediate model predictions, and your source data

**Author(s)**

Adrian Antico

**See Also**

Other Automated Model Hurdle Modeling: [AutoLightGBMHurdleModelScoring\(\)](#), [AutoXGBoostHurdleModelScoring\(\)](#)

**Examples**

```
## Not run:

# Define file path
Path <- getwd()

# Create hurdle data with correlated features
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.70,
  N = 25000,
  ID = 3,
  FactorCount = 2L,
  AddDate = TRUE,
  ZIP = 1,
  Classification = FALSE,
  MultiClass = FALSE)

# Define features
```

```

Features <- names(data)[!names(data) %chin%
  c("Adrian", "IDcol_1", "IDcol_2", "IDcol_3", "DateTime")]

# Build hurdle model
Output <- RemixAutoML::AutoCatBoostHurdleModel(

  # Operationalization args
  TreeMethod = "hist",
  TrainOnFull = FALSE,
  PassInGrid = NULL,

  # Metadata args
  NThreads = max(1L, parallel::detectCores()-2L),
  ModelID = "ModelTest",
  Paths = normalizePath(Path),
  MetaDataPaths = NULL,
  ReturnModelObjects = TRUE,

  # data args
  data,
  ValidationData = NULL,
  TestData = NULL,
  Buckets = c(0),
  TargetColumnName = "Adrian",
  FeatureColNames = Features,
  IDcols = c("IDcol_1", "IDcol_2", "IDcol_3"),

  # options
  TransformNumericColumns = NULL,
  SplitRatios = c(0.70, 0.20, 0.10),
  SaveModelObjects = TRUE,
  NumOfParDepPlots = 10L,

  # grid tuning args
  GridTune = FALSE,
  grid_eval_metric = "accuracy",
  MaxModelsInGrid = 1L,
  BaselineComparison = "default",
  MaxRunsWithoutNewWinner = 10L,
  MaxRunMinutes = 60L,

  # bandit hyperparameters
  Trees = 100L,
  eta = seq(0.05, 0.40, 0.05),
  max_depth = seq(4L, 16L, 2L),

  # random hyperparameters
  min_child_weight = seq(1.0, 10.0, 1.0),
  subsample = seq(0.55, 1.0, 0.05),
  colsample_bytree = seq(0.55, 1.0, 0.05))

# Score XGBoost Hurdle Model
HurdleScores <- RemixAutoML::AutoCatBoostHurdleModelScoring(
  TestData = data,
  Path = Path,
  ModelID = "ModelTest",
  ModelList = NULL,

```

```

    ArgsList = NULL,
    Threshold = NULL)

## End(Not run)

```

---

AutoCatBoostMultiClass

*AutoCatBoostMultiClass*


---

## Description

AutoCatBoostMultiClass is an automated modeling function that runs a variety of steps. First, a stratified sampling (by the target variable) is done to create train and validation sets. Then, the function will run a random grid tune over N number of models and find which model is the best (a default model is always included in that set). Once the model is identified and built, several other outputs are generated: validation data with predictions, evaluation metrics, variable importance, and column names used in model fitting. You can download the catboost package using devtools, via: `devtools::install_github('catboost/catboost', subdir = 'catboost/R-package')`.

## Usage

```

AutoCatBoostMultiClass(
  OutputSelection = c("Importances", "EvalPlots", "EvalMetrics", "Score_TrainData"),
  data = NULL,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = NULL,
  FeatureColNames = NULL,
  PrimaryDateColumn = NULL,
  WeightsColumnName = NULL,
  IDcols = NULL,
  TrainOnFull = FALSE,
  task_type = "GPU",
  NumGPUs = 1,
  DebugMode = FALSE,
  ReturnModelObjects = TRUE,
  SaveModelObjects = FALSE,
  ModelID = "FirstModel",
  model_path = NULL,
  metadata_path = NULL,
  ClassWeights = NULL,
  NumOfParDepPlots = 3,
  eval_metric = "MultiClassOneVsAll",
  loss_function = "MultiClassOneVsAll",
  grid_eval_metric = "Accuracy",
  BaselineComparison = "default",
  MetricPeriods = 10L,
  PassInGrid = NULL,
  GridTune = FALSE,
  MaxModelsInGrid = 30L,
  MaxRunsWithoutNewWinner = 20L,

```



```

MaxRunMinutes = 24L * 60L,
Trees = 50L,
Depth = 6,
LearningRate = NULL,
L2_Leaf_Reg = NULL,
RandomStrength = 1,
BorderCount = 128,
RSM = NULL,
BootStrapType = NULL,
GrowPolicy = NULL,
langevin = FALSE,
diffusion_temperature = 10000,
model_size_reg = 0.5,
feature_border_type = "GreedyLogSum",
sampling_unit = "Object",
subsample = NULL,
score_function = "Cosine",
min_data_in_leaf = 1
)

```

## Arguments

OutputSelection	You can select what type of output you want returned. Choose from c('Importances', 'EvalPlots', 'EvalMetrics', 'PDFs', 'Score_TrainData')
data	This is your data set for training and testing your model
ValidationData	This is your holdout data set used in modeling either refine your hyperparameters. Catboost using both training and validation data in the training process so you should evaluate out of sample performance with this data set.
TestData	This is your holdout data set. Catboost using both training and validation data in the training process so you should evaluate out of sample performance with this data set.
TargetColumnName	Either supply the target column name OR the column number where the target is located, but not mixed types. Note that the target column needs to be a 0   1 numeric variable.
FeatureColNames	Either supply the feature column names OR the column number where the target is located, but not mixed types. Also, not zero-indexed.
PrimaryDateColumn	Supply a date or datetime column for catboost to utilize time as its basis for handling categorical features, instead of random shuffling
WeightsColumnName	Supply a column name for your weights column. Leave NULL otherwise
IDcols	A vector of column names or column numbers to keep in your data but not include in the modeling.
TrainOnFull	Set to TRUE to train on full data and skip over evaluation steps
task_type	Set to 'GPU' to utilize your GPU for training. Default is 'CPU'.
NumGPUs	Set to 1, 2, 3, etc.
DebugMode	TRUE to print out steps taken

ReturnModelObjects	Set to TRUE to output all modeling objects. E.g. plots and evaluation metrics
SaveModelObjects	Set to TRUE to return all modeling objects to your environment
ModelID	A character string to name your model and output
model_path	A character string of your path file to where you want your output saved
metadata_path	A character string of your path file to where you want your model evaluation output saved. If left NULL, all output will be saved to model_path.
ClassWeights	Supply a vector of weights for your target classes. E.g. c(0.25, 1) to weight your 0 class by 0.25 and your 1 class by 1.
NumOfParDepPlots	Number of partial dependence plots to create for each target level
eval_metric	Internal bandit metric. Select from 'MultiClass', 'MultiClassOneVsAll', 'AUC', 'TotalF1', 'MCC', 'Accuracy', 'HingeLoss', 'HammingLoss', 'ZeroOneLoss', 'Kappa', 'WKappa'
loss_function	Select from 'MultiClass' or 'MultiClassOneVsAll'
grid_eval_metric	For evaluating models within grid tuning. Choices include, 'accuracy', 'microauc', 'logloss'
BaselineComparison	Set to either 'default' or 'best'. Default is to compare each successive model build to the baseline model using max trees (from function args). Best makes the comparison to the current best model.
MetricPeriods	Number of trees to build before evaluating intermediate metrics. Default is 10L
PassInGrid	Defaults to NULL. Pass in a single row of grid from a previous output as a data.table (they are collected as data.tables)
GridTune	Set to TRUE to run a grid tuning procedure. Set a number in MaxModelsInGrid to tell the procedure how many models you want to test.
MaxModelsInGrid	Number of models to test from grid options.
MaxRunsWithoutNewWinner	A number
MaxRunMinutes	In minutes
Trees	Bandit grid partitioned. Supply a single value for non-grid tuning cases. Otherwise, supply a vector for the trees numbers you want to test. For running grid tuning, a NULL value supplied will mean these values are tested seq(1000L, 10000L, 1000L)
Depth	Bandit grid partitioned. Number, or vector for depth to test. For running grid tuning, a NULL value supplied will mean these values are tested seq(4L, 16L, 2L)
LearningRate	Bandit grid partitioned. Supply a single value for non-grid tuning cases. Otherwise, supply a vector for the LearningRate values to test. For running grid tuning, a NULL value supplied will mean these values are tested c(0.01, 0.02, 0.03, 0.04)
L2_Leaf_Reg	Random testing. Supply a single value for non-grid tuning cases. Otherwise, supply a vector for the L2_Leaf_Reg values to test. For running grid tuning, a NULL value supplied will mean these values are tested seq(1.0, 10.0, 1.0)
RandomStrength	A multiplier of randomness added to split evaluations. Default value is 1 which adds no randomness.

BorderCount	Number of splits for numerical features. Catboost defaults to 254 for CPU and 128 for GPU
RSM	CPU only. Random testing. Supply a single value for non-grid tuning cases. Otherwise, supply a vector for the RSM values to test. For running grid tuning, a NULL value supplied will mean these values are tested c(0.80, 0.85, 0.90, 0.95, 1.0)
BootStrapType	Random testing. Supply a single value for non-grid tuning cases. Otherwise, supply a vector for the BootStrapType values to test. For running grid tuning, a NULL value supplied will mean these values are tested c('Bayesian', 'Bernoulli', 'Poisson', 'MVS', 'No')
GrowPolicy	Random testing. NULL, character, or vector for GrowPolicy to test. For grid tuning, supply a vector of values. For running grid tuning, a NULL value supplied will mean these values are tested c('SymmetricTree', 'Depthwise', 'Lossguide')
langevin	TRUE or FALSE. Enable stochastic gradient langevin boosting
diffusion_temperature	Default is 10000 and is only used when langevin is set to TRUE
model_size_reg	Defaults to 0.5. Set to 0 to allow for bigger models. This is for models with high cardinality categorical features. Values greater than 0 will shrink the model and quality will decline but models won't be huge.
feature_border_type	Defaults to 'GreedyLogSum'. Other options include: Median, Uniform, UniformAndQuantiles, MaxLogSum, MinEntropy
sampling_unit	Default is Group. Other option is Object. if GPU is selected, this will be turned off unless the loss_function is YetiRankPairWise
subsample	Default is NULL. Catboost will turn this into 0.66 for BootStrapTypes Poisson and Bernoulli. 0.80 for MVS. Doesn't apply to others.
score_function	Default is Cosine. CPU options are Cosine and L2. GPU options are Cosine, L2, NewtonL2, and NewtonCosine (not available for Lossguide)
min_data_in_leaf	Default is 1. Cannot be used with SymmetricTree is GrowPolicy

**Value**

Saves to file and returned in list: VariableImportance.csv, Model (the model), ValidationData.csv, EvaluationMetrics.csv, GridCollect, and GridList

**Author(s)**

Adrian Antico

**See Also**

Other Automated Supervised Learning - Multiclass Classification: [AutoH2oDRFMultiClass\(\)](#), [AutoH2oGAMMultiClass\(\)](#), [AutoH2oGBMMultiClass\(\)](#), [AutoH2oGLMMultiClass\(\)](#), [AutoH2oMLMultiClass\(\)](#), [AutoXGBoostMultiClass\(\)](#)

## Examples

```
## Not run:
# Create some dummy correlated data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 10000L,
  ID = 2L,
  ZIP = 0L,
  AddDate = FALSE,
  Classification = FALSE,
  MultiClass = TRUE)

# Run function
TestModel <- RemixAutoML::AutoCatBoostMultiClass(

  # GPU or CPU and the number of available GPUs
  task_type = 'GPU',
  NumGPUs = 1,
  TrainOnFull = FALSE,
  DebugMode = FALSE,

  # Metadata args
  OutputSelection = c('Importances', 'EvalPlots', 'EvalMetrics', 'Score_TrainData'),
  ModelID = 'Test_Model_1',
  model_path = normalizePath('./'),
  metadata_path = normalizePath('./'),
  SaveModelObjects = FALSE,
  ReturnModelObjects = TRUE,

  # Data args
  data = data,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = 'Adrian',
  FeatureColNames = names(data)[!names(data) %in%
    c('IDcol_1', 'IDcol_2', 'Adrian')],
  PrimaryDateColumn = NULL,
  WeightsColumnName = NULL,
  ClassWeights = c(1L, 1L, 1L, 1L, 1L),
  IDcols = c('IDcol_1', 'IDcol_2'),

  # Model evaluation
  eval_metric = 'MCC',
  loss_function = 'MultiClassOneVsAll',
  grid_eval_metric = 'Accuracy',
  MetricPeriods = 10L,
  NumOfParDepPlots = 3,

  # Grid tuning args
  PassInGrid = NULL,
  GridTune = FALSE,
  MaxModelsInGrid = 30L,
  MaxRunsWithoutNewWinner = 20L,
  MaxRunMinutes = 24L*60L,
  BaselineComparison = 'default',
```

```

# ML args
langevin = FALSE,
diffusion_temperature = 10000,
Trees = 100L,
Depth = 4L,
LearningRate = NULL,
L2_Leaf_Reg = NULL,
RandomStrength = 1,
BorderCount = 254,
RSM = NULL,
BootStrapType = 'Bayesian',
GrowPolicy = 'SymmetricTree',
model_size_reg = 0.5,
feature_border_type = 'GreedyLogSum',
sampling_unit = 'Object',
subsample = NULL,
score_function = 'Cosine',
min_data_in_leaf = 1)

## End(Not run)

```

---

AutoCatBoostRegression

*AutoCatBoostRegression*


---

## Description

AutoCatBoostRegression is an automated modeling function that runs a variety of steps. First, the function will run a random grid tune over N number of models and find which model is the best (a default model is always included in that set). Once the model is identified and built, several other outputs are generated: validation data with predictions, evaluation plot, evaluation boxplot, evaluation metrics, variable importance, partial dependence calibration plots, partial dependence calibration box plots, and column names used in model fitting. You can download the catboost package using devtools, via: `devtools::install_github('catboost/catboost', subdir = 'catboost/R-package')`

## Usage

```

AutoCatBoostRegression(
  OutputSelection = c("Importances", "EvalPlots", "EvalMetrics", "Score_TrainData"),
  data,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = NULL,
  FeatureColNames = NULL,
  PrimaryDateColumn = NULL,
  WeightsColumnName = NULL,
  IDcols = NULL,
  TransformNumericColumns = NULL,
  Methods = c("BoxCox", "Asinh", "Log", "LogPlus1", "Sqrt", "Asin", "Logit"),
  TrainOnFull = FALSE,
  task_type = "GPU",
  NumGPUs = 1,

```

```

DebugMode = FALSE,
ReturnModelObjects = TRUE,
SaveModelObjects = FALSE,
ModelID = "FirstModel",
model_path = NULL,
metadata_path = NULL,
SaveInfoToPDF = FALSE,
eval_metric = "RMSE",
eval_metric_value = 1.5,
loss_function = "RMSE",
loss_function_value = 1.5,
grid_eval_metric = "r2",
NumOfParDepPlots = 0L,
PassInGrid = NULL,
GridTune = FALSE,
MaxModelsInGrid = 30L,
MaxRunsWithoutNewWinner = 20L,
MaxRunMinutes = 24L * 60L,
BaselineComparison = "default",
MetricPeriods = 10L,
Trees = 500L,
Depth = 9,
L2_Leaf_Reg = 3,
RandomStrength = 1,
BorderCount = 254,
LearningRate = NULL,
RSM = 1,
BootStrapType = NULL,
GrowPolicy = "SymmetricTree",
langevin = FALSE,
diffusion_temperature = 10000,
model_size_reg = 0.5,
feature_border_type = "GreedyLogSum",
sampling_unit = "Object",
subsample = NULL,
score_function = "Cosine",
min_data_in_leaf = 1
)

```

## Arguments

### OutputSelection

You can select what type of output you want returned. Choose from c('Importances', 'EvalPlots', 'EvalMetrics', 'PDFs', 'Score\_TrainData')

### data

This is your data set for training and testing your model

### ValidationData

This is your holdout data set used in modeling either refine your hyperparameters. Catboost using both training and validation data in the training process so you should evaluate out of sample performance with this data set.

### TestData

This is your holdout data set. Catboost using both training and validation data in the training process so you should evaluate out of sample performance with this data set.

TargetColumnName	Either supply the target column name OR the column number where the target is located (but not mixed types).
FeatureColNames	Either supply the feature column names OR the column number where the target is located (but not mixed types)
PrimaryDateColumn	Supply a date or datetime column for catboost to utilize time as its basis for handling categorical features, instead of random shuffling
WeightsColumnName	Supply a column name for your weights column. Leave NULL otherwise
IDcols	A vector of column names or column numbers to keep in your data but not include in the modeling.
TransformNumericColumns	Set to NULL to do nothing; otherwise supply the column names of numeric variables you want transformed
Methods	Choose from 'YeoJohnson', 'BoxCox', 'Asinh', 'Log', 'LogPlus1', 'Sqrt', 'Asin', or 'Logit'. If more than one is selected, the one with the best normalization pearson statistic will be used. Identity is automatically selected and compared.
TrainOnFull	Set to TRUE to train on full data and skip over evaluation steps
task_type	Set to 'GPU' to utilize your GPU for training. Default is 'CPU'.
NumGPUs	Set to 1, 2, 3, etc.
DebugMode	Set to TRUE to get a printout of which step the function is on. FALSE, otherwise
ReturnModelObjects	Set to TRUE to output all modeling objects (E.g. plots and evaluation metrics)
SaveModelObjects	Set to TRUE to return all modeling objects to your environment
ModelID	A character string to name your model and output
model_path	A character string of your path file to where you want your output saved
metadata_path	A character string of your path file to where you want your model evaluation output saved. If left NULL, all output will be saved to model_path.
SaveInfoToPDF	Set to TRUE to save modeling information to PDF. If model_path or metadata_path aren't defined then output will be saved to the working directory
eval_metric	Select from 'RMSE', 'MAE', 'MAPE', 'R2', 'Poisson', 'MedianAbsoluteError', 'SMAPE', 'MSLE', 'NumErrors', 'FairLoss', 'Tweedie', 'Huber', 'LogLinQuantile', 'Quantile', 'Lq', 'Expectile', 'MultiRMSE'
eval_metric_value	Used with the specified eval_metric. See <a href="https://catboost.ai/docs/concepts/loss-functions-regression.html">https://catboost.ai/docs/concepts/loss-functions-regression.html</a>
loss_function	Used in model training for model fitting. 'MAPE', 'MAE', 'RMSE', 'Poisson', 'Tweedie', 'Huber', 'LogLinQuantile', 'Quantile', 'Lq', 'Expectile', 'MultiRMSE'
loss_function_value	Used with the specified loss function if an associated value is required. 'Tweedie', 'Huber', 'LogLinQuantile', 'Quantile', 'Lq', 'Expectile'. See <a href="https://catboost.ai/docs/concepts/loss-functions-regression.html">https://catboost.ai/docs/concepts/loss-functions-regression.html</a>
grid_eval_metric	Choose from 'mae', 'mape', 'rmse', 'r2'. Case sensitive

NumOfParDepPlots	Tell the function the number of partial dependence calibration plots you want to create. Calibration boxplots will only be created for numerical features (not dummy variables)
PassInGrid	Defaults to NULL. Pass in a single row of grid from a previous output as a data.table (they are collected as data.tables)
GridTune	Set to TRUE to run a grid tuning procedure. Set a number in MaxModelsInGrid to tell the procedure how many models you want to test.
MaxModelsInGrid	Number of models to test from grid options
MaxRunsWithoutNewWinner	Number of models built before calling it quits
MaxRunMinutes	Maximum number of minutes to let this run
BaselineComparison	Set to either 'default' or 'best'. Default is to compare each successive model build to the baseline model using max trees (from function args). Best makes the comparison to the current best model.
MetricPeriods	Number of periods to use between Catboost evaluations
Trees	Standard + Grid Tuning. Bandit grid partitioned. The maximum number of trees you want in your models
Depth	Standard + Grid Tuning. Bandit grid partitioned. Number, or vector for depth to test. For running grid tuning, a NULL value supplied will mean these values are tested seq(4L, 16L, 2L)
L2_Leaf_Reg	Standard + Grid Tuning. Random testing. Supply a single value for non-grid tuning cases. Otherwise, supply a vector for the L2_Leaf_Reg values to test. For running grid tuning, a NULL value supplied will mean these values are tested seq(1.0, 10.0, 1.0)
RandomStrength	Standard + Grid Tuning. A multiplier of randomness added to split evaluations. Default value is 1 which adds no randomness.
BorderCount	Standard + Grid Tuning. Number of splits for numerical features. Catboost defaults to 254 for CPU and 128 for GPU
LearningRate	Standard + Grid Tuning. Default varies if RMSE, MultiClass, or Logloss is utilized. Otherwise default is 0.03. Bandit grid partitioned. Supply a single value for non-grid tuning cases. Otherwise, supply a vector for the LearningRate values to test. For running grid tuning, a NULL value supplied will mean these values are tested c(0.01,0.02,0.03,0.04)
RSM	CPU only. Standard + Grid Tuning. If GPU is set, this is turned off. Random testing. Supply a single value for non-grid tuning cases. Otherwise, supply a vector for the RSM values to test. For running grid tuning, a NULL value supplied will mean these values are tested c(0.80, 0.85, 0.90, 0.95, 1.0)
BootStrapType	Standard + Grid Tuning. NULL value to default to catboost default (Bayesian for GPU and MVS for CPU). Random testing. Supply a single value for non-grid tuning cases. Otherwise, supply a vector for the BootStrapType values to test. For running grid tuning, a NULL value supplied will mean these values are tested c('Bayesian', 'Bernoulli', 'Poisson', 'MVS', 'No')
GrowPolicy	Standard + Grid Tuning. Catboost default of SymmetricTree. Random testing. Default 'SymmetricTree', character, or vector for GrowPolicy to test. For grid tuning, supply a vector of values. For running grid tuning, a NULL value supplied will mean these values are tested c('SymmetricTree', 'Depthwise', 'Loss-guide')



langevin	Set to TRUE to enable
diffusion_temperature	Defaults to 10000
model_size_reg	Defaults to 0.5. Set to 0 to allow for bigger models. This is for models with high cardinality categorical features. Values greater than 0 will shrink the model and quality will decline but models won't be huge.
feature_border_type	Defaults to 'GreedyLogSum'. Other options include: Median, Uniform, UniformAndQuantiles, MaxLogSum, MinEntropy
sampling_unit	Default is Group. Other option is Object. if GPU is selected, this will be turned off unless the loss_function is YetiRankPairWise
subsample	Default is NULL. Catboost will turn this into 0.66 for BootstrapTypes Poisson and Bernoulli. 0.80 for MVS. Doesn't apply to others.
score_function	Default is Cosine. CPU options are Cosine and L2. GPU options are Cosine, L2, NewtonL2, and NewtonCosine (not available for Lossguide)
min_data_in_leaf	Default is 1. Cannot be used with SymmetricTree is GrowPolicy

### Value

Saves to file and returned in list: VariableImportance.csv, Model, ValidationData.csv, Evaluation-Plot.png, EvaluationBoxPlot.png, EvaluationMetrics.csv, ParDepPlots.R a named list of features with partial dependence calibration plots, ParDepBoxPlots.R, GridCollect, catboostgrid, and a transformation details file.

### Author(s)

Adrian Antico

### See Also

Other Automated Supervised Learning - Regression: [AutoH2oDRFRegression\(\)](#), [AutoH2oGAMRegression\(\)](#), [AutoH2oGBMRegression\(\)](#), [AutoH2oGLMRegression\(\)](#), [AutoH2oMLRegression\(\)](#), [AutoLightGBMRegression\(\)](#), [AutoNLS\(\)](#), [AutoXGBoostRegression\(\)](#)

### Examples

```
## Not run:
# Create some dummy correlated data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 10000,
  ID = 2,
  ZIP = 0,
  AddDate = FALSE,
  Classification = FALSE,
  MultiClass = FALSE)

# Run function
TestModel <- RemixAutoML::AutoCatBoostRegression(

  # GPU or CPU and the number of available GPUs
  TrainOnFull = FALSE,
```

```

task_type = 'GPU',
NumGPUs = 1,
DebugMode = FALSE,

# Metadata args
OutputSelection = c('Importances', 'EvalPlots', 'EvalMetrics', 'Score_TrainData'),
ModelID = 'Test_Model_1',
model_path = normalizePath('./'),
metadata_path = normalizePath('./'),
SaveModelObjects = FALSE,
SaveInfoToPDF = FALSE,
ReturnModelObjects = TRUE,

# Data args
data = data,
ValidationData = NULL,
TestData = NULL,
TargetColumnName = 'Adrian',
FeatureColNames = names(data)[!names(data) %in%
  c('IDcol_1', 'IDcol_2', 'Adrian')],
PrimaryDateColumn = NULL,
WeightsColumnName = NULL,
IDcols = c('IDcol_1', 'IDcol_2'),
TransformNumericColumns = 'Adrian',
Methods = c('BoxCox', 'Asinh', 'Asin', 'Log',
  'LogPlus1', 'Sqrt', 'Logit'),

# Model evaluation
eval_metric = 'RMSE',
eval_metric_value = 1.5,
loss_function = 'RMSE',
loss_function_value = 1.5,
MetricPeriods = 10L,
NumOfParDepPlots = ncol(data)-1L-2L,

# Grid tuning args
PassInGrid = NULL,
GridTune = FALSE,
MaxModelsInGrid = 30L,
MaxRunsWithoutNewWinner = 20L,
MaxRunMinutes = 60*60,
BaselineComparison = 'default',

# ML args
langevin = FALSE,
diffusion_temperature = 10000,
Trees = 1000,
Depth = 9,
L2_Leaf_Reg = NULL,
RandomStrength = 1,
BorderCount = 128,
LearningRate = NULL,
RSM = 1,
BootstrapType = NULL,
GrowPolicy = 'SymmetricTree',
model_size_reg = 0.5,
feature_border_type = 'GreedyLogSum',

```

```
sampling_unit = 'Object',
subsample = NULL,
score_function = 'Cosine',
min_data_in_leaf = 1)

## End(Not run)
```

---

AutoCatBoostScoring	<i>AutoCatBoostScoring</i>
---------------------	----------------------------

---

## Description

AutoCatBoostScoring is an automated scoring function that compliments the AutoCatBoost model training functions. This function requires you to supply features for scoring. It will run `ModelDataPrep()` to prepare your features for catboost data conversion and scoring.

## Usage

```
AutoCatBoostScoring(
  TargetType = NULL,
  ScoringData = NULL,
  FeatureColumnNames = NULL,
  FactorLevelsList = NULL,
  IDcols = NULL,
  OneHot = FALSE,
  ReturnShapValues = FALSE,
  ModelObject = NULL,
  ModelPath = NULL,
  ModelID = NULL,
  ReturnFeatures = TRUE,
  MultiClassTargetLevels = NULL,
  TransformNumeric = FALSE,
  BackTransNumeric = FALSE,
  TargetColumnName = NULL,
  TransformationObject = NULL,
  TransID = NULL,
  TransPath = NULL,
  MDP_Impute = FALSE,
  MDP_CharToFactor = FALSE,
  MDP_RemoveDates = FALSE,
  MDP_MissFactor = "0",
  MDP_MissNum = -1,
  RemoveModel = FALSE
)
```

## Arguments

TargetType	Set this value to 'regression', 'classification', 'multiclass', or 'multiregression' to score models built using <code>AutoCatBoostRegression()</code> , <code>AutoCatBoostClassifier()</code> or <code>AutoCatBoostMultiClass()</code> .
ScoringData	This is your data.table of features for scoring. Can be a single row or batch.

FeatureColumnNames	Supply either column names or column numbers used in the AutoCatBoostRegression() function
FactorLevelsList	List of factors levels to DummifyDT()
IDcols	Supply ID column numbers for any metadata you want returned with your predicted values
OneHot	Passed to DummifyD
ReturnShapValues	Set to TRUE to return a data.table of feature contributions to all predicted values generated
ModelObject	Supply the model object directly for scoring instead of loading it from file. If you supply this, ModelID and ModelPath will be ignored.
ModelPath	Supply your path file used in the AutoCatBoost__() function
ModelID	Supply the model ID used in the AutoCatBoost__() function
ReturnFeatures	Set to TRUE to return your features with the predicted values.
MultiClassTargetLevels	For use with AutoCatBoostMultiClass(). If you saved model objects then this scoring function will locate the target levels file. If you did not save model objects, you can supply the target levels returned from AutoCatBoostMultiClass().
TransformNumeric	Set to TRUE if you have features that were transformed automatically from an Auto__Regression() model AND you haven't already transformed them.
BackTransNumeric	Set to TRUE to generate back-transformed predicted values. Also, if you return features, those will also be back-transformed.
TargetColumnName	Input your target column name used in training if you are utilizing the transformation service
TransformationObject	Set to NULL if you didn't use transformations or if you want the function to pull from the file output from the Auto__Regression() function. You can also supply the transformation data.table object with the transformation details versus having it pulled from file.
TransID	Set to the ID used for saving the transformation data.table object or set it to the ModelID if you are pulling from file from a build with Auto__Regression().
TransPath	Set the path file to the folder where your transformation data.table detail object is stored. If you used the Auto__Regression() to build, set it to the same path as ModelPath.
MDP_Impute	Set to TRUE if you did so for modeling and didn't do so before supplying ScoringData in this function
MDP_CharToFactor	Set to TRUE to turn your character columns to factors if you didn't do so to your ScoringData that you are supplying to this function
MDP_RemoveDates	Set to TRUE if you have date of timestamp columns in your ScoringData
MDP_MissFactor	If you set MDP_Impute to TRUE, supply the character values to replace missing values with

MDP_MissNum	If you set MDP_Impute to TRUE, supply a numeric value to replace missing values with
RemoveModel	Set to TRUE if you want the model removed immediately after scoring

**Value**

A data.table of predicted values with the option to return model features as well.

**Author(s)**

Adrian Antico

**See Also**

Other Automated Model Scoring: [AutoH2OMLScoring\(\)](#), [AutoLightGBMScoring\(\)](#), [AutoXGBoostScoring\(\)](#)

**Examples**

```
## Not run:

# CatBoost Regression Example

# Create some dummy correlated data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 10000,
  ID = 2,
  ZIP = 0,
  AddDate = FALSE,
  Classification = FALSE,
  MultiClass = FALSE)

# Copy data
data1 <- data.table::copy(data)

# Run function
TestModel <- RemixAutoML::AutoCatBoostRegression(

  # GPU or CPU and the number of available GPUs
  TrainOnFull = FALSE,
  task_type = 'CPU',
  NumGPUs = 1,
  DebugMode = FALSE,

  # Metadata args
  OutputSelection = c('Importances', 'EvalPlots', 'EvalMetrics', 'Score_TrainData'),
  ModelID = 'Test_Model_1',
  model_path = getwd(),
  metadata_path = getwd(),
  SaveModelObjects = FALSE,
  SaveInfoToPDF = FALSE,
  ReturnModelObjects = TRUE,

  # Data args
  data = data1,
  ValidationData = NULL,
```

```

TestData = NULL,
TargetColumnName = 'Adrian',
FeatureColNames = names(data1)[!names(data1) %in% c('IDcol_1', 'IDcol_2', 'Adrian')],
PrimaryDateColumn = NULL,
WeightsColumnName = NULL,
IDcols = c('IDcol_1', 'IDcol_2'),
TransformNumericColumns = 'Adrian',
Methods = c('Asinh', 'Asin', 'Log', 'LogPlus1', 'Sqrt', 'Logit'),

# Model evaluation
eval_metric = 'RMSE',
eval_metric_value = 1.5,
loss_function = 'RMSE',
loss_function_value = 1.5,
MetricPeriods = 10L,
NumOfParDepPlots = ncol(data1)-1L-2L,

# Grid tuning args
PassInGrid = NULL,
GridTune = FALSE,
MaxModelsInGrid = 30L,
MaxRunsWithoutNewWinner = 20L,
MaxRunMinutes = 60*60,
BaselineComparison = 'default',

# ML args
langevin = FALSE,
diffusion_temperature = 10000,
Trees = 1000,
Depth = 9,
L2_Leaf_Reg = NULL,
RandomStrength = 1,
BorderCount = 128,
LearningRate = NULL,
RSM = 1,
BootStrapType = NULL,
GrowPolicy = 'SymmetricTree',
model_size_reg = 0.5,
feature_border_type = 'GreedyLogSum',
sampling_unit = 'Object',
subsample = NULL,
score_function = 'Cosine',
min_data_in_leaf = 1)

# Trained Model Object
TestModel$Model

# Train Data (includes validation data) and Test Data with predictions and shap values
TestModel$TrainData
TestModel$TestData

# Calibration Plots
TestModel$PlotList$Train_EvaluationPlot
TestModel$PlotList$Test_EvaluationPlot

# Calibration Box Plots
TestModel$PlotList$Train_EvaluationBoxPlot

```

```

TestModel$PlotList$Test_EvaluationBoxPlot

# Residual Analysis Plots
TestModel$PlotList$Train_ResidualsHistogram
TestModel$PlotList$Test_ResidualsHistogram

# Preds vs Actuals Scatterplots
TestModel$PlotList$Train_ScatterPlot
TestModel$PlotList$Test_ScatterPlot

# Preds vs Actuals Copula Plot
TestModel$PlotList$Train_CopulaPlot
TestModel$PlotList$Test_CopulaPlot

# Variable Importance Plots
TestModel$PlotList$Train_VariableImportance
TestModel$PlotList$Validation_VariableImportance
TestModel$PlotList$Test_VariableImportance

# Evaluation Metrics
TestModel$EvaluationMetrics$TrainData
TestModel$EvaluationMetrics$TestData

# Variable Importance Tables
TestModel$VariableImportance$Train_Importance
TestModel$VariableImportance$Validation_Importance
TestModel$VariableImportance$Test_Importance

# Interaction Importance
TestModel$InteractionImportance$Train_Interaction
TestModel$InteractionImportance$Validation_Interaction
TestModel$InteractionImportance$Test_Interaction

# Meta Data
TestModel$ColNames
TestModel$TransformationResults
TestModel$GridList

# Score data
Preds <- RemixAutoML::AutoCatBoostScoring(
  TargetType = 'regression',
  ScoringData = data,
  FeatureColumnNames = names(data)[!names(data) %in% c('IDcol_1', 'IDcol_2', 'Adrian')],
  FactorLevelsList = TestModel$FactorLevelsList,
  IDcols = c('IDcol_1', 'IDcol_2'),
  OneHot = FALSE,
  ReturnShapValues = TRUE,
  ModelObject = TestModel$Model,
  ModelPath = NULL,
  ModelID = 'Test_Model_1',
  ReturnFeatures = TRUE,
  MultiClassTargetLevels = NULL,
  TransformNumeric = FALSE,
  BackTransNumeric = FALSE,
  TargetColumnName = NULL,
  TransformationObject = NULL,
  TransID = NULL,

```

```

TransPath = NULL,
MDP_Impute = TRUE,
MDP_CharToFactor = TRUE,
MDP_RemoveDates = TRUE,
MDP_MissFactor = '0',
MDP_MissNum = -1,
RemoveModel = FALSE)

## End(Not run)

```

---

AutoCatBoostVectorCARMA

*AutoCatBoostVectorCARMA*


---

## Description

AutoCatBoostVectorCARMA Multiple Regression, Multivariate Forecasting with calendar variables, Holiday counts, holiday lags, holiday moving averages, differencing, transformations, interaction-based categorical encoding using target variable and features to generate various time-based aggregated lags, moving averages, moving standard deviations, moving skewness, moving kurtosis, moving quantiles, parallelized interaction-based fourier pairs by grouping variables, and Trend Variables.

## Usage

```

AutoCatBoostVectorCARMA(
  data,
  NonNegativePred = FALSE,
  RoundPreds = FALSE,
  TrainOnFull = FALSE,
  TargetColumnName = "Target",
  DateColumnName = "DateTime",
  HierarchGroups = NULL,
  GroupVariables = NULL,
  TimeWeights = 1,
  FC_Periods = 30,
  TimeUnit = "week",
  TimeGroups = c("weeks", "months"),
  NumOfParDepPlots = 10L,
  TargetTransformation = FALSE,
  Methods = c("BoxCox", "Asinh", "Asin", "Log", "LogPlus1", "Logit", "YeoJohnson"),
  AnomalyDetection = NULL,
  XREGS = NULL,
  Lags = c(1L:5L),
  MA_Periods = c(2L:5L),
  SD_Periods = NULL,
  Skew_Periods = NULL,
  Kurt_Periods = NULL,
  Quantile_Periods = NULL,
  Quantiles_Selected = c("q5", "q95"),
  Difference = TRUE,
  FourierTerms = 6L,

```



```

CalendarVariables = c("second", "minute", "hour", "wday", "mday", "yday", "week",
  "isoweek", "month", "quarter", "year"),
HolidayVariable = c("USPublicHolidays", "EasterGroup", "ChristmasGroup",
  "OtherEcclesticalFeasts"),
HolidayLookback = NULL,
HolidayLags = 1L,
HolidayMovingAverages = 1L:2L,
TimeTrendVariable = FALSE,
ZeroPadSeries = NULL,
DataTruncate = FALSE,
SplitRatios = c(0.7, 0.2, 0.1),
TaskType = "GPU",
NumGPU = 1,
PartitionType = "timeseries",
Timer = TRUE,
DebugMode = FALSE,
EvalMetric = "RMSE",
EvalMetricValue = 1.5,
LossFunction = "RMSE",
LossFunctionValue = 1.5,
GridTune = FALSE,
PassInGrid = NULL,
ModelCount = 100,
MaxRunsWithoutNewWinner = 50,
MaxRunMinutes = 24L * 60L,
Langevin = FALSE,
DiffusionTemperature = 10000,
NTrees = 1000,
L2_Leaf_Reg = NULL,
LearningRate = NULL,
RandomStrength = 1,
BorderCount = 254,
Depth = 6,
RSM = 1,
BootStrapType = "Bayesian",
GrowPolicy = "SymmetricTree",
ModelSizeReg = 0.5,
FeatureBorderType = "GreedyLogSum",
SamplingUnit = "Group",
SubSample = NULL,
ScoreFunction = "Cosine",
MinDataInLeaf = 1
)

```

### Arguments

<code>data</code>	Supply your full series data set here
<code>NonNegativePred</code>	TRUE or FALSE
<code>RoundPreds</code>	Rounding predictions to an integer value. TRUE or FALSE. Defaults to FALSE
<code>TrainOnFull</code>	Set to TRUE to train on full data

TargetColumnName	List the column names of your target variables column. E.g. <code>c('Target1','Target2', ..., 'TargetN')</code>
DateColumnName	List the column name of your date column. E.g. <code>'DateTime'</code>
HierarchGroups	Vector of hierarchy categorical columns.
GroupVariables	Defaults to NULL. Use NULL when you have a single series. Add in GroupVariables when you have a series for every level of a group or multiple groups.
TimeWeights	NULL or a value.
FC_Periods	Set the number of periods you want to have forecasts for. E.g. 52 for weekly data to forecast a year ahead
TimeUnit	List the time unit your data is aggregated by. E.g. <code>'1min', '5min', '10min', '15min', '30min', 'hour', 'day', 'week', 'month', 'quarter', 'year'</code> .
TimeGroups	Select time aggregations for adding various time aggregated GDL features.
NumOfParDepPlots	Supply a number for the number of partial dependence plots you want returned
TargetTransformation	Run <code>AutoTransformationCreate()</code> to find best transformation for the target variable. Tests YeoJohnson, BoxCox, and Asigh (also Asin and Logit for proportion target variables).
Methods	Transformation options to test which include <code>'BoxCox', 'Asinh', 'Asin', 'Log', 'LogPlus1', 'Logit', 'YeoJohnson'</code>
AnomalyDetection	NULL for not using the service. Other, provide a list, e.g. <code>AnomalyDetection = list('tstat_high' = 4, tstat_low = -4)</code>
XREGS	Additional data to use for model development and forecasting. Data needs to be a complete series which means both the historical and forward looking values over the specified forecast window needs to be supplied.
Lags	Select the periods for all lag variables you want to create. E.g. <code>c(1:5,52)</code>
MA_Periods	Select the periods for all moving average variables you want to create. E.g. <code>c(1:5,52)</code>
SD_Periods	Select the periods for all moving standard deviation variables you want to create. E.g. <code>c(1:5,52)</code>
Skew_Periods	Select the periods for all moving skewness variables you want to create. E.g. <code>c(1:5,52)</code>
Kurt_Periods	Select the periods for all moving kurtosis variables you want to create. E.g. <code>c(1:5,52)</code>
Quantile_Periods	Select the periods for all moving quantiles variables you want to create. E.g. <code>c(1:5,52)</code>
Quantiles_Selected	Select from the following <code>'q5', 'q10', 'q15', 'q20', 'q25', 'q30', 'q35', 'q40', 'q45', 'q50', 'q55', 'q60', 'q65', 'q70', 'q75', 'q80', 'q85', 'q90', 'q95'</code>
Difference	Puts the I in ARIMA for single series and grouped series.
FourierTerms	Set to the max number of pairs. E.g. 2 means to generate two pairs for by each group level and interactions if hierarchy is enabled.
CalendarVariables	NULL, or select from <code>'second', 'minute', 'hour', 'wday', 'mday', 'yday', 'week', 'isoweek', 'month', 'quarter', 'year'</code>

HolidayVariable	NULL, or select from 'USPublicHolidays', 'EasterGroup', 'ChristmasGroup', 'OtherEcclesticalFeasts'
HolidayLookback	Number of days in range to compute number of holidays from a given date in the data. If NULL, the number of days are computed for you.
HolidayLags	Number of lags to build off of the holiday count variable.
HolidayMovingAverages	Number of moving averages to build off of the holiday count variable.
TimeTrendVariable	Set to TRUE to have a time trend variable added to the model. Time trend is numeric variable indicating the numeric value of each record in the time series (by group). Time trend starts at 1 for the earliest point in time and increments by one for each success time point.
ZeroPadSeries	Set to 'all', 'inner', or NULL. See TimeSeriesFill for explanation
DataTruncate	Set to TRUE to remove records with missing values from the lags and moving average features created
SplitRatios	E.g c(0.7,0.2,0.1) for train, validation, and test sets
TaskType	Has to CPU for now. If catboost makes GPU available for 'MultiRMSE' then it will be enabled. If you set to GPU the function will coerce it back to CPU.
NumGPU	Defaults to 1. If CPU is set this argument will be ignored.
PartitionType	Select 'random' for random data partitioning 'timeseries' for partitioning by time frames
Timer	Set to FALSE to turn off the updating print statements for progress
DebugMode	Defaults to FALSE. Set to TRUE to get a print statement of each high level comment in function
EvalMetric	'MultiRMSE' only. If catboost updates this I'll add more later
EvalMetricValue	Placeholder for later
LossFunction	'MultiRMSE' only. If catboost updates this I'll add more later
LossFunctionValue	Placeholder for later
GridTune	Set to TRUE to run a grid tune
PassInGrid	Defaults to NULL
ModelCount	Set the number of models to try in the grid tune
MaxRunsWithoutNewWinner	Default is 50
MaxRunMinutes	Default is 60*60
Langevin	Enables the Stochastic Gradient Langevin Boosting mode. If TRUE and TaskType == 'GPU' then TaskType will be converted to 'CPU'
DiffusionTemperature	Default is 10000
NTrees	Select the number of trees you want to have built to train the model
L2_Leaf_Reg	l2 reg parameter
LearningRate	Defaults to NULL. Catboost will dynamically define this if L2_Leaf_Reg is NULL and RMSE is chosen (otherwise catboost will default it to 0.03). Then you can pull it out of the model object and pass it back in should you wish.

RandomStrength	Default is 1
BorderCount	Default is 254
Depth	Depth of catboost model
RSM	CPU only. If TaskType is GPU then RSM will not be used
BootStrapType	If NULL, then if TaskType is GPU then Bayesian will be used. If CPU then MVS will be used. If MVS is selected when TaskType is GPU, then BootStrapType will be switched to Bayesian
GrowPolicy	Default is SymmetricTree. Others include Lossguide and Depthwise
ModelSizeReg	Defaults to 0.5. Set to 0 to allow for bigger models. This is for models with high cardinality categorical features. Values greater than 0 will shrink the model and quality will decline but models won't be huge.
FeatureBorderType	Defaults to 'GreedyLogSum'. Other options include: Median, Uniform, UniformAndQuantiles, MaxLogSum, MinEntropy
SamplingUnit	Default is Group. Other option is Object. if GPU is selected, this will be turned off unless the loss_function is YetiRankPairWise
SubSample	Can use if BootStrapType is neither Bayesian nor No. Pass NULL to use Catboost default. Used for bagging.
ScoreFunction	Default is Cosine. CPU options are Cosine and L2. GPU options are Cosine, L2, NewtonL2, and NewtonCosine (not available for Lossguide)
MinDataInLeaf	Defaults to 1. Used if GrowPolicy is not SymmetricTree

### Value

Returns a data.table of original series and forecasts, the catboost model objects (everything returned from AutoCatBoostRegression()), a time series forecast plot, and transformation info if you set TargetTransformation to TRUE. The time series forecast plot will plot your single series or aggregate your data to a single series and create a plot from that.

### Author(s)

Adrian Antico

### See Also

Other Automated Panel Data Forecasting: [AutoCatBoostCARMA\(\)](#), [AutoCatBoostHurdleCARMA\(\)](#), [AutoH2OCARMA\(\)](#), [AutoLightGBMCARMA\(\)](#), [AutoLightGBMHurdleCARMA\(\)](#), [AutoXGBoostCARMA\(\)](#), [AutoXGBoostHurdleCARMA\(\)](#)

### Examples

```
## Not run:
# Two group variables and xregs

# Load Walmart Data from Dropbox
data <- data.table::fread(
  'https://www.dropbox.com/s/2str3ek4f4cheqi/walmart_train.csv?dl=1')

# Filter out zeros
data <- data[Weekly_Sales != 0]
```

```

# Subset for Stores / Departments With Full Series
data <- data[, Counts := .N, by = c('Store','Dept')][Counts == 143][
  , Counts := NULL]

# Subset Columns (remove IsHoliday column)----
keep <- c('Store','Dept','Date','Weekly_Sales')
data <- data[, ..keep]
data <- data[Store %in% c(1,2)]
xregs <- data.table::copy(data)
xregs[, GroupVar := do.call(paste, c(.SD, sep = ' ')), .SDcols = c('Store','Dept')]
xregs[, c('Store','Dept') := NULL]
data.table::setnames(xregs, 'Weekly_Sales', 'Other')
xregs[, Other := jitter(Other, factor = 25)]
data <- data[as.Date(Date) < as.Date('2012-09-28')]

# Vector CARMA testing
data[, Weekly_Profit := Weekly_Sales * 0.75]

# Build forecast
CatBoostResults <- RemixAutoML::AutoCatBoostVectorCARMA(

  # data args
  data = data, # TwoGroup_Data,
  TargetColumnName = c('Weekly_Sales','Weekly_Profit'),
  DateColumnName = 'Date',
  HierarchGroups = NULL,
  GroupVariables = c('Store','Dept'),
  TimeWeights = 1,
  TimeUnit = 'weeks',
  TimeGroups = c('weeks','months'),

  # Production args
  TaskType = 'GPU',
  NumGPU = 1,
  TrainOnFull = TRUE,
  SplitRatios = c(1 - 10 / 138, 10 / 138),
  PartitionType = 'random',
  FC_Periods = 4,
  Timer = TRUE,
  DebugMode = TRUE,

  # Target transformations
  TargetTransformation = TRUE,
  Methods = c('BoxCox', 'Asinh', 'Asin', 'Log',
    'LogPlus1', 'Logit', 'YeoJohnson'),
  Difference = FALSE,
  NonNegativePred = FALSE,
  RoundPreds = FALSE,

  # Date features
  CalendarVariables = c('week', 'month', 'quarter'),
  HolidayVariable = c('USPublicHolidays',
    'EasterGroup',
    'ChristmasGroup','OtherEcclesticalFeasts'),
  HolidayLookback = NULL,
  HolidayLags = 1,
  HolidayMovingAverages = 1:2,

```

```

# Time series features
Lags = list('weeks' = seq(2L, 10L, 2L),
            'months' = c(1:3)),
MA_Periods = list('weeks' = seq(2L, 10L, 2L),
                  'months' = c(2,3)),
SD_Periods = NULL,
Skew_Periods = NULL,
Kurt_Periods = NULL,
Quantile_Periods = NULL,
Quantiles_Selected = c('q5','q95'),

# Bonus features
AnomalyDetection = NULL,
XREGS = xregs,
FourierTerms = 2,
TimeTrendVariable = TRUE,
ZeroPadSeries = NULL,
DataTruncate = FALSE,

# Eval args
NumOfParDepPlots = 100L,
EvalMetric = 'MultiRMSE',
EvalMetricValue = 1.5,
LossFunction = 'MultiRMSE',
LossFunctionValue = 1.5,

# Grid args
GridTune = FALSE,
PassInGrid = NULL,
ModelCount = 5,
MaxRunsWithoutNewWinner = 50,
MaxRunMinutes = 60*60,

# ML Args
NTrees = 1000,
Depth = 6,
LearningRate = NULL,
L2_Leaf_Reg = NULL,
RandomStrength = 1,
BorderCount = 254,
RSM = 1,
BootstrapType = 'Bayesian',
GrowPolicy = 'SymmetricTree',
Langevin = FALSE,
DiffusionTemperature = 10000,
ModelSizeReg = 0.5,
FeatureBorderType = 'GreedyLogSum',
SamplingUnit = 'Group',
SubSample = NULL,
ScoreFunction = 'Cosine',
MinDataInLeaf = 1)

## End(Not run)

```

---

AutoClustering	<i>AutoClustering</i>
----------------	-----------------------

---

## Description

AutoClustering adds a column to your original data with a cluster number identifier. You can request an autoencoder to be built to reduce the dimensionality of your data before running the clustering algo.

## Usage

```
AutoClustering(
  data,
  FeatureColumns = NULL,
  ModelID = "TestModel",
  SavePath = NULL,
  NThreads = 8,
  MaxMemory = "28G",
  MaxClusters = 50,
  ClusterMetric = "totss",
  RunDimReduction = TRUE,
  ShrinkRate = (sqrt(5) - 1)/2,
  Epochs = 5L,
  L2_Reg = 0.1,
  ElasticAveraging = TRUE,
  ElasticAveragingMovingRate = 0.9,
  ElasticAveragingRegularization = 0.001
)
```

## Arguments

<code>data</code>	is the source time series data.table
<code>FeatureColumns</code>	Independent variables
<code>ModelID</code>	For naming the files to save
<code>SavePath</code>	Directory path for saving models
<code>NThreads</code>	set based on number of threads your machine has available
<code>MaxMemory</code>	set based on the amount of memory your machine has available
<code>MaxClusters</code>	number of factors to test out in k-means to find the optimal number
<code>ClusterMetric</code>	pick the metric to identify top model in grid tune c('totss','betweenss','withinss')
<code>RunDimReduction</code>	If TRUE, an autoencoder will be built to reduce the feature space. Otherwise, all features in FeatureColumns will be used for clustering
<code>ShrinkRate</code>	Node shrink rate for H2OAutoencoder. See that function for details.
<code>Epochs</code>	For the autoencoder
<code>L2_Reg</code>	For the autoencoder
<code>ElasticAveraging</code>	For the autoencoder

ElasticAveragingMovingRate  
                                     For the autoencoder  
 ElasticAveragingRegularization  
                                     For the autoencoder

**Value**

Original data.table with added column with cluster number identifier

**Author(s)**

Adrian Antico

**See Also**

Other Unsupervised Learning: [AutoClusteringScoring\(\)](#), [GentTSAnomVars\(\)](#), [H2OIsolationForestScoring\(\)](#), [H2OIsolationForest\(\)](#), [ResidualOutliers\(\)](#)

**Examples**

```
## Not run:
#####
# Training Setup
#####

# Create fake data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 1000,
  ID = 2,
  ZIP = 0,
  AddDate = TRUE,
  Classification = FALSE,
  MultiClass = FALSE)

# Run function
data <- RemixAutoML::AutoClustering(
  data,
  FeatureColumns = names(data)[2:(ncol(data)-1)],
  ModelID = 'TestModel',
  SavePath = getwd(),
  NThreads = 8,
  MaxMemory = '28G',
  MaxClusters = 50,
  ClusterMetric = 'totss',
  RunDimReduction = TRUE,
  ShrinkRate = (sqrt(5) - 1) / 2,
  Epochs = 5L,
  L2_Reg = 0.10,
  ElasticAveraging = TRUE,
  ElasticAveragingMovingRate = 0.90,
  ElasticAveragingRegularization = 0.001)

#####
# Scoring Setup
#####
```



```

Sys.sleep(10)

# Create fake data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 1000,
  ID = 2,
  ZIP = 0,
  AddDate = TRUE,
  Classification = FALSE,
  MultiClass = FALSE)

# Run function
data <- RemixAutoML::AutoClusteringScoring(
  data,
  FeatureColumns = names(data)[2:(ncol(data)-1)],
  ModelID = 'TestModel',
  SavePath = getwd(),
  NThreads = 8,
  MaxMemory = '28G',
  DimReduction = TRUE)

## End(Not run)

```

---

AutoClusteringScoring *AutoClusteringScoring*


---

## Description

AutoClusteringScoring adds a column to your original data with a cluster number identifier. You can run request an autoencoder to be built to reduce the dimensionality of your data before running the clusering algo.

## Usage

```

AutoClusteringScoring(
  data,
  FeatureColumns = NULL,
  ModelID = "TestModel",
  SavePath = NULL,
  NThreads = 8,
  MaxMemory = "28G",
  DimReduction = TRUE
)

```

## Arguments

data	is the source time series data.table
FeatureColumns	Independent variables
ModelID	This is returned from the training run in the output list with element named 'model_name'. It's not identical to the ModelID used in training due to the grid tuning.

SavePath	Directory path for saving models
NThreads	set based on number of threads your machine has available
MaxMemory	set based on the amount of memory your machine has available
DimReduction	Set to TRUE if you set RunDimReduction in the training version of this function

**Value**

Original data.table with added column with cluster number identifier

**Author(s)**

Adrian Antico

**See Also**

Other Unsupervised Learning: [AutoClustering\(\)](#), [GenTSAnomVars\(\)](#), [H2OIsolationForestScoring\(\)](#), [H2OIsolationForest\(\)](#), [ResidualOutliers\(\)](#)

**Examples**

```
## Not run:
#####
# Training Setup
#####

# Create fake data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 1000,
  ID = 2,
  ZIP = 0,
  AddDate = TRUE,
  Classification = FALSE,
  MultiClass = FALSE)

# Run function
data <- RemixAutoML::AutoClustering(
  data,
  FeatureColumns = names(data)[2:(ncol(data)-1)],
  ModelID = 'TestModel',
  SavePath = getwd(),
  NThreads = 8,
  MaxMemory = '28G',
  MaxClusters = 50,
  ClusterMetric = 'totss',
  RunDimReduction = TRUE,
  ShrinkRate = (sqrt(5) - 1) / 2,
  Epochs = 5L,
  L2_Reg = 0.10,
  ElasticAveraging = TRUE,
  ElasticAveragingMovingRate = 0.90,
  ElasticAveragingRegularization = 0.001)

#####
# Scoring Setup
```

```
#####

Sys.sleep(10)

# Create fake data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 1000,
  ID = 2,
  ZIP = 0,
  AddDate = TRUE,
  Classification = FALSE,
  MultiClass = FALSE)

# Run function
data <- RemixAutoML::AutoClusteringScoring(
  data,
  FeatureColumns = names(data)[2:(ncol(data)-1)],
  ModelID = 'TestModel',
  SavePath = getwd(),
  NThreads = 8,
  MaxMemory = '28G',
  DimReduction = TRUE)

## End(Not run)
```

---

AutoDataDictionaries    *AutoDataDictionaries*

---

## Description

AutoDataDictionaries is a function to return data dictionary data in table form

## Usage

```
AutoDataDictionaries(
  Type = "sqlserver",
  DBConnection,
  DDType = 1L,
  Query = NULL,
  ASIS = FALSE,
  CloseChannel = TRUE
)
```

## Arguments

Type	= "sqlserver" is currently the only system supported
DBConnection	This is a RODBC connection object for sql server
DDType	Select from 1 - 6 based on this article
Query	Supply a query
ASIS	Set to TRUE to pull in values without coercing types
CloseChannel	Set to TRUE to disconnect

Author(s)

Adrian Antico

See Also

Other Database: [SQL\\_ClearTable\(\)](#), [SQL\\_DropTable\(\)](#), [SQL\\_Query\\_Push\(\)](#), [SQL\\_Query\(\)](#), [SQL\\_SaveTable\(\)](#), [SQL\\_Server\\_DBConnection\(\)](#)

---

AutoDataPartition	<i>AutoDataPartition</i>
-------------------	--------------------------

---

Description

This function will take your ratings matrix and model and score your data in parallel.

Usage

```
AutoDataPartition(  
  data,  
  NumDataSets = 3L,  
  Ratios = c(0.7, 0.2, 0.1),  
  PartitionType = "random",  
  StratifyColumnNames = NULL,  
  TimeColumnName = NULL  
)
```

Arguments

data	Source data to do your partitioning on
NumDataSets	The number of total data sets you want built
Ratios	A vector of values for how much data each data set should get in each split. E.g. <code>c(0.70, 0.20, 0.10)</code>
PartitionType	Set to either "random", "timeseries", or "time". With "random", your data will be partitioned randomly (with stratified sampling if column names are supplied). With "timeseries", you can partition by time with a stratify option (so long as you have an equal number of records for each strata). With "time" you will have data sets generated so that the training data contains the earliest records in time, validation data the second earliest, test data the third earliest, etc.
StratifyColumnNames	Supply column names of categorical features to use in a stratified sampling procedure for partitioning the data. Partition type must be "random" to use this option
TimeColumnName	Supply a date column name or a name of a column with an ID for sorting by time such that the smallest number is the earliest in time.

Value

Returns a list of data.tables

**Author(s)**

Adrian Antico

**See Also**

Other Feature Engineering: [AutoDiffLagN\(\)](#), [AutoHierarchicalFourier\(\)](#), [AutoInteraction\(\)](#), [AutoLagRollMode\(\)](#), [AutoLagRollStatsScoring\(\)](#), [AutoLagRollStats\(\)](#), [AutoTransformationCreate\(\)](#), [AutoTransformationScore\(\)](#), [AutoWord2VecModeler\(\)](#), [AutoWord2VecScoring\(\)](#), [CategoricalEncoding\(\)](#), [CreateCalendarVariables\(\)](#), [CreateHolidayVariables\(\)](#), [DummifyDT\(\)](#), [H2OAutoencoderScoring\(\)](#), [H2OAutoencoder\(\)](#), [ModelDataPrep\(\)](#), [TimeSeriesFill\(\)](#)

**Examples**

```
# Create fake data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 1000,
  ID = 2,
  ZIP = 0,
  AddDate = FALSE,
  Classification = FALSE,
  MultiClass = FALSE)

# Run data partitioning function
dataSets <- RemixAutoML::AutoDataPartition(
  data,
  NumDataSets = 3L,
  Ratios = c(0.70,0.20,0.10),
  PartitionType = "random",
  StratifyColumnNames = NULL,
  TimeColumnName = NULL)

# Collect data
TrainData <- dataSets$TrainData
ValidationData <- dataSets$ValidationData
TestData <- dataSets$TestData
```

---

AutoDiffLagN

*AutoDiffLagN*


---

**Description**

AutoDiffLagN create differences for selected numerical columns

**Usage**

```
AutoDiffLagN(
  data,
  DateVariable = NULL,
  GroupVariables = NULL,
  DiffVariables = NULL,
  DiffDateVariables = NULL,
```

```

DiffGroupVariables = NULL,
NLag1 = 0L,
NLag2 = 1L,
Sort = FALSE,
RemoveNA = TRUE
)

```

### Arguments

data	Source data
DateVariable	Date column used for sorting
GroupVariables	Difference data by group
DiffVariables	Column names of numeric columns to difference
DiffDateVariables	Columns names for date variables to difference. Output is a numeric value representing the difference in days.
DiffGroupVariables	Column names for categorical variables to difference. If no change then the output is 'No_Change' else 'New=NEWVAL Old=OLDVAL' where NEWVAL and OLDVAL are placeholders for the actual values
NLag1	If the diff calc, we have column 1 - column 2. NLag1 is in reference to column 1. If you want to take the current value minus the previous weeks value, supply a zero. If you want to create a lag2 - lag4 NLag1 gets a 2.
NLag2	If the diff calc, we have column 1 - column 2. NLag2 is in reference to column 2. If you want to take the current value minus the previous weeks value, supply a 1. If you want to create a lag2 - lag4 NLag1 gets a 4.
Sort	TRUE to sort your data inside the function
RemoveNA	Set to TRUE to remove rows with NA generated by the lag operation

### Author(s)

Adrian Antico

### See Also

Other Feature Engineering: [AutoDataPartition\(\)](#), [AutoHierarchicalFourier\(\)](#), [AutoInteraction\(\)](#), [AutoLagRollMode\(\)](#), [AutoLagRollStatsScoring\(\)](#), [AutoLagRollStats\(\)](#), [AutoTransformationCreate\(\)](#), [AutoTransformationScore\(\)](#), [AutoWord2VecModeler\(\)](#), [AutoWord2VecScoring\(\)](#), [CategoricalEncoding\(\)](#), [CreateCalendarVariables\(\)](#), [CreateHolidayVariables\(\)](#), [DummifyDT\(\)](#), [H2OAutoencoderScoring\(\)](#), [H2OAutoencoder\(\)](#), [ModelDataPrep\(\)](#), [TimeSeriesFill\(\)](#)

### Examples

```

## Not run:

# Create fake data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.70,
  N = 50000,
  ID = 2L,
  FactorCount = 3L,
  AddDate = TRUE,

```

```

ZIP = 0L,
TimeSeries = FALSE,
ChainLadderData = FALSE,
Classification = FALSE,
MultiClass = FALSE)

# Store Cols to diff
Cols <- names(data)[which(unlist(data[, lapply(.SD, is.numeric)]))]

# Clean data before running AutoDiffLagN
data <- RemixAutoML::ModelDataPrep(data = data, Impute = FALSE, CharToFactor = FALSE, FactorToChar = TRUE)

# Run function
data <- RemixAutoML::AutoDiffLagN(
  data,
  DateVariable = "DateTime",
  GroupVariables = c("Factor_1", "Factor_2"),
  DiffVariables = Cols,
  DiffDateVariables = NULL,
  DiffGroupVariables = NULL,
  NLag1 = 0L,
  NLag2 = 1L,
  Sort = TRUE,
  RemoveNA = TRUE)

## End(Not run)

```

---

AutoETS

*AutoETS*


---

## Description

AutoETS is a multi-armed bandit model testing framework for AR and SAR NNets. Randomized probability matching is the underlying bandit algorithm. Model evaluation is done by blending the training error and the validation error from testing the model on out of sample data. The bandit algorithm compares the performance of the current build against the previous builds which starts with the classic nnetar model from the forecast package. Depending on how many lags, seasonal lags, and fourier pairs you test the number of combinations of features to test begins to approach 10,000 different combinations of settings. The function tests out transformations, differencing, and variations of the lags, seasonal lags, and fourier pairs. The parameter space is broken up into various buckets that are increasing in sophistication. The bandit algorithm samples from those buckets and based on many rounds of testing it determines which buckets to generate samples from more frequently based on the models performance coming from that bucket. All of the models have performance data collected on them and a final rebuild is initiated when a winner is found. The rebuild process begins by retraining the model with the settings that produced the best performance. If the model fails to build, for whatever reason, the next best buildable model is rebuilt.

## Usage

```

AutoETS(
  data,
  FilePath = NULL,

```

```

    TargetVariableName,
    DateColumnName,
    TimeAggLevel = "week",
    EvaluationMetric = "MAE",
    NumHoldOutPeriods = 5L,
    NumFCPeriods = 5L,
    TrainWeighting = 0.5,
    MaxConsecutiveFails = 12L,
    MaxNumberModels = 100L,
    MaxRunTimeMinutes = 10L,
    NumberCores = max(1L, min(4L, parallel::detectCores() - 2L))
)

```

### Arguments

<code>data</code>	Source data.table
<code>FilePath</code>	NULL to return nothing. Provide a file path to save the model and xregs if available
<code>TargetVariableName</code>	Name of your time series target variable
<code>DateColumnName</code>	Name of your date column
<code>TimeAggLevel</code>	Choose from "year", "quarter", "month", "week", "day", "hour"
<code>EvaluationMetric</code>	Choose from MAE, MSE, and MAPE
<code>NumHoldOutPeriods</code>	Number of time periods to use in the out of sample testing
<code>NumFCPeriods</code>	Number of periods to forecast
<code>TrainWeighting</code>	Model ranking is based on a weighted average of training metrics and out of sample metrics. Supply the weight of the training metrics, such as 0.50 for 50 percent.
<code>MaxConsecutiveFails</code>	When a new best model is found MaxConsecutiveFails resets to zero. Indicated the number of model attempts without a new winner before terminating the procedure.
<code>MaxNumberModels</code>	Indicate the maximum number of models to test.
<code>MaxRunTimeMinutes</code>	Indicate the maximum number of minutes to wait for a result.
<code>NumberCores</code>	Default max(1L, min(4L, parallel::detectCores()-2L))

### Author(s)

Adrian Antico

### See Also

Other Automated Time Series: [AutoArfima\(\)](#), [AutoBanditNNet\(\)](#), [AutoBanditSarima\(\)](#), [AutoTBATS\(\)](#), [AutoTS\(\)](#)



## Examples

```
## Not run:
# Create fake data
data <- RemixAutoML::FakeDataGenerator(TimeSeries = TRUE, TimeSeriesTimeAgg = "days")

# Build model
Output <- RemixAutoML::AutoETS(
  data,
  FilePath = NULL,
  TargetVariableName = "Weekly_Sales",
  DateColumnName = "Date",
  TimeAggLevel = "weeks",
  EvaluationMetric = "MAE",
  NumHoldOutPeriods = 5L,
  NumFCPeriods = 5L,
  TrainWeighting = 0.50,
  MaxConsecutiveFails = 12L,
  MaxNumberModels = 100L,
  MaxRunTimeMinutes = 10L,
  NumberCores = max(1L, min(4L, parallel::detectCores()-2L)))

# Output
Output$ForecastPlot
Output$Forecast
Output$PerformanceGrid

## End(Not run)
```

---

AutoH2OCARMA

*AutoH2OCARMA*


---

## Description

AutoH2OCARMA Multivariate Forecasting with calendar variables, Holiday counts, holiday lags, holiday moving averages, differencing, transformations, interaction-based categorical encoding using target variable and features to generate various time-based aggregated lags, moving averages, moving standard deviations, moving skewness, moving kurtosis, moving quantiles, parallelized interaction-based fourier pairs by grouping variables, and Trend Variables.

## Usage

```
AutoH2OCARMA(
  AlgoType = "drf",
  ExcludeAlgos = "XGBoost",
  data,
  TrainOnFull = FALSE,
  TargetColumnName = "Target",
  PDFOutputPath = NULL,
  SaveDataPath = NULL,
  TimeWeights = NULL,
  NonNegativePred = FALSE,
  RoundPreds = FALSE,
  DateColumnName = "DateTime",
```

```

GroupVariables = NULL,
HierarchGroups = NULL,
TimeUnit = "week",
TimeGroups = c("weeks", "months"),
FC_Periods = 30,
PartitionType = "timeseries",
MaxMem = {      gc()
  paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo",
    intern = TRUE))/1e+06)), "G") },
NThreads = max(1, parallel::detectCores() - 2),
Timer = TRUE,
DebugMode = FALSE,
TargetTransformation = FALSE,
Methods = c("YeoJohnson", "BoxCox", "Asinh", "Log", "LogPlus1", "Sqrt", "Asin",
  "Logit"),
XREGS = NULL,
Lags = c(1:5),
MA_Periods = c(1:5),
SD_Periods = NULL,
Skew_Periods = NULL,
Kurt_Periods = NULL,
Quantile_Periods = NULL,
Quantiles_Selected = NULL,
AnomalyDetection = NULL,
Difference = TRUE,
FourierTerms = 6,
CalendarVariables = c("second", "minute", "hour", "wday", "mday", "yday", "week",
  "wom", "isoweek", "month", "quarter", "year"),
HolidayVariable = c("USPublicHolidays", "EasterGroup", "ChristmasGroup",
  "OtherEccelesticalFeasts"),
HolidayLookback = NULL,
HolidayLags = 1,
HolidayMovingAverages = 1:2,
TimeTrendVariable = FALSE,
DataTruncate = FALSE,
ZeroPadSeries = NULL,
SplitRatios = c(0.7, 0.2, 0.1),
EvalMetric = "rmse",
NumOfParDepPlots = 0L,
GridTune = FALSE,
ModelCount = 1,
NTrees = 1000,
LearnRate = 0.1,
LearnRateAnnealing = 1,
GridStrategy = "Cartesian",
MaxRunTimeSecs = 60 * 60 * 24,
StoppingRounds = 10,
MaxDepth = 20,
SampleRate = 0.632,
MTries = -1,
ColSampleRate = 1,
ColSampleRatePerTree = 1,

```

```

ColSampleRatePerTreeLevel = 1,
MinRows = 1,
NBins = 20,
NBinsCats = 1024,
NBinsTopLevel = 1024,
CategoricalEncoding = "AUTO",
HistogramType = "AUTO",
Distribution = "gaussian",
Link = "identity",
RandomDistribution = NULL,
RandomLink = NULL,
Solver = "AUTO",
Alpha = NULL,
Lambda = NULL,
LambdaSearch = FALSE,
NLambdas = -1,
Standardize = TRUE,
RemoveCollinearColumns = FALSE,
InterceptInclude = TRUE,
NonNegativeCoefficients = FALSE,
RandomColNumbers = NULL,
InteractionColNumbers = NULL
)

```

### Arguments

AlgoType	Select from "dfr" for RandomForecast, "gbm" for gradient boosting, "glm" for generalized linear model, "automl" for H2O's AutoML algo, and "gam" for H2O's Generalized Additive Model.
ExcludeAlgos	For use when AlgoType = "AutoML". Selections include "DRF","GLM","XGBoost","GBM","DeepL and "Stacke-dEnsemble"
data	Supply your full series data set here
TrainOnFull	Set to TRUE to train on full data
TargetColumnName	List the column name of your target variables column. E.g. "Target"
PDFOutputPath	NULL or a path file to output PDFs to a specified folder
SaveDataPath	NULL Or supply a path. Data saved will be called 'ModelID'_data.csv
TimeWeights	1 or a value between zero and 1. Data will be weighted less and less the more historic it gets, by group
NonNegativePred	TRUE or FALSE
RoundPreds	Rounding predictions to an integer value. TRUE or FALSE. Defaults to FALSE
DateColumnName	List the column name of your date column. E.g. "DateTime"
GroupVariables	Defaults to NULL. Use NULL when you have a single series. Add in Group-Variables when you have a series for every level of a group or multiple groups.
HierarchGroups	Vector of hierachy categorical columns.
TimeUnit	List the time unit your data is aggregated by. E.g. "1min", "5min", "10min", "15min", "30min", "hour", "day", "week", "month", "quarter", "year".
TimeGroups	Select time aggregations for adding various time aggregated GDL features.

FC_Periods	Set the number of periods you want to have forecasts for. E.g. 52 for weekly data to forecast a year ahead
PartitionType	Select "random" for random data partitioning "time" for partitioning by time frames
MaxMem	Set to the maximum amount of memory you want to allow for running this function. Default is "32G".
NThreads	Set to the number of threads you want to dedicate to this function.
Timer	Set to FALSE to turn off the updating print statements for progress
DebugMode	Defaults to FALSE. Set to TRUE to get a print statement of each high level comment in function
TargetTransformation	Run AutoTransformationCreate() to find best transformation for the target variable. Tests YeoJohnson, BoxCox, and Asigh (also Asin and Logit for proportion target variables).
Methods	Choose from "YeoJohnson", "BoxCox", "Asinh", "Log", "LogPlus1", "Sqrt", "Asin", or "Logit". If more than one is selected, the one with the best normalization pearson statistic will be used. Identity is automatically selected and compared.
XREGS	Additional data to use for model development and forecasting. Data needs to be a complete series which means both the historical and forward looking values over the specified forecast window needs to be supplied.
Lags	Select the periods for all lag variables you want to create. E.g. c(1:5,52) or list("day" = c(1:10), "weeks" = c(1:4))
MA_Periods	Select the periods for all moving average variables you want to create. E.g. c(1:5,52) or list("day" = c(2:10), "weeks" = c(2:4))
SD_Periods	Select the periods for all moving standard deviation variables you want to create. E.g. c(1:5,52) or list("day" = c(2:10), "weeks" = c(2:4))
Skew_Periods	Select the periods for all moving skewness variables you want to create. E.g. c(1:5,52) or list("day" = c(2:10), "weeks" = c(2:4))
Kurt_Periods	Select the periods for all moving kurtosis variables you want to create. E.g. c(1:5,52) or list("day" = c(2:10), "weeks" = c(2:4))
Quantile_Periods	Select the periods for all moving quantiles variables you want to create. E.g. c(1:5,52) or list("day" = c(2:10), "weeks" = c(2:4))
Quantiles_Selected	Select from the following c("q5", "q10", "q15", "q20", "q25", "q30", "q35", "q40", "q45", "q50", "q55", "q60", "q65", "q70", "q75", "q80", "q85", "q90", "q95", "q99")
AnomalyDetection	NULL for not using the service. Other, provide a list, e.g. AnomalyDetection = list("tstat_high" = 4, tstat_low = -4)
Difference	Puts the I in ARIMA for single series and grouped series.
FourierTerms	Set to the max number of pairs. E.g. 2 means to generate two pairs for by each group level and interactions if hierarchy is enabled.
CalendarVariables	NULL, or select from "second", "minute", "hour", "wday", "mday", "yday", "week", "isoweek", "month", "quarter", "year"
HolidayVariable	NULL, or select from "USPublicHolidays", "EasterGroup", "ChristmasGroup", "OtherEcclestialFeasts"

HolidayLookback	Number of days in range to compute number of holidays from a given date in the data. If NULL, the number of days are computed for you.
HolidayLags	Number of lags to build off of the holiday count variable.
HolidayMovingAverages	Number of moving averages to build off of the holiday count variable.
TimeTrendVariable	Set to TRUE to have a time trend variable added to the model. Time trend is numeric variable indicating the numeric value of each record in the time series (by group). Time trend starts at 1 for the earliest point in time and increments by one for each success time point.
DataTruncate	Set to TRUE to remove records with missing values from the lags and moving average features created
ZeroPadSeries	NULL to do nothing. Otherwise, set to "maxmax", "minmax", "maxmin", "minmin". See <a href="#">TimeSeriesFill</a> for explanations of each type
SplitRatios	E.g c(0.7,0.2,0.1) for train, validation, and test sets
EvalMetric	Select from "RMSE", "MAE", "MAPE", "Poisson", "Quantile", "LogLinQuantile", "Lq", "SMAPE", "R2", "MSLE", "MedianAbsoluteError"
NumOfParDepPlots	Set to zeros if you do not want any returned. Can set to a very large value and it will adjust to the max number of features if it's too high
GridTune	Set to TRUE to run a grid tune
ModelCount	Set the number of models to try in the grid tune
NTrees	Select the number of trees you want to have built to train the model
LearnRate	Default 0.10, models available include gbm
LearnRateAnnealing	Default 1, models available include gbm
GridStrategy	Default "Cartesian", models available include
MaxRunTimeSecs	Default 60*60*24, models available include
StoppingRounds	Default 10, models available include
MaxDepth	Default 20, models available include drf, gbm
SampleRate	Default 0.632, models available include drf, gbm
MTries	Default 1, models available include drf
ColSampleRate	Default 1, model available include gbm
ColSampleRatePerTree	Default 1, models available include drf, gbm
ColSampleRatePerTreeLevel	Default 1, models available include drf, gbm
MinRows	Default 1, models available include drf, gbm
NBins	Default 20, models available include drf, gbm
NBinsCats	Default 1024, models available include drf, gbm
NBinsTopLevel	Default 1024, models available include drf, gbm
CategoricalEncoding	Default "AUTO". Choices include : "AUTO", "Enum", "OneHotInternal", "OneHotExplicit", "Binary", "Eigen", "LabelEncoder", "Sort-ByResponse", "Enum-Limited"

HistogramType	Default "AUTO". Select from "AUTO", "UniformAdaptive", "Random", "QuantilesGlobal", "RoundRobin"
Distribution	Model family
Link	Link for model family
RandomDistribution	Default NULL
RandomLink	Default NULL
Solver	Model optimizer
Alpha	Default NULL
Lambda	Default NULL
LambdaSearch	Default FALSE,
NLambdas	Default -1
Standardize	Default TRUE
RemoveCollinearColumns	Default FALSE
InterceptInclude	Default TRUE
NonNegativeCoefficients	Default FALSE
RandomColNumbers	NULL
InteractionColNumbers	NULL

**Value**

See examples

**Author(s)**

Adrian Antico

**See Also**

Other Automated Panel Data Forecasting: [AutoCatBoostCARMA\(\)](#), [AutoCatBoostHurdleCARMA\(\)](#), [AutoCatBoostVectorCARMA\(\)](#), [AutoLightGBMCARMA\(\)](#), [AutoLightGBMHurdleCARMA\(\)](#), [AutoXGBoostCARMA\(\)](#), [AutoXGBoostHurdleCARMA\(\)](#)

**Examples**

```
## Not run:

# Load data
data <- data.table::fread("https://www.dropbox.com/s/2str3ek4f4cheqi/walmart_train.csv?dl=1")

# Ensure series have no missing dates (also remove series with more than 25% missing values)
data <- RemixAutoML::TimeSeriesFill(
  data,
  DateColumnName = "Date",
  GroupVariables = c("Store", "Dept"),
  TimeUnit = "weeks",
```

```

    FillType = "maxmax",
    MaxMissingPercent = 0.25,
    SimpleImpute = TRUE)

# Set negative numbers to 0
data <- data[, Weekly_Sales := data.table::fifelse(Weekly_Sales < 0, 0, Weekly_Sales)]

# Remove IsHoliday column
data[, IsHoliday := NULL]

# Create xregs (this is the include the categorical variables instead of utilizing only the interaction of them)
xregs <- data[, .SD, .SDcols = c("Date", "Store", "Dept")]

# Change data types
data[, "Date" := as.character(Date), Dept = as.character(Dept)]
xregs[, "Date" := as.character(Date), Dept = as.character(Dept)]

# Build forecast
Results <- RemixAutoML::AutoH2OCARMA(

  # Data Artifacts
  AlgoType = "drf",
  ExcludeAlgos = NULL,
  data = data,
  TargetColumnName = "Weekly_Sales",
  DateColumnName = "Date",
  HierarchGroups = NULL,
  GroupVariables = c("Dept"),
  TimeUnit = "week",
  TimeGroups = c("weeks", "months"),

  # Data Wrangling Features
  SplitRatios = c(1 - 10 / 138, 10 / 138),
  PartitionType = "random",

  # Production args
  FC_Periods = 4L,
  TrainOnFull = FALSE,
  MaxMem = {gc();paste0(as.character(floor(max(32, as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo))))))},
  NThreads = parallel::detectCores(),
  PDFOutputPath = NULL,
  SaveDataPath = NULL,
  Timer = TRUE,
  DebugMode = TRUE,

  # Target Transformations
  TargetTransformation = FALSE,
  Methods = c("BoxCox", "Asinh", "Asin", "Log",
    "LogPlus1", "Sqrt", "Logit", "YeoJohnson"),
  Difference = FALSE,
  NonNegativePred = FALSE,
  RoundPreds = FALSE,

  # Calendar features
  CalendarVariables = c("week", "wom", "month", "quarter", "year"),
  HolidayVariable = c("USPublicHolidays", "EasterGroup",
    "ChristmasGroup", "OtherEcclesticalFeasts"),

```

```

HolidayLookback = NULL,
HolidayLags = 1:7,
HolidayMovingAverages = 2:7,
TimeTrendVariable = TRUE,

# Time series features
Lags = list("weeks" = c(1:4), "months" = c(1:3)),
MA_Periods = list("weeks" = c(2:8), "months" = c(6:12)),
SD_Periods = NULL,
Skew_Periods = NULL,
Kurt_Periods = NULL,
Quantile_Periods = NULL,
Quantiles_Selected = NULL,

# Bonus Features
XREGS = NULL,
FourierTerms = 2L,
AnomalyDetection = NULL,
ZeroPadSeries = NULL,
DataTruncate = FALSE,

# ML evaluation args
EvalMetric = "RMSE",
NumOfParDepPlots = 0L,

# ML grid tuning args
GridTune = FALSE,
GridStrategy = "Cartesian",
ModelCount = 5,
MaxRunTimeSecs = 60*60*24,
StoppingRounds = 10,

# ML Args
NTrees = 1000L,
MaxDepth = 20,
SampleRate = 0.632,
MTries = -1,
ColSampleRatePerTree = 1,
ColSampleRatePerTreeLevel = 1,
MinRows = 1,
NBins = 20,
NBinsCats = 1024,
NBinsTopLevel = 1024,
HistogramType = "AUTO",
CategoricalEncoding = "AUTO",
RandomColNumbers = NULL,
InteractionColNumbers = NULL,
WeightsColumn = NULL,

# ML args
Distribution = "gaussian",
Link = "identity",
RandomDistribution = NULL,
RandomLink = NULL,
Solver = "AUTO",
Alpha = NULL,
Lambda = NULL,

```



```

LambdaSearch = FALSE,
NLambdas = -1,
Standardize = TRUE,
RemoveCollinearColumns = FALSE,
InterceptInclude = TRUE,
NonNegativeCoefficients = FALSE)

UpdateMetrics <-
  Results$ModelInformation$EvaluationMetrics[
    Metric == "MSE", MetricValue := sqrt(MetricValue)]
print(UpdateMetrics)

# Get final number of trees actually used
Results$Model@model$model_summary$number_of_internal_trees

# Inspect performance
Results$ModelInformation$EvaluationMetricsByGroup[order(-R2_Metric)]
Results$ModelInformation$EvaluationMetricsByGroup[order(MAE_Metric)]
Results$ModelInformation$EvaluationMetricsByGroup[order(MSE_Metric)]
Results$ModelInformation$EvaluationMetricsByGroup[order(MAPE_Metric)]

## End(Not run)

```

---

AutoH2oDRFClassifier    *AutoH2oDRFClassifier*

---

## Description

AutoH2oDRFClassifier is an automated H2O modeling framework with grid-tuning and model evaluation that runs a variety of steps. First, a stratified sampling (by the target variable) is done to create train and validation sets. Then, the function will run a random grid tune over N number of models and find which model is the best (a default model is always included in that set). Once the model is identified and built, several other outputs are generated: validation data with predictions, evaluation plot, evaluation metrics, variable importance, partial dependence calibration plots, and column names used in model fitting.

## Usage

```

AutoH2oDRFClassifier(
  OutputSelection = c("EvalMetrics", "PDFs", "Score_TrainData"),
  data = NULL,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = NULL,
  FeatureColNames = NULL,
  WeightsColumn = NULL,
  MaxMem = { gc()
    paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo",
      intern = TRUE))/1e+06)), "G") },
  NThreads = max(1L, parallel::detectCores() - 2L),
  model_path = NULL,
  metadata_path = NULL,

```

```

ModelID = "FirstModel",
NumOfParDepPlots = 3L,
ReturnModelObjects = TRUE,
SaveModelObjects = FALSE,
SaveInfoToPDF = FALSE,
IfSaveModel = "mojo",
H2OShutdown = FALSE,
H2OStartUp = TRUE,
GridTune = FALSE,
GridStrategy = "RandomDiscrete",
MaxRunTimeSecs = 60 * 60 * 24,
StoppingRounds = 10,
MaxModelsInGrid = 2,
DebugMode = FALSE,
eval_metric = "auc",
CostMatrixWeights = c(1, 0, 0, 1),
Trees = 50L,
MaxDepth = 20L,
SampleRate = 0.632,
MTries = -1,
ColSampleRatePerTree = 1,
ColSampleRatePerTreeLevel = 1,
MinRows = 1,
NBins = 20,
NBinsCats = 1024,
NBinsTopLevel = 1024,
HistogramType = "AUTO",
CategoricalEncoding = "AUTO"
)

```

## Arguments

OutputSelection	You can select what type of output you want returned. Choose from c("EvalMetrics", "PDFs", "Score_TrainData")
data	This is your data set for training and testing your model
TrainOnFull	Set to TRUE to train on full data
ValidationData	This is your holdout data set used in modeling either refine your hyperparameters.
TestData	This is your holdout data set. Catboost using both training and validation data in the training process so you should evaluate out of sample performance with this data set.
TargetColumnName	Either supply the target column name OR the column number where the target is located (but not mixed types). Note that the target column needs to be a 0   1 numeric variable.
FeatureColNames	Either supply the feature column names OR the column number where the target is located (but not mixed types)
WeightsColumn	Column name of a weights column
MaxMem	Set the maximum amount of memory you'd like to dedicate to the model run. E.g. "32G"

NThreads	Set the number of threads you want to dedicate to the model building
model_path	A character string of your path file to where you want your output saved
metadata_path	A character string of your path file to where you want your model evaluation output saved. If left NULL, all output will be saved to model_path.
ModelID	A character string to name your model and output
NumOfParDepPlots	Tell the function the number of partial dependence calibration plots you want to create.
ReturnModelObjects	Set to TRUE to output all modeling objects (E.g. plots and evaluation metrics)
SaveModelObjects	Set to TRUE to return all modeling objects to your environment
SaveInfoToPDF	Set to TRUE to save modeling information to PDF. If model_path or meta-data_path aren't defined then output will be saved to the working directory
IfSaveModel	Set to "mojo" to save a mojo file, otherwise "standard" to save a regular H2O model object
H2OShutdown	Set to TRUE to shutdown H2O after running the function
H2OStartup	Defaults to TRUE which means H2O will be started inside the function
GridTune	Set to TRUE to run a grid tuning procedure. Set a number in MaxModelsInGrid to tell the procedure how many models you want to test.
GridStrategy	Default "Cartesian"
MaxRunTimeSecs	Default 86400
StoppingRounds	Default 10
MaxModelsInGrid	Number of models to test from grid options (1080 total possible options)
DebugMode	Set to TRUE to get a printout of each step taken internally
eval_metric	This is the metric used to identify best grid tuned model. Choose from "AUC" or "logloss"
CostMatrixWeights	A vector with 4 elements c(True Positive Cost, False Negative Cost, False Positive Cost, True Negative Cost). Default c(1,0,0,1),
Trees	The maximum number of trees you want in your models
MaxDepth	Default 20
SampleRate	Default 0.632
MTries	Default -1 means it will default to number of features divided by 3
ColSampleRatePerTree	Default 1
ColSampleRatePerTreeLevel	Default 1
MinRows	Default 1
NBinsCats	Default 1024
NBinsTopLevel	Default 1024
HistogramType	Default "AUTO"
CategoricalEncoding	Default "AUTO"

**Value**

Saves to file and returned in list: VariableImportance.csv, Model, ValidationData.csv, Evaluation-Plot.png, EvaluationMetrics.csv, ParDepPlots.R a named list of features with partial dependence calibration plots, GridCollect, and GridList

**Author(s)**

Adrian Antico

**See Also**

Other Automated Supervised Learning - Binary Classification: [AutoCatBoostClassifier\(\)](#), [AutoH2oGAMClassifier\(\)](#), [AutoH2oGBMClassifier\(\)](#), [AutoH2oGLMClassifier\(\)](#), [AutoH2oMLClassifier\(\)](#), [AutoLightGBMClassifier\(\)](#), [AutoXGBoostClassifier\(\)](#)

**Examples**

```
## Not run:
# Create some dummy correlated data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 1000L,
  ID = 2L,
  ZIP = 0L,
  AddDate = FALSE,
  Classification = TRUE,
  MultiClass = FALSE)

TestModel <- RemixAutoML::AutoH2oDRFClassifier(

  # Compute management args
  MaxMem = {gc();paste0(as.character(floor(as.numeric(system("awk 'MemFree/ {print $2}' /proc/meminfo", inter
  NThreads = max(1L, parallel::detectCores() - 2L)},
  IfSaveModel = "mojo",
  H2oShutdown = FALSE,
  H2oStartUp = TRUE,

  # Model evaluation args
  eval_metric = "auc",
  NumOfParDepPlots = 3L,
  CostMatrixWeights = c(1,0,0,1),

  # Metadata args
  OutputSelection = c("EvalMetrics", "PDFs", "Score_TrainData"),
  model_path = normalizePath("./"),
  metadata_path = NULL,
  ModelID = "FirstModel",
  ReturnModelObjects = TRUE,
  SaveModelObjects = FALSE,
  SaveInfoToPDF = FALSE,
  DebugMode = FALSE,

  # Data args
  data,
  TrainOnFull = FALSE,
  ValidationData = NULL,
```

```

    TestData = NULL,
    TargetColumnName = "Adrian",
    FeatureColNames = names(data)[!names(data) %in% c("IDcol_1", "IDcol_2", "Adrian")],
    WeightsColumn = NULL,

    # Grid Tuning Args
    GridStrategy = "RandomDiscrete",
    GridTune = FALSE,
    MaxModelsInGrid = 10,
    MaxRunTimeSecs = 60*60*24,
    StoppingRounds = 10,

    # Model args
    Trees = 50L,
    MaxDepth = 20,
    SampleRate = 0.632,
    MTries = -1,
    ColSampleRatePerTree = 1,
    ColSampleRatePerTreeLevel = 1,
    MinRows = 1,
    NBins = 20,
    NBinsCats = 1024,
    NBinsTopLevel = 1024,
    HistogramType = "AUTO",
    CategoricalEncoding = "AUTO")

## End(Not run)

```

---

AutoH2oDRFHurdleModel *AutoH2oDRFHurdleModel*

---

## Description

AutoH2oDRFHurdleModel for hurdle modeling

## Usage

```

AutoH2oDRFHurdleModel(
  data,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  Buckets = 0L,
  TargetColumnName = NULL,
  FeatureColNames = NULL,
  TransformNumericColumns = NULL,
  SplitRatios = c(0.7, 0.2, 0.1),
  ModelID = "ModelTest",
  Paths = NULL,
  MetaDataPaths = NULL,
  SaveModelObjects = TRUE,
  IfSaveModel = "mojo",
  MaxMem = {      gc()

```

```

paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo",
  intern = TRUE))/1e+06)), "G") },
NThreads = max(1L, parallel::detectCores() - 2L),
Trees = 1000L,
GridTune = TRUE,
MaxModelsInGrid = 1L,
NumOfParDepPlots = 10L,
PassInGrid = NULL
)

```

### Arguments

<code>data</code>	Source training data. Do not include a column that has the class labels for the buckets as they are created internally.
<code>TrainOnFull</code>	Set to TRUE to train on full data
<code>ValidationData</code>	Source validation data. Do not include a column that has the class labels for the buckets as they are created internally.
<code>TestData</code>	Source test data. Do not include a column that has the class labels for the buckets as they are created internally.
<code>Buckets</code>	A numeric vector of the buckets used for subsetting the data. NOTE: the final Bucket value will first create a subset of data that is less than the value and a second one thereafter for data greater than the bucket value.
<code>TargetColumnName</code>	Supply the column name or number for the target variable
<code>FeatureColNames</code>	Supply the column names or number of the features (not included the Primary-DateColumn)
<code>TransformNumericColumns</code>	Transform numeric column inside the AutoCatBoostRegression() function
<code>SplitRatios</code>	Supply vector of partition ratios. For example, c(0.70,0.20,0,10).
<code>ModelID</code>	Define a character name for your models
<code>Paths</code>	The path to your folder where you want your model information saved
<code>MetaDataPaths</code>	A character string of your path file to where you want your model evaluation output saved. If left NULL, all output will be saved to Paths.
<code>SaveModelObjects</code>	Set to TRUE to save the model objects to file in the folders listed in Paths
<code>IfSaveModel</code>	Save as "mojo" or "standard"
<code>MaxMem</code>	Set the maximum memory your system can provide
<code>NThreads</code>	Set the number of threads you want to dedicate to the model building
<code>Trees</code>	Default 1000
<code>GridTune</code>	Set to TRUE if you want to grid tune the models
<code>MaxModelsInGrid</code>	Set to a numeric value for the number of models to try in grid tune
<code>NumOfParDepPlots</code>	Set to pull back N number of partial dependence calibration plots.
<code>PassInGrid</code>	Pass in a grid for changing up the parameter settings for catboost

**Value**

Returns AutoXGBoostRegression() model objects: VariableImportance.csv, Model, Validation-Data.csv, EvaluationPlot.png, EvaluationBoxPlot.png, EvaluationMetrics.csv, ParDepPlots.R a named list of features with partial dependence calibration plots, ParDepBoxPlots.R, GridCollect, and the grid used

**Author(s)**

Adrian Antico

**See Also**

Other Supervised Learning - Hurdle Modeling: [AutoCatBoostHurdleModel\(\)](#), [AutoH2oGBMHurdleModel\(\)](#), [AutoLightGBMHurdleModel\(\)](#), [AutoXGBoostHurdleModel\(\)](#)

**Examples**

```
## Not run:
Output <- AutoH2oDRFHurdleModel(
  data,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  Buckets = 1L,
  TargetColumnName = "Target_Variable",
  FeatureColNames = 4:ncol(data),
  TransformNumericColumns = NULL,
  SplitRatios = c(0.7, 0.2, 0.1),
  NThreads = max(1L, parallel::detectCores()-2L),
  ModelID = "ModelID",
  Paths = NULL,
  MetadataPaths = NULL,
  SaveModelObjects = TRUE,
  IfSaveModel = "mojo",
  MaxMem = {gc();paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo", intern=TRUE)))
  NThreads = max(1L, parallel::detectCores()-2L),
  Trees = 1000L,
  GridTune = FALSE,
  MaxModelsInGrid = 1L,
  NumOfParDepPlots = 10L,
  PassInGrid = NULL)

## End(Not run)
```

---

AutoH2oDRFMultiClass    *AutoH2oDRFMultiClass*

---

**Description**

AutoH2oDRFMultiClass is an automated H2O modeling framework with grid-tuning and model evaluation that runs a variety of steps. First, a stratified sampling (by the target variable) is done to create train and validation sets. Then, the function will run a random grid tune over N number of models and find which model is the best (a default model is always included in that set). Once the model is identified and built, several other outputs are generated: validation data with predictions, evaluation metrics, confusion matrix, and variable importance.

**Usage**

```

AutoH2oDRFMultiClass(
  OutputSelection = c("EvalMetrics", "PDFs", "Score_TrainData"),
  data = NULL,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = NULL,
  FeatureColNames = NULL,
  WeightsColumn = NULL,
  ReturnModelObjects = TRUE,
  SaveModelObjects = FALSE,
  IfSaveModel = "mojo",
  MaxMem = {      gc()
    paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo",
      intern = TRUE))/1e+06)), "G") },
  NThreads = max(1, parallel::detectCores() - 2),
  model_path = NULL,
  metadata_path = NULL,
  ModelID = "FirstModel",
  H2OShutdown = FALSE,
  H2OStartUp = TRUE,
  DebugMode = FALSE,
  eval_metric = "logloss",
  GridTune = FALSE,
  GridStrategy = "RandomDiscrete",
  MaxRunTimeSecs = 60 * 60 * 24,
  StoppingRounds = 10,
  MaxModelsInGrid = 2,
  Trees = 50,
  MaxDepth = 20L,
  SampleRate = 0.632,
  MTries = -1,
  ColSampleRatePerTree = 1,
  ColSampleRatePerTreeLevel = 1,
  MinRows = 1,
  NBins = 20,
  NBinsCats = 1024,
  NBinsTopLevel = 1024,
  HistogramType = "AUTO",
  CategoricalEncoding = "AUTO"
)

```

**Arguments**

OutputSelection	You can select what type of output you want returned. Choose from c("EvalMetrics", "PDFs", "Score_TrainData")
data	This is your data set for training and testing your model
TrainOnFull	Set to TRUE to train on full data
ValidationData	This is your holdout data set used in modeling either refine your hyperparameters.



TestData	This is your holdout data set. Catboost using both training and validation data in the training process so you should evaluate out of sample performance with this data set.
TargetColumnName	Either supply the target column name OR the column number where the target is located (but not mixed types).
FeatureColNames	Either supply the feature column names OR the column number where the target is located (but not mixed types)
WeightsColumn	Column name of a weights column
ReturnModelObjects	Set to TRUE to output all modeling objects (E.g. plots and evaluation metrics)
SaveModelObjects	Set to TRUE to return all modeling objects to your environment
IfSaveModel	Set to "mojo" to save a mojo file, otherwise "standard" to save a regular H2O model object
MaxMem	Set the maximum amount of memory you'd like to dedicate to the model run. E.g. "32G"
NThreads	Set the number of threads you want to dedicate to the model building
model_path	A character string of your path file to where you want your output saved
metadata_path	A character string of your path file to where you want your model evaluation output saved. If left NULL, all output will be saved to model_path.
ModelID	A character string to name your model and output
H2OShutdown	Set to TRUE to have H2O shutdown after running this function
H2OStartUp	Defaults to TRUE which means H2O will be started inside the function
DebugMode	Set to TRUE to print steps to screen
eval_metric	This is the metric used to identify best grid tuned model. Choose from "logloss", "r2", "RMSE", "MSE"
GridTune	Set to TRUE to run a grid tuning procedure. Set a number in MaxModelsInGrid to tell the procedure how many models you want to test.
GridStrategy	Default "Cartesian"
MaxRunTimeSecs	Default 86400
StoppingRounds	Default 10
MaxModelsInGrid	Number of models to test from grid options (1080 total possible options)
Trees	The maximum number of trees you want in your models
MaxDepth	Default 20
SampleRate	Default 0.632
MTries	Default -1 means it will default to number of features divided by 3
ColSampleRatePerTree	Default 1
ColSampleRatePerTreeLevel	Default 1
MinRows	Default 1
NBins	Default 20

NBinsCats	Default 1024
NBinsTopLevel	Default 1024
HistogramType	Default "AUTO"
CategoricalEncoding	Default "AUTO"

### Value

Saves to file and returned in list: VariableImportance.csv, Model, ValidationData.csv, Evaluation-Metrics.csv, GridCollect, and GridList

### Author(s)

Adrian Antico

### See Also

Other Automated Supervised Learning - Multiclass Classification: [AutoCatBoostMultiClass\(\)](#), [AutoH2oGAMMultiClass\(\)](#), [AutoH2oGBMMultiClass\(\)](#), [AutoH2oGLMMultiClass\(\)](#), [AutoH2oMLMultiClass\(\)](#), [AutoXGBoostMultiClass\(\)](#)

### Examples

```
## Not run:
# Create some dummy correlated data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 1000L,
  ID = 2L,
  ZIP = 0L,
  AddDate = FALSE,
  Classification = FALSE,
  MultiClass = TRUE)

# Run function
TestModel <- RemixAutoML::AutoH2oDRFMultiClass(
  OutputSelection = c("EvalMetrics", "PDFs", "Score_TrainData"),
  data,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = "Adrian",
  FeatureColNames = names(data)[!names(data) %in% c("IDcol_1", "IDcol_2", "Adrian")],
  WeightsColumn = NULL,
  eval_metric = "logloss",
  MaxMem = {gc();paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo", inter
  NThreads = max(1, parallel::detectCores()-2)},
  model_path = normalizePath("./"),
  metadata_path = file.path(normalizePath("./")),
  ModelID = "FirstModel",
  ReturnModelObjects = TRUE,
  SaveModelObjects = FALSE,
  IfSaveModel = "mojo",
  H2OShutdown = FALSE,
  H2OStartUp = TRUE,
```

```

DebugMode = FALSE,

# Grid Tuning Args
GridStrategy = "RandomDiscrete",
GridTune = FALSE,
MaxModelsInGrid = 10,
MaxRunTimeSecs = 60*60*24,
StoppingRounds = 10,

# ML args
Trees = 50,
MaxDepth = 20,
SampleRate = 0.632,
MTries = -1,
ColSampleRatePerTree = 1,
ColSampleRatePerTreeLevel = 1,
MinRows = 1,
NBins = 20,
NBinsCats = 1024,
NBinsTopLevel = 1024,
HistogramType = "AUTO",
CategoricalEncoding = "AUTO")

## End(Not run)

```

---

AutoH2oDRFRegression    *AutoH2oDRFRegression*

---

## Description

AutoH2oDRFRegression is an automated H2O modeling framework with grid-tuning and model evaluation that runs a variety of steps. First, the function will run a random grid tune over N number of models and find which model is the best (a default model is always included in that set). Once the model is identified and built, several other outputs are generated: validation data with predictions, evaluation plot, evaluation boxplot, evaluation metrics, variable importance, partial dependence calibration plots, partial dependence calibration box plots, and column names used in model fitting.

## Usage

```

AutoH2oDRFRegression(
  OutputSelection = c("EvalMetrics", "PDFs", "Score_TrainData"),
  data = NULL,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = NULL,
  FeatureColNames = NULL,
  WeightsColumn = NULL,
  MaxMem = { gc()
    paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo",
      intern = TRUE))/1e+06)), "G") },
  NThreads = max(1, parallel::detectCores() - 2),

```

```

H2OShutdown = TRUE,
H2OStartUp = TRUE,
DebugMode = FALSE,
ReturnModelObjects = TRUE,
SaveModelObjects = FALSE,
SaveInfoToPDF = FALSE,
IfSaveModel = "mojo",
model_path = NULL,
metadata_path = NULL,
ModelID = "FirstModel",
TransformNumericColumns = NULL,
Methods = c("BoxCox", "Asinh", "Log", "LogPlus1", "Sqrt", "Asin", "Logit"),
NumOfParDepPlots = 3,
eval_metric = "RMSE",
GridTune = FALSE,
GridStrategy = "RandomDiscrete",
MaxRunTimeSecs = 60 * 60 * 24,
StoppingRounds = 10,
MaxModelsInGrid = 2,
Trees = 50,
MaxDepth = 20,
SampleRate = 0.632,
MTries = -1,
ColSampleRatePerTree = 1,
ColSampleRatePerTreeLevel = 1,
MinRows = 1,
NBins = 20,
NBinsCats = 1024,
NBinsTopLevel = 1024,
HistogramType = "AUTO",
CategoricalEncoding = "AUTO"
)

```

## Arguments

OutputSelection	You can select what type of output you want returned. Choose from c("EvalMetrics", "PDFs", "Score_TrainData")
data	This is your data set for training and testing your model
TrainOnFull	Set to TRUE to train on full data
ValidationData	This is your holdout data set used in modeling either refine your hyperparameters.
TestData	This is your holdout data set. Catboost using both training and validation data in the training process so you should evaluate out of sample performance with this data set.
TargetColumnName	Either supply the target column name OR the column number where the target is located (but not mixed types).
FeatureColNames	Either supply the feature column names OR the column number where the target is located (but not mixed types)

WeightsColumn	Column name of a weights column
MaxMem	Set the maximum amount of memory you'd like to dedicate to the model run. E.g. "32G"
NThreads	Set the number of threads you want to dedicate to the model building
H2OShutdown	Set to TRUE to shutdown H2O inside the function
H2OStartUp	Defaults to TRUE which means H2O will be started inside the function
DebugMode	Set to TRUE to print steps to screen
ReturnModelObjects	Set to TRUE to output all modeling objects (E.g. plots and evaluation metrics)
SaveModelObjects	Set to TRUE to return all modeling objects to your environment
SaveInfoToPDF	Set to TRUE to save insights to PDF
IfSaveModel	Set to "mojo" to save a mojo file, otherwise "standard" to save a regular H2O model object
model_path	A character string of your path file to where you want your output saved
metadata_path	A character string of your path file to where you want your model evaluation output saved. If left NULL, all output will be saved to model_path.
ModelID	A character string to name your model and output
TransformNumericColumns	Set to NULL to do nothing; otherwise supply the column names of numeric variables you want transformed
Methods	Choose from "YeoJohnson", "BoxCox", "Asinh", "Log", "LogPlus1", "Sqrt", "Asin", or "Logit". If more than one is selected, the one with the best normalization pearson statistic will be used. Identity is automatically selected and compared.
NumOfParDepPlots	Tell the function the number of partial dependence calibration plots you want to create. Calibration boxplots will only be created for numerical features (not dummy variables)
eval_metric	This is the metric used to identify best grid tuned model. Choose from "MSE", "RMSE", "MAE", "RMSLE"
GridTune	Set to TRUE to run a grid tuning procedure. Set a number in MaxModelsInGrid to tell the procedure how many models you want to test.
GridStrategy	Default "Cartesian"
MaxRunTimeSecs	Default 86400
StoppingRounds	Default 10
MaxModelsInGrid	Number of models to test from grid options (1080 total possible options)
Trees	The maximum number of trees you want in your models
MaxDepth	Default 20
SampleRate	Default 0.632
MTries	Default -1 means it will default to number of features divided by 3
ColSampleRatePerTree	Default 1

ColSampleRatePerTreeLevel	Default 1
MinRows	Default 1
NBins	Default 20
NBinsCats	Default 1024
NBinsTopLevel	Default 1024
HistogramType	Default "AUTO". Select from "AUTO", "UniformAdaptive", "Random", "QuantilesGlobal", "RoundRobin"
CategoricalEncoding	Default "AUTO"

**Value**

Saves to file and returned in list: VariableImportance.csv, Model, ValidationData.csv, Evaluation-Plot.png, EvaluationBoxPlot.png, EvaluationMetrics.csv, ParDepPlots.R a named list of features with partial dependence calibration plots, ParDepBoxPlots.R, GridCollect, GridList, and Transformation metadata

**Author(s)**

Adrian Antico

**See Also**

Other Automated Supervised Learning - Regression: [AutoCatBoostRegression\(\)](#), [AutoH2oGAMRegression\(\)](#), [AutoH2oGBMRegression\(\)](#), [AutoH2oGLMRegression\(\)](#), [AutoH2oMLRegression\(\)](#), [AutoLightGBMRegression\(\)](#), [AutoNLS\(\)](#), [AutoXGBoostRegression\(\)](#)

**Examples**

```
## Not run:
# Create some dummy correlated data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 1000,
  ID = 2,
  ZIP = 0,
  AddDate = FALSE,
  Classification = FALSE,
  MultiClass = FALSE)

# Run function
TestModel <- RemixAutoML::AutoH2oDRFRegression(

  # Compute management
  MaxMem = {gc();paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo", int
  NThreads = max(1L, parallel::detectCores() - 2L),
  H2oShutdown = TRUE,
  H2oStartUp = TRUE,
  IfSaveModel = "mojo",

  # Model evaluation:
  eval_metric = "RMSE",
  NumOfParDepPlots = 3,
```

```

# Metadata arguments
OutputSelection = c("EvalMetrics", "PDFs", "Score_TrainData"),
model_path = normalizePath("./"),
metadata_path = NULL,
ModelID = "FirstModel",
ReturnModelObjects = TRUE,
SaveModelObjects = FALSE,
SaveInfoToPDF = FALSE,
DebugMode = FALSE,

# Data Args
data = data,
TrainOnFull = FALSE,
ValidationData = NULL,
TestData = NULL,
TargetColumnName = "Adrian",
FeatureColNames = names(data)[!names(data) %in%
  c("IDcol_1", "IDcol_2", "Adrian")],
WeightsColumn = NULL,
TransformNumericColumns = NULL,
Methods = c("BoxCox", "Asinh", "Asin", "Log",
  "LogPlus1", "Sqrt", "Logit", "YeoJohnson"),

# Grid Tuning Args
GridStrategy = "RandomDiscrete",
GridTune = FALSE,
MaxModelsInGrid = 10,
MaxRunTimeSecs = 60*60*24,
StoppingRounds = 10,

# ML Args
Trees = 50,
MaxDepth = 20,
SampleRate = 0.632,
MTries = -1,
ColSampleRatePerTree = 1,
ColSampleRatePerTreeLevel = 1,
MinRows = 1,
NBins = 20,
NBinsCats = 1024,
NBinsTopLevel = 1024,
HistogramType = "AUTO",
CategoricalEncoding = "AUTO")

## End(Not run)

```

---

AutoH2oGAMClassifier    *AutoH2oGAMClassifier*

---

## Description

AutoH2oGAMClassifier is an automated H2O modeling framework with grid-tuning and model evaluation that runs a variety of steps. First, a stratified sampling (by the target variable) is done to create train and validation sets. Then, the function will run a random grid tune over N number of

models and find which model is the best (a default model is always included in that set). Once the model is identified and built, several other outputs are generated: validation data with predictions, evaluation plot, evaluation metrics, variable importance, partial dependence calibration plots, and column names used in model fitting.

### Usage

```
AutoH2oGAMClassifier(
  OutputSelection = c("EvalMetrics", "PDFs", "Score_TrainData"),
  data = NULL,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = NULL,
  FeatureColNames = NULL,
  WeightsColumn = NULL,
  GamColNames = NULL,
  Distribution = "binomial",
  Link = "logit",
  eval_metric = "auc",
  CostMatrixWeights = c(1, 0, 0, 1),
  MaxMem = {      gc()
    paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo",
      intern = TRUE))/1e+06)), "G") },
  NThreads = max(1, parallel::detectCores() - 2),
  model_path = NULL,
  metadata_path = NULL,
  ModelID = "FirstModel",
  NumOfParDepPlots = 3,
  ReturnModelObjects = TRUE,
  SaveModelObjects = FALSE,
  SaveInfoToPDF = FALSE,
  IfSaveModel = "mojo",
  H2OShutdown = FALSE,
  H2OStartUp = TRUE,
  DebugMode = FALSE,
  GridTune = FALSE,
  GridStrategy = "Cartesian",
  StoppingRounds = 10,
  MaxRunTimeSecs = 3600 * 24 * 7,
  MaxModelsInGrid = 2,
  num_knots = NULL,
  keep_gam_cols = TRUE,
  Solver = "AUTO",
  Alpha = 0.5,
  Lambda = NULL,
  LambdaSearch = FALSE,
  NLambdas = -1,
  Standardize = TRUE,
  RemoveCollinearColumns = FALSE,
  InterceptInclude = TRUE,
  NonNegativeCoefficients = FALSE
)
```



**Arguments**

OutputSelection	You can select what type of output you want returned. Choose from c("EvalMetrics", "PDFs", "Score_TrainData")
data	This is your data set for training and testing your model
TrainOnFull	Set to TRUE to train on full data
ValidationData	This is your holdout data set used in modeling either refine your hyperparameters.
TestData	This is your holdout data set. Catboost using both training and validation data in the training process so you should evaluate out of sample performance with this data set.
TargetColumnName	Either supply the target column name OR the column number where the target is located (but not mixed types). Note that the target column needs to be a 0   1 numeric variable.
FeatureColNames	Either supply the feature column names OR the column number where the target is located (but not mixed types)
WeightsColumn	Weighted classification
GamColNames	GAM column names. Up to 9 features
Distribution	"binomial", "quasibinomial"
Link	identity, logit, log, inverse, tweedie
eval_metric	This is the metric used to identify best grid tuned model. Choose from "AUC" or "logloss"
CostMatrixWeights	A vector with 4 elements c(True Positive Cost, False Negative Cost, False Positive Cost, True Negative Cost). Default c(1,0,0,1),
MaxMem	Set the maximum amount of memory you'd like to dedicate to the model run. E.g. "32G"
NThreads	Set the number of threads you want to dedicate to the model building
model_path	A character string of your path file to where you want your output saved
metadata_path	A character string of your path file to where you want your model evaluation output saved. If left NULL, all output will be saved to model_path.
ModelID	A character string to name your model and output
NumOfParDepPlots	Tell the function the number of partial dependence calibration plots you want to create.
ReturnModelObjects	Set to TRUE to output all modeling objects (E.g. plots and evaluation metrics)
SaveModelObjects	Set to TRUE to return all modeling objects to your environment
SaveInfoToPDF	Set to TRUE to save modeling information to PDF. If model_path or metadata_path aren't defined then output will be saved to the working directory
IfSaveModel	Set to "mojo" to save a mojo file, otherwise "standard" to save a regular H2O model object
H2OShutdown	Set to TRUE to shutdown H2O after running the function

H2OStartUp	Set to TRUE to start up H2O inside function
DebugMode	Set to TRUE to get a print out of steps taken internally
GridTune	Set to TRUE to run a grid tuning procedure. Set a number in MaxModelsInGrid to tell the procedure how many models you want to test.
GridStrategy	"RandomDiscrete" or "Cartesian"
StoppingRounds	Iterations in grid tuning
MaxRunTimeSecs	Max run time in seconds
MaxModelsInGrid	Number of models to test from grid options (1080 total possible options)
num_knots	Numeric values for gam
keep_gam_cols	Logical
Solver	Default "AUTO". Options include "IRLSM", "L_BFGS", "COORDINATE_DESCENT_NAIVE", "COORDINATE_DESCENT", "GRADIENT_DESCENT_LH", "GRADIENT_DESCENT_SQERR"
Alpha	Gridable. Default 0.5 Otherwise supply a value between 0 and 1. 1 is equivalent to Lasso regression. 0 is equivalent to Ridge regression. Inbetween for a blend of the two.
Lambda	Gridable. Default NULL. Regularization strength.
LambdaSearch	Default FALSE.
NLambdas	Default -1
Standardize	Default TRUE. Standardize numerical columns
RemoveCollinearColumns	Default FALSE. Removes some of the linearly dependent columns
InterceptInclude	Default TRUE
NonNegativeCoefficients	Default FALSE

### Value

Saves to file and returned in list: VariableImportance.csv, Model, ValidationData.csv, Evaluation-Plot.png, EvaluationMetrics.csv, ParDepPlots.R a named list of features with partial dependence calibration plots, GridCollect, and GridList

### Author(s)

Adrian Antico

### See Also

Other Automated Supervised Learning - Binary Classification: [AutoCatBoostClassifier\(\)](#), [AutoH2oDRFClassifier\(\)](#), [AutoH2oGBMClassifier\(\)](#), [AutoH2oGLMClassifier\(\)](#), [AutoH2oMLClassifier\(\)](#), [AutoLightGBMClassifier\(\)](#), [AutoXGBoostClassifier\(\)](#)

**Examples**

```

# Create some dummy correlated data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 1000,
  ID = 2,
  ZIP = 0,
  AddDate = FALSE,
  Classification = TRUE,
  MultiClass = FALSE)

# Define GAM Columns to use - up to 9 are allowed
GamCols <- names(which(unlist(lapply(data, is.numeric))))
GamCols <- GamCols[!GamCols %in% c("Adrian", "IDcol_1", "IDcol_2")]
GamCols <- GamCols[1L:(min(9L, length(GamCols)))]

# Run function
TestModel <- RemixAutoML::AutoH2oGAMClassifier(

  # Compute management
  MaxMem = {gc()};paste0(as.character(floor(as.numeric(system("awk 'MemFree/ {print $2}' /proc/meminfo", intern=TRUE))))),
  NThreads = max(1, parallel::detectCores()-2),
  H2OShutdown = TRUE,
  H2OStartUp = TRUE,
  IfSaveModel = "mojo",

  # Model evaluation args
  CostMatrixWeights = c(1,0,0,1),
  eval_metric = "auc",
  NumOfParDepPlots = 3,

  # Metadata arguments
  OutputSelection = c("EvalMetrics", "PDFs", "Score_TrainData"),
  model_path = NULL,
  metadata_path = NULL,
  ModelID = "FirstModel",
  ReturnModelObjects = TRUE,
  SaveModelObjects = FALSE,
  SaveInfoToPDF = FALSE,
  DebugMode = FALSE,

  # Data args
  data = data,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = "Adrian",
  FeatureColNames = names(data)[!names(data) %in% c("IDcol_1", "IDcol_2", "Adrian")],
  WeightsColumn = NULL,
  GamColNames = GamCols,

  # ML args
  num_knots = NULL,
  keep_gam_cols = TRUE,
  GridTune = FALSE,

```

```

GridStrategy = "Cartesian",
StoppingRounds = 10,
MaxRunTimeSecs = 3600 * 24 * 7,
MaxModelsInGrid = 10,
Distribution = "binomial",
Link = "logit",
Solver = "AUTO",
Alpha = 0.5,
Lambda = NULL,
LambdaSearch = FALSE,
NLambdas = -1,
Standardize = TRUE,
RemoveCollinearColumns = FALSE,
InterceptInclude = TRUE,
NonNegativeCoefficients = FALSE)

```

---

AutoH2oGAMMultiClass    *AutoH2oGAMMultiClass*

---

## Description

AutoH2oGAMMultiClass is an automated H2O modeling framework with grid-tuning and model evaluation that runs a variety of steps. First, a stratified sampling (by the target variable) is done to create train and validation sets. Then, the function will run a random grid tune over N number of models and find which model is the best (a default model is always included in that set). Once the model is identified and built, several other outputs are generated: validation data with predictions, evaluation metrics, confusion matrix, and variable importance.

## Usage

```

AutoH2oGAMMultiClass(
  OutputSelection = c("EvalMetrics", "PDFs", "Score_TrainData"),
  data = NULL,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = NULL,
  FeatureColNames = NULL,
  WeightsColumn = NULL,
  GamColNames = NULL,
  eval_metric = "logloss",
  MaxMem = { gc()
    paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo",
      intern = TRUE))/1e+06)), "G") },
  NThreads = max(1, parallel::detectCores() - 2),
  model_path = NULL,
  metadata_path = NULL,
  ModelID = "FirstModel",
  ReturnModelObjects = TRUE,
  SaveModelObjects = FALSE,
  IfSaveModel = "mojo",

```

```

H2OShutdown = FALSE,
H2OStartUp = TRUE,
DebugMode = FALSE,
GridTune = FALSE,
GridStrategy = "Cartesian",
StoppingRounds = 10,
MaxRunTimeSecs = 3600 * 24 * 7,
MaxModelsInGrid = 2,
Distribution = "multinomial",
Link = "Family_Default",
num_knots = NULL,
keep_gam_cols = TRUE,
Solver = "AUTO",
Alpha = 0.5,
Lambda = NULL,
LambdaSearch = FALSE,
NLambdas = -1,
Standardize = TRUE,
RemoveCollinearColumns = FALSE,
InterceptInclude = TRUE,
NonNegativeCoefficients = FALSE
)

```

## Arguments

OutputSelection	You can select what type of output you want returned. Choose from c("EvalMetrics", "PDFs", "Score_TrainData")
data	This is your data set for training and testing your model
TrainOnFull	Set to TRUE to train on full data
ValidationData	This is your holdout data set used in modeling either refine your hyperparameters.
TestData	This is your holdout data set. Catboost using both training and validation data in the training process so you should evaluate out of sample performance with this data set.
TargetColumnName	Either supply the target column name OR the column number where the target is located (but not mixed types).
FeatureColNames	Either supply the feature column names OR the column number where the target is located (but not mixed types)
WeightsColumn	Weighted classification
GamColNames	GAM column names. Up to 9 features
eval_metric	This is the metric used to identify best grid tuned model. Choose from "logloss", "r2", "RMSE", "MSE"
MaxMem	Set the maximum amount of memory you'd like to dedicate to the model run. E.g. "32G"
NThreads	Set the number of threads you want to dedicate to the model building
model_path	A character string of your path file to where you want your output saved

metadata_path	A character string of your path file to where you want your model evaluation output saved. If left NULL, all output will be saved to model_path.
ModelID	A character string to name your model and output
ReturnModelObjects	Set to TRUE to output all modeling objects (E.g. plots and evaluation metrics)
SaveModelObjects	Set to TRUE to return all modeling objects to your environment
IfSaveModel	Set to "mojo" to save a mojo file, otherwise "standard" to save a regular H2O model object
H2OShutdown	Set to TRUE to have H2O shutdown after running this function
H2OStartUp	Set to TRUE to start up H2O inside function
DebugMode	Set to TRUE to print steps to screen
GridTune	Set to TRUE to run a grid tuning procedure. Set a number in MaxModelsInGrid to tell the procedure how many models you want to test.
GridStrategy	"RandomDiscrete" or "Cartesian"
StoppingRounds	Iterations in grid tuning
MaxRunTimeSecs	Max run time in seconds
MaxModelsInGrid	Number of models to test from grid options (1080 total possible options)
num_knots	Numeric values for gam
keep_gam_cols	Logical
Solver	Default "AUTO". Options include "IRLSM", "L_BFGS", "COORDINATE_DESCENT_NAIVE", "COORDINATE_DESCENT", "GRADIENT_DESCENT_LH", "GRADIENT_DESCENT_SQERR"
Alpha	Gridable. Default 0.5 Otherwise supply a value between 0 and 1. 1 is equivalent to Lasso regression. 0 is equivalent to Ridge regression. Inbetween for a blend of the two.
Lambda	Gridable. Default NULL. Regularization strength.
LambdaSearch	Default FALSE.
NLambdas	Default -1
Standardize	Default TRUE. Standardize numerical columns
RemoveCollinearColumns	Default FALSE. Removes some of the linearly dependent columns
InterceptInclude	Default TRUE
NonNegativeCoefficients	Default FALSE

**Value**

Saves to file and returned in list: VariableImportance.csv, Model, ValidationData.csv, Evaluation-Metrics.csv, GridCollect, and GridList

**Author(s)**

Adrian Antico

**See Also**

Other Automated Supervised Learning - Multiclass Classification: [AutoCatBoostMultiClass\(\)](#), [AutoH2oDRFMultiClass\(\)](#), [AutoH2oGBMMultiClass\(\)](#), [AutoH2oGLMMultiClass\(\)](#), [AutoH2oMLMultiClass\(\)](#), [AutoXGBoostMultiClass\(\)](#)

**Examples**

```
# Create some dummy correlated data with numeric and categorical features
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 1000L,
  ID = 2L,
  ZIP = 0L,
  AddDate = FALSE,
  Classification = FALSE,
  MultiClass = TRUE)

# Define GAM Columns to use - up to 9 are allowed
GamCols <- names(which(unlist(lapply(data, is.numeric))))
GamCols <- GamCols[!GamCols %in% c("Adrian", "IDcol_1", "IDcol_2")]
GamCols <- GamCols[1L:(min(9L, length(GamCols)))]

# Run function
TestModel <- RemixAutoML::AutoH2oGAMMultiClass(
  OutputSelection = c("EvalMetrics", "PDFs", "Score_TrainData"),
  data,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = "Adrian",
  FeatureColNames = names(data)[!names(data) %in% c("IDcol_1", "IDcol_2", "Adrian")],
  WeightsColumn = NULL,
  GamColNames = GamCols,
  eval_metric = "logloss",
  MaxMem = {gc();paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo", intern=TRUE))))},
  NThreads = max(1, parallel::detectCores()-2),
  model_path = normalizePath("./"),
  metadata_path = NULL,
  ModelID = "FirstModel",
  ReturnModelObjects = TRUE,
  SaveModelObjects = FALSE,
  IfSaveModel = "mojo",
  H2OShutdown = FALSE,
  H2OStartUp = TRUE,
  DebugMode = FALSE,

  # ML args
  num_knots = NULL,
  keep_gam_cols = TRUE,
  GridTune = FALSE,
  GridStrategy = "Cartesian",
  StoppingRounds = 10,
  MaxRunTimeSecs = 3600 * 24 * 7,
  MaxModelsInGrid = 10,
  Distribution = "multinomial",
  Link = "Family_Default",
```

```

Solver = "AUTO",
Alpha = 0.5,
Lambda = NULL,
LambdaSearch = FALSE,
NLambdas = -1,
Standardize = TRUE,
RemoveCollinearColumns = FALSE,
InterceptInclude = TRUE,
NonNegativeCoefficients = FALSE)

```

---

AutoH2oGAMRegression    *AutoH2oGAMRegression*

---

## Description

AutoH2oGAMRegression is an automated H2O modeling framework with grid-tuning and model evaluation that runs a variety of steps. First, the function will run a random grid tune over N number of models and find which model is the best (a default model is always included in that set). Once the model is identified and built, several other outputs are generated: validation data with predictions, evaluation plot, evaluation boxplot, evaluation metrics, variable importance, partial dependence calibration plots, partial dependence calibration box plots, and column names used in model fitting.

## Usage

```

AutoH2oGAMRegression(
  OutputSelection = c("EvalMetrics", "PDFs", "Score_TrainData"),
  data = NULL,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = NULL,
  FeatureColNames = NULL,
  InteractionColNumbers = NULL,
  WeightsColumn = NULL,
  GamColNames = NULL,
  Distribution = "gaussian",
  Link = "identity",
  TweedieLinkPower = NULL,
  TweedieVariancePower = NULL,
  TransformNumericColumns = NULL,
  Methods = c("BoxCox", "Asinh", "Log", "LogPlus1", "Sqrt", "Asin", "Logit"),
  eval_metric = "RMSE",
  MaxMem = {
    gc()
    paste0(as.character(floor(as.numeric(system("awk '/MemFree/{print $2}' /proc/meminfo",
      intern = TRUE))/1e+06)), "G") },
  NThreads = max(1, parallel::detectCores() - 2),
  model_path = NULL,
  metadata_path = NULL,
  ModelID = "FirstModel",
  NumOfParDepPlots = 3,
  ReturnModelObjects = TRUE,

```



```

SaveModelObjects = FALSE,
SaveInfoToPDF = FALSE,
IfSaveModel = "mojo",
H2oShutdown = TRUE,
H2oStartUp = TRUE,
GridTune = FALSE,
GridStrategy = "Cartesian",
StoppingRounds = 10,
MaxRunTimeSecs = 3600 * 24 * 7,
MaxModelsInGrid = 2,
num_knots = NULL,
keep_gam_cols = TRUE,
Solver = "AUTO",
Alpha = 0.5,
Lambda = NULL,
LambdaSearch = FALSE,
NLambdas = -1,
Standardize = TRUE,
RemoveCollinearColumns = FALSE,
InterceptInclude = TRUE,
NonNegativeCoefficients = FALSE,
DebugMode = FALSE
)

```

## Arguments

OutputSelection	You can select what type of output you want returned. Choose from c("EvalMetrics", "PDFs", "Score_TrainData")
data	This is your data set for training and testing your model
TrainOnFull	Set to TRUE to train on full data
ValidationData	This is your holdout data set used in modeling either refine your hyperparameters.
TestData	This is your holdout data set. Catboost using both training and validation data in the training process so you should evaluate out of sample performance with this data set.
TargetColumnName	Either supply the target column name OR the column number where the target is located (but not mixed types).
FeatureColNames	Either supply the feature column names OR the column number where the target is located (but not mixed types)
InteractionColNumbers	Column numbers of the features you want to be pairwise interacted
WeightsColumn	Column name of a weights column
GamColNames	GAM column names. Up to 9 features
Distribution	: "AUTO", "gaussian", "binomial", "quasi-binomial", "ordinal", "multinomial", "poisson", "gamma", "tweedie", "negative-binomial", "fractionalbinomial"
Link	"family_default", "identity", "logit", "log", "inverse", "tweedie", "ologit"

TweedieLinkPower	See h2o docs for background
TweedieVariancePower	See h2o docs for background
TransformNumericColumns	Set to NULL to do nothing; otherwise supply the column names of numeric variables you want transformed
Methods	Choose from "BoxCox", "Asinh", "Log", "LogPlus1", "Sqrt", "Asin", or "Logit". If more than one is selected, the one with the best normalization pearson statistic will be used. Identity is automatically selected and compared.
eval_metric	This is the metric used to identify best grid tuned model. Choose from "MSE", "RMSE", "MAE", "RMSLE"
MaxMem	Set the maximum amount of memory you'd like to dedicate to the model run. E.g. "32G"
NThreads	Set the number of threads you want to dedicate to the model building
model_path	A character string of your path file to where you want your output saved
metadata_path	A character string of your path file to where you want your model evaluation output saved. If left NULL, all output will be saved to model_path.
ModelID	A character string to name your model and output
NumOfParDepPlots	Tell the function the number of partial dependence calibration plots you want to create. Calibration boxplots will only be created for numerical features (not dummy variables)
ReturnModelObjects	Set to TRUE to output all modeling objects (E.g. plots and evaluation metrics)
SaveModelObjects	Set to TRUE to return all modeling objects to your environment
SaveInfoToPDF	Set to TRUE to save insights to PDF
IfSaveModel	Set to "mojo" to save a mojo file, otherwise "standard" to save a regular H2O model object
H2OShutdown	Set to TRUE to shutdown H2O inside the function
H2OStartUp	Defaults to TRUE which means H2O will be started inside the function
GridTune	Set to TRUE to run a grid tuning procedure. Set a number in MaxModelsInGrid to tell the procedure how many models you want to test.
GridStrategy	"RandomDiscrete" or "Cartesian"
StoppingRounds	Iterations in grid tuning
MaxRunTimeSecs	Max run time in seconds
MaxModelsInGrid	Number of models to test from grid options (1080 total possible options)
num_knots	Numeric values for gam
keep_gam_cols	Logical
Solver	Default "AUTO". Options include "IRLSM", "L_BFGS", "COORDINATE_DESCENT_NAIVE", "COORDINATE_DESCENT", "GRADIENT_DESCENT_LH", "GRADIENT_DESCENT_SQERR"
Alpha	Gridable. Default 0.5 Otherwise supply a value between 0 and 1. 1 is equivalent to Lasso regression. 0 is equivalent to Ridge regression. Inbetween for a blend of the two.

Lambda	Gridable. Default NULL. Regularization strength.
LambdaSearch	Default FALSE.
NLambdas	Default -1
Standardize	Default TRUE. Standardize numerical columns
RemoveCollinearColumns	Default FALSE. Removes some of the linearly dependent columns
InterceptInclude	Default TRUE
NonNegativeCoefficients	Default FALSE
DebugMode	Set to TRUE to get a printout of steps taken

**Value**

Saves to file and returned in list: VariableImportance.csv, Model, ValidationData.csv, Evaluation-Plot.png, EvaluationBoxPlot.png, EvaluationMetrics.csv, ParDepPlots.R a named list of features with partial dependence calibration plots, ParDepBoxPlots.R, GridCollect, GridList, and Transformation metadata

**Author(s)**

Adrian Antico

**See Also**

Other Automated Supervised Learning - Regression: [AutoCatBoostRegression\(\)](#), [AutoH2oDRFRegression\(\)](#), [AutoH2oGBMRegression\(\)](#), [AutoH2oGLMRegression\(\)](#), [AutoH2oMLRegression\(\)](#), [AutoLightGBMRegression\(\)](#), [AutoNLS\(\)](#), [AutoXGBoostRegression\(\)](#)

**Examples**

```
# Create some dummy correlated data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 1000,
  ID = 2,
  ZIP = 0,
  AddDate = FALSE,
  Classification = FALSE,
  MultiClass = FALSE)

# Define GAM Columns to use - up to 9 are allowed
GamCols <- names(which(unlist(lapply(data, is.numeric))))
GamCols <- GamCols[!GamCols %in% c("Adrian", "IDcol_1", "IDcol_2")]
GamCols <- GamCols[1L:(min(9L, length(GamCols)))]

# Run function
TestModel <- RemixAutoML::AutoH2oGAMRegression(

  # Compute management
  MaxMem = {gc();paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo", inter
  NThreads = max(1, parallel::detectCores()-2),
  H2OShutdown = TRUE,
```

```

H2OStartUp = TRUE,
IfSaveModel = "mojo",

# Model evaluation
eval_metric = "RMSE",
NumOfParDepPlots = 3,

# Metadata arguments
OutputSelection = c("EvalMetrics", "PDFs", "Score_TrainData"),
model_path = NULL,
metadata_path = NULL,
ModelID = "FirstModel",
ReturnModelObjects = TRUE,
SaveModelObjects = FALSE,
SaveInfoToPDF = FALSE,

# Data arguments:
data = data,
TrainOnFull = FALSE,
ValidationData = NULL,
TestData = NULL,
TargetColumnName = "Adrian",
FeatureColNames = names(data)[!names(data) %in%
  c("IDcol_1", "IDcol_2", "Adrian")],
InteractionColNumbers = NULL,
WeightsColumn = NULL,
GamColNames = GamCols,
TransformNumericColumns = NULL,
Methods = c("BoxCox", "Asinh", "Asin", "Log",
  "LogPlus1", "Sqrt", "Logit"),

# Model args
num_knots = NULL,
keep_gam_cols = TRUE,
GridTune = FALSE,
GridStrategy = "Cartesian",
StoppingRounds = 10,
MaxRunTimeSecs = 3600 * 24 * 7,
MaxModelsInGrid = 10,
Distribution = "gaussian",
Link = "Family_Default",
TweedieLinkPower = NULL,
TweedieVariancePower = NULL,
Solver = "AUTO",
Alpha = 0.5,
Lambda = NULL,
LambdaSearch = FALSE,
NLambdas = -1,
Standardize = TRUE,
RemoveCollinearColumns = FALSE,
InterceptInclude = TRUE,
NonNegativeCoefficients = FALSE,
DebugMode = FALSE)

```

---

AutoH2oGBMClassifier    *AutoH2oGBMClassifier*


---

## Description

AutoH2oGBMClassifier is an automated H2O modeling framework with grid-tuning and model evaluation that runs a variety of steps. First, a stratified sampling (by the target variable) is done to create train and validation sets. Then, the function will run a random grid tune over N number of models and find which model is the best (a default model is always included in that set). Once the model is identified and built, several other outputs are generated: validation data with predictions, evaluation plot, evaluation metrics, variable importance, partial dependence calibration plots, and column names used in model fitting.

## Usage

```
AutoH2oGBMClassifier(
  OutputSelection = c("EvalMetrics", "PDFs", "Score_TrainData"),
  data = NULL,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = NULL,
  FeatureColNames = NULL,
  WeightsColumn = NULL,
  MaxMem = {      gc()
    paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo",
      intern = TRUE))/1e+06)), "G") },
  NThreads = max(1L, parallel::detectCores() - 2L),
  model_path = NULL,
  metadata_path = NULL,
  ModelID = "FirstModel",
  NumOfParDepPlots = 3L,
  ReturnModelObjects = TRUE,
  SaveModelObjects = FALSE,
  SaveInfoToPDF = FALSE,
  IfSaveModel = "mojo",
  H2OShutdown = FALSE,
  H2OStartUp = TRUE,
  DebugMode = FALSE,
  GridStrategy = "Cartesian",
  MaxRunTimeSecs = 60 * 60 * 24,
  StoppingRounds = 10,
  MaxModelsInGrid = 2,
  eval_metric = "auc",
  CostMatrixWeights = c(1, 0, 0, 1),
  Trees = 50L,
  GridTune = FALSE,
  LearnRate = 0.1,
  LearnRateAnnealing = 1,
  Distribution = "bernoulli",
  MaxDepth = 20,
```

```

SampleRate = 0.632,
ColSampleRate = 1,
ColSampleRatePerTree = 1,
ColSampleRatePerTreeLevel = 1,
MinRows = 1,
NBins = 20,
NBinsCats = 1024,
NBinsTopLevel = 1024,
HistogramType = "AUTO",
CategoricalEncoding = "AUTO"
)

```

## Arguments

OutputSelection	You can select what type of output you want returned. Choose from c("EvalMetrics", "PDFs", "Score_TrainData")
data	This is your data set for training and testing your model
TrainOnFull	Set to TRUE to train on full data
ValidationData	This is your holdout data set used in modeling either refine your hyperparameters.
TestData	This is your holdout data set. Catboost using both training and validation data in the training process so you should evaluate out of sample performance with this data set.
TargetColumnName	Either supply the target column name OR the column number where the target is located (but not mixed types).
FeatureColNames	Either supply the feature column names OR the column number where the target is located (but not mixed types)
WeightsColumn	Column name of a weights column
MaxMem	Set the maximum amount of memory you'd like to dedicate to the model run. E.g. "32G"
NThreads	Set to the maximum amount of threads you want to use for this function
model_path	A character string of your path file to where you want your output saved
metadata_path	A character string of your path file to where you want your model evaluation output saved. If left NULL, all output will be saved to model_path.
ModelID	A character string to name your model and output
NumOfParDepPlots	Tell the function the number of partial dependence calibration plots you want to create. Calibration boxplots will only be created for numerical features (not dummy variables)
ReturnModelObjects	Set to TRUE to output all modeling objects (E.g. plots and evaluation metrics)
SaveModelObjects	Set to TRUE to return all modeling objects to your environment
SaveInfoToPDF	Set to TRUE to save modeling information to PDF. If model_path or metadata_path aren't defined then output will be saved to the working directory

IfSaveModel	Set to "mojo" to save a mojo file, otherwise "standard" to save a regular H2O model object
H2OShutdown	Set to TRUE to shutdown H2O inside the function
H2OStartUp	Defaults to TRUE which means H2O will be started inside the function
DebugMode	Set to TRUE to get a printout of the steps taken internally
GridStrategy	Default "Cartesian"
MaxRunTimeSecs	Default 60*60*24
StoppingRounds	Number of runs
MaxModelsInGrid	Number of models to test from grid options (1080 total possible options)
eval_metric	This is the metric used to identify best grid tuned model. Choose from "auc", "logloss", "aucpr", "lift_top_group", "misclassification", "mean_per_class_error"
CostMatrixWeights	A vector with 4 elements c(True Positive Cost, False Negative Cost, False Positive Cost, True Negative Cost). Default c(1,0,0,1),
Trees	The maximum number of trees you want in your models
GridTune	Set to TRUE to run a grid tuning procedure. Set a number in MaxModelsInGrid to tell the procedure how many models you want to test.
LearnRate	Default 0.10
LearnRateAnnealing	Default 1
Distribution	Choose from "AUTO", "bernoulli", and "quasibinomial"
MaxDepth	Default 20
SampleRate	Default 0.632
ColSampleRate	Default 1
ColSampleRatePerTree	Default 1
ColSampleRatePerTreeLevel	Default 1
MinRows	Default 1
NBins	Default 20
NBinsCats	Default 1024
NBinsTopLevel	Default 1024
HistogramType	Default "AUTO"
CategoricalEncoding	Default "AUTO"

**Value**

Saves to file and returned in list: VariableImportance.csv, Model, ValidationData.csv, Evaluation-Plot.png, EvaluationMetrics.csv, ParDepPlots.R a named list of features with partial dependence calibration plots, GridCollect, and GridList

**Author(s)**

Adrian Antico

## See Also

Other Automated Supervised Learning - Binary Classification: [AutoCatBoostClassifier\(\)](#), [AutoH2oDRFCClassifier\(\)](#), [AutoH2oGAMClassifier\(\)](#), [AutoH2oGLMClassifier\(\)](#), [AutoH2oMLClassifier\(\)](#), [AutoLightGBMClassifier\(\)](#), [AutoXGBoostClassifier\(\)](#)

## Examples

```
## Not run:
# Create some dummy correlated data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 1000L,
  ID = 2L,
  ZIP = 0L,
  AddDate = FALSE,
  Classification = TRUE,
  MultiClass = FALSE)

TestModel <- RemixAutoML::AutoH2oGBMClassifier(

  # Compute management
  MaxMem = {gc();paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo", int
  NThreads = max(1, parallel::detectCores()-2),
  H2OShutdown = TRUE,
  H2OStartUp = TRUE,
  IfSaveModel = "mojo",

  # Model evaluation
  CostMatrixWeights = c(1,0,0,1),
  eval_metric = "auc",
  NumOfParDepPlots = 3,

  # Metadata arguments
  OutputSelection = c("EvalMetrics", "PDFs", "Score_TrainData"),
  model_path = normalizePath("./"),
  metadata_path = file.path(normalizePath("./")),
  ModelID = "FirstModel",
  ReturnModelObjects = TRUE,
  SaveModelObjects = FALSE,
  SaveInfoToPDF = FALSE,
  DebugMode = FALSE,

  # Data arguments
  data = data,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = "Adrian",
  FeatureColNames = names(data)[!names(data) %in% c("IDcol_1", "IDcol_2","Adrian")],
  WeightsColumn = NULL,

  # ML grid tuning args
  GridTune = FALSE,
  GridStrategy = "Cartesian",
  MaxRunTimeSecs = 60*60*24,
  StoppingRounds = 10,
```



```

MaxModelsInGrid = 2,

# Model args
Trees = 50,
LearnRate = 0.10,
LearnRateAnnealing = 1,
Distribution = "bernoulli",
MaxDepth = 20,
SampleRate = 0.632,
ColSampleRate = 1,
ColSampleRatePerTree = 1,
ColSampleRatePerTreeLevel = 1,
MinRows = 1,
NBins = 20,
NBinsCats = 1024,
NBinsTopLevel = 1024,
HistogramType = "AUTO",
CategoricalEncoding = "AUTO")

## End(Not run)

```

---

AutoH2oGBMHurdleModel    *AutoH2oGBMHurdleModel*

---

## Description

AutoH2oGBMHurdleModel for hurdle modeling

## Usage

```

AutoH2oGBMHurdleModel(
  data,
  ValidationData = NULL,
  TestData = NULL,
  Buckets = 0L,
  TargetColumnName = NULL,
  FeatureColNames = NULL,
  TransformNumericColumns = NULL,
  Distribution = "gaussian",
  SplitRatios = c(0.7, 0.2, 0.1),
  ModelID = "ModelTest",
  Paths = NULL,
  MetadataPaths = NULL,
  SaveModelObjects = TRUE,
  IfSaveModel = "mojo",
  MaxMem = {      gc()
    paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo",
      intern = TRUE))/1e+06)), "G") },
  NThreads = max(1L, parallel::detectCores() - 2L),
  Trees = 1000L,
  GridTune = TRUE,
  MaxModelsInGrid = 1L,
  NumOfParDepPlots = 10L,

```

```

    PassInGrid = NULL
)

```

### Arguments

<code>data</code>	Source training data. Do not include a column that has the class labels for the buckets as they are created internally.
<code>ValidationData</code>	Source validation data. Do not include a column that has the class labels for the buckets as they are created internally.
<code>TestData</code>	Source test data. Do not include a column that has the class labels for the buckets as they are created internally.
<code>Buckets</code>	A numeric vector of the buckets used for subsetting the data. NOTE: the final Bucket value will first create a subset of data that is less than the value and a second one thereafter for data greater than the bucket value.
<code>TargetColumnName</code>	Supply the column name or number for the target variable
<code>FeatureColNames</code>	Supply the column names or number of the features (not included the Primary-DateColumn)
<code>TransformNumericColumns</code>	Transform numeric column inside the <code>AutoCatBoostRegression()</code> function
<code>Distribution</code>	Set to the distribution of choice based on H2O regression documents.
<code>SplitRatios</code>	Supply vector of partition ratios. For example, <code>c(0.70,0.20,0,10)</code> .
<code>ModelID</code>	Define a character name for your models
<code>Paths</code>	The path to your folder where you want your model information saved
<code>MetaDataPaths</code>	A character string of your path file to where you want your model evaluation output saved. If left NULL, all output will be saved to Paths.
<code>SaveModelObjects</code>	Set to TRUE to save the model objects to file in the folders listed in Paths
<code>IfSaveModel</code>	Save as "mojo" or "standard"
<code>MaxMem</code>	Set the maximum memory your system can provide
<code>NThreads</code>	Set the number of threads you want to dedicate to the model building
<code>Trees</code>	Default 1000
<code>GridTune</code>	Set to TRUE if you want to grid tune the models
<code>MaxModelsInGrid</code>	Set to a numeric value for the number of models to try in grid tune
<code>NumOfParDepPlots</code>	Set to pull back N number of partial dependence calibration plots.
<code>PassInGrid</code>	Pass in a grid for changing up the parameter settings for catboost

### Value

Returns `AutoXGBoostRegression()` model objects: `VariableImportance.csv`, `Model`, `ValidationData.csv`, `EvaluationPlot.png`, `EvaluationBoxPlot.png`, `EvaluationMetrics.csv`, `ParDepPlots.R` a named list of features with partial dependence calibration plots, `ParDepBoxPlots.R`, `GridCollect`, and the grid used

**Author(s)**

Adrian Antico

**See Also**

Other Supervised Learning - Hurdle Modeling: [AutoCatBoostHurdleModel\(\)](#), [AutoH2oDRFHurdleModel\(\)](#), [AutoLightGBMHurdleModel\(\)](#), [AutoXGBoostHurdleModel\(\)](#)

**Examples**

```
Output <- RemixAutoML::AutoH2oGBMHurdleModel(
  data,
  ValidationData = NULL,
  TestData = NULL,
  Buckets = 1L,
  TargetColumnName = "Target_Variable",
  FeatureColNames = 4L:ncol(data),
  TransformNumericColumns = NULL,
  Distribution = "gaussian",
  SplitRatios = c(0.7, 0.2, 0.1),
  MaxMem = {gc();paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo", intern=T)))/1024)},
  NThreads = max(1L, parallel::detectCores()-2L),
  ModelID = "ModelID",
  Paths = normalizePath("./"),
  MetaDataPaths = NULL,
  SaveModelObjects = TRUE,
  IfSaveModel = "mojo",
  Trees = 1000L,
  GridTune = FALSE,
  MaxModelsInGrid = 1L,
  NumOfParDepPlots = 10L,
  PassInGrid = NULL)
```

---

AutoH2oGBMMultiClass    *AutoH2oGBMMultiClass*


---

**Description**

AutoH2oGBMMultiClass is an automated H2O modeling framework with grid-tuning and model evaluation that runs a variety of steps. First, a stratified sampling (by the target variable) is done to create train and validation sets. Then, the function will run a random grid tune over N number of models and find which model is the best (a default model is always included in that set). Once the model is identified and built, several other outputs are generated: validation data with predictions, evaluation metrics, confusion matrix, and variable importance.

**Usage**

```
AutoH2oGBMMultiClass(
  OutputSelection = c("EvalMetrics", "PDFs", "Score_TrainData"),
  data = NULL,
  TrainOnFull = FALSE,
  ValidationData = NULL,
```

```

TestData = NULL,
TargetColumnName = NULL,
FeatureColNames = NULL,
WeightsColumn = NULL,
MaxMem = {      gc()
  paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo",
    intern = TRUE))/1e+06)), "G") },
NThreads = max(1L, parallel::detectCores() - 2L),
model_path = NULL,
metadata_path = NULL,
ModelID = "FirstModel",
NumOfParDepPlots = 3L,
ReturnModelObjects = TRUE,
SaveModelObjects = FALSE,
IfSaveModel = "mojo",
H2OShutdown = TRUE,
H2OStartUp = TRUE,
DebugMode = FALSE,
GridTune = FALSE,
GridStrategy = "Cartesian",
MaxRunTimeSecs = 60 * 60 * 24,
StoppingRounds = 10,
MaxModelsInGrid = 2,
eval_metric = "auc",
Trees = 50L,
LearnRate = 0.1,
LearnRateAnnealing = 1,
Distribution = "multinomial",
MaxDepth = 20,
SampleRate = 0.632,
MTries = -1,
ColSampleRate = 1,
ColSampleRatePerTree = 1,
ColSampleRatePerTreeLevel = 1,
MinRows = 1,
NBins = 20,
NBinsCats = 1024,
NBinsTopLevel = 1024,
HistogramType = "AUTO",
CategoricalEncoding = "AUTO"
)

```

## Arguments

### OutputSelection

You can select what type of output you want returned. Choose from `c("EvalMetrics", "PDFs", "Score_TrainData")`

**data** This is your data set for training and testing your model

**TrainOnFull** Set to TRUE to train on full data

**ValidationData** This is your holdout data set used in modeling either refine your hyperparameters.

TestData	This is your holdout data set. Catboost using both training and validation data in the training process so you should evaluate out of sample performance with this data set.
TargetColumnName	Either supply the target column name OR the column number where the target is located (but not mixed types).
FeatureColNames	Either supply the feature column names OR the column number where the target is located (but not mixed types)
WeightsColumn	Column name of a weights column
MaxMem	Set the maximum amount of memory you'd like to dedicate to the model run. E.g. "32G"
NThreads	Set to the maximum amount of threads you want to use for this function
model_path	A character string of your path file to where you want your output saved
metadata_path	A character string of your path file to where you want your model evaluation output saved. If left NULL, all output will be saved to model_path.
ModelID	A character string to name your model and output
NumOfParDepPlots	Tell the function the number of partial dependence calibration plots you want to create. Calibration boxplots will only be created for numerical features (not dummy variables)
ReturnModelObjects	Set to TRUE to output all modeling objects (E.g. plots and evaluation metrics)
SaveModelObjects	Set to TRUE to return all modeling objects to your environment
IfSaveModel	Set to "mojo" to save a mojo file, otherwise "standard" to save a regular H2O model object
H2OShutdown	Set to TRUE to shutdown H2O inside the function
H2OStartup	Defaults to TRUE which means H2O will be started inside the function
DebugMode	Set to TRUE to print steps
GridTune	Set to TRUE to run a grid tuning procedure. Set a number in MaxModelsInGrid to tell the procedure how many models you want to test.
GridStrategy	Default "Cartesian"
MaxRunTimeSecs	Default 60*60*24
StoppingRounds	Number of runs
MaxModelsInGrid	Number of models to test from grid options (1080 total possible options)
eval_metric	This is the metric used to identify best grid tuned model. Choose from "auc", "logloss"
Trees	The maximum number of trees you want in your models
LearnRate	Default 0.10
LearnRateAnnealing	Default 1
Distribution	Choose from "multinomial". Placeholder in more options get added
MaxDepth	Default 20

SampleRate	Default 0.632
ColSampleRate	Default 1
ColSampleRatePerTree	Default 1
ColSampleRatePerTreeLevel	Default 1
MinRows	Default 1
NBins	Default 20
NBinsCats	Default 1024
NBinsTopLevel	Default 1024
HistogramType	Default "AUTO"
CategoricalEncoding	Default "AUTO"
SaveInfoToPDF	Set to TRUE to save insights to PDF

**Value**

Saves to file and returned in list: VariableImportance.csv, Model, ValidationData.csv, Evaluation-Metrics.csv, GridCollect, and GridList

**Author(s)**

Adrian Antico

**See Also**

Other Automated Supervised Learning - Multiclass Classification: [AutoCatBoostMultiClass\(\)](#), [AutoH2oDRFMultiClass\(\)](#), [AutoH2oGAMMultiClass\(\)](#), [AutoH2oGLMMultiClass\(\)](#), [AutoH2oMLMultiClass\(\)](#), [AutoXGBoostMultiClass\(\)](#)

**Examples**

```
# Create some dummy correlated data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 1000,
  ID = 2,
  ZIP = 0,
  AddDate = FALSE,
  Classification = FALSE,
  MultiClass = TRUE)

# Run function
TestModel <- RemixAutoML::AutoH2oGBMMultiClass(
  OutputSelection = c("EvalMetrics", "PDFs", "Score_TrainData"),
  data,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = "Adrian",
  FeatureColNames = names(data)[!names(data) %in% c("IDcol_1", "IDcol_2", "Adrian")],
  WeightsColumn = NULL,
  eval_metric = "logloss",
```

```

MaxMem = {gc();paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo", inter
NThreads = max(1, parallel::detectCores()-2),
model_path = normalizePath("./"),
metadata_path = file.path(normalizePath("./")),
ModelID = "FirstModel",
ReturnModelObjects = TRUE,
SaveModelObjects = FALSE,
IfSaveModel = "mojo",
H2OShutdown = TRUE,
H2OStartUp = TRUE,
DebugMode = FALSE,

# Model args
GridTune = FALSE,
GridStrategy = "Cartesian",
MaxRunTimeSecs = 60*60*24,
StoppingRounds = 10,
MaxModelsInGrid = 2,
Trees = 50,
LearnRate = 0.10,
LearnRateAnnealing = 1,
eval_metric = "RMSE",
Distribution = "multinomial",
MaxDepth = 20,
SampleRate = 0.632,
ColSampleRate = 1,
ColSampleRatePerTree = 1,
ColSampleRatePerTreeLevel = 1,
MinRows = 1,
NBins = 20,
NBinsCats = 1024,
NBinsTopLevel = 1024,
HistogramType = "AUTO",
CategoricalEncoding = "AUTO")

```

---

AutoH2oGBMRegression    *AutoH2oGBMRegression*

---

## Description

AutoH2oGBMRegression is an automated H2O modeling framework with grid-tuning and model evaluation that runs a variety of steps. First, the function will run a random grid tune over N number of models and find which model is the best (a default model is always included in that set). Once the model is identified and built, several other outputs are generated: validation data with predictions, evaluation plot, evaluation boxplot, evaluation metrics, variable importance, partial dependence calibration plots, partial dependence calibration box plots, and column names used in model fitting.

## Usage

```

AutoH2oGBMRegression(
  OutputSelection = c("EvalMetrics", "PDFs", "Score_TrainData"),
  data = NULL,
  TrainOnFull = FALSE,

```

```

ValidationData,
TestData = NULL,
TargetColumnName = NULL,
FeatureColNames = NULL,
WeightsColumn = NULL,
TransformNumericColumns = NULL,
Methods = c("BoxCox", "Asinh", "Log", "LogPlus1", "Sqrt", "Asin", "Logit"),
MaxMem = {      gc()
  paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo",
    intern = TRUE))/1e+06)), "G") },
NThreads = max(1, parallel::detectCores() - 2),
model_path = NULL,
metadata_path = NULL,
ModelID = "FirstModel",
NumOfParDepPlots = 3,
ReturnModelObjects = TRUE,
SaveModelObjects = FALSE,
SaveInfoToPDF = FALSE,
IfSaveModel = "mojo",
H2OShutdown = TRUE,
H2OStartup = TRUE,
DebugMode = FALSE,
GridTune = FALSE,
GridStrategy = "Cartesian",
MaxRunTimeSecs = 60 * 60 * 24,
StoppingRounds = 10,
MaxModelsInGrid = 2,
eval_metric = "RMSE",
Trees = 50,
LearnRate = 0.1,
LearnRateAnnealing = 1,
Alpha = NULL,
Distribution = "poisson",
MaxDepth = 20,
SampleRate = 0.632,
MTries = -1,
ColSampleRate = 1,
ColSampleRatePerTree = 1,
ColSampleRatePerTreeLevel = 1,
MinRows = 1,
NBins = 20,
NBinsCats = 1024,
NBinsTopLevel = 1024,
HistogramType = "AUTO",
CategoricalEncoding = "AUTO"
)

```

## Arguments

### OutputSelection

You can select what type of output you want returned. Choose from `c("EvalMetrics", "PDFs", "Score_TrainData")`

### data

This is your data set for training and testing your model



TrainOnFull	Set to TRUE to train on full data
ValidationData	This is your holdout data set used in modeling either refine your hyperparameters.
TestData	This is your holdout data set. Catboost using both training and validation data in the training process so you should evaluate out of sample performance with this data set.
TargetColumnName	Either supply the target column name OR the column number where the target is located (but not mixed types).
FeatureColNames	Either supply the feature column names OR the column number where the target is located (but not mixed types)
WeightsColumn	Column name of a weights column
TransformNumericColumns	Set to NULL to do nothing; otherwise supply the column names of numeric variables you want transformed
Methods	Choose from "YeoJohnson", "BoxCox", "Asinh", "Log", "LogPlus1", "Sqrt", "Asin", or "Logit". If more than one is selected, the one with the best normalization pearson statistic will be used. Identity is automatically selected and compared.
MaxMem	Set the maximum amount of memory you'd like to dedicate to the model run. E.g. "32G"
NThreads	Set to the mamimum amount of threads you want to use for this function
model_path	A character string of your path file to where you want your output saved
metadata_path	A character string of your path file to where you want your model evaluation output saved. If left NULL, all output will be saved to model_path.
ModelID	A character string to name your model and output
NumOfParDepPlots	Tell the function the number of partial dependence calibration plots you want to create. Calibration boxplots will only be created for numerical features (not dummy variables)
ReturnModelObjects	Set to TRUE to output all modeling objects (E.g. plots and evaluation metrics)
SaveModelObjects	Set to TRUE to return all modeling objects to your environment
SaveInfoToPDF	Set to TRUE to save insights to PDF
IfSaveModel	Set to "mojo" to save a mojo file, otherwise "standard" to save a regular H2O model object
H2OShutdown	Set to TRUE to shutdown H2O inside the function
H2OStartUp	Defaults to TRUE which means H2O will be started inside the function
DebugMode	Set to TRUE to print steps to screen
GridTune	Set to TRUE to run a grid tuning procedure. Set a number in MaxModelsInGrid to tell the procedure how many models you want to test.
GridStrategy	Default "Cartesian"
MaxRunTimeSecs	Default 60*60*24
StoppingRounds	Number of runs

MaxModelsInGrid	Number of models to test from grid options (1080 total possible options)
eval_metric	This is the metric used to identify best grid tuned model. Choose from "MSE", "RMSE", "MAE", "RMSLE"
Trees	The maximum number of trees you want in your models
LearnRate	Default 0.10
LearnRateAnnealing	Default 1
Alpha	This is the quantile value you want to use for quantile regression. Must be a decimal between 0 and 1.
Distribution	Choose from gaussian", "poisson", "gamma", "tweedie", "laplace", "quantile", "huber"
MaxDepth	Default 20
SampleRate	Default 0.632
ColSampleRate	Default 1
ColSampleRatePerTree	Default 1
ColSampleRatePerTreeLevel	Default 1
MinRows	Default 1
NBins	Default 20
NBinsCats	Default 1024
NBinsTopLevel	Default 1024
HistogramType	Default "AUTO"
CategoricalEncoding	Default "AUTO"

**Value**

Saves to file and returned in list: VariableImportance.csv, Model, ValidationData.csv, Evaluation-Plot.png, EvaluationBoxPlot.png, EvaluationMetrics.csv, ParDepPlots.R a named list of features with partial dependence calibration plots, ParDepBoxPlots.R, GridCollect, GridList, and metadata

**Author(s)**

Adrian Antico

**See Also**

Other Automated Supervised Learning - Regression: [AutoCatBoostRegression\(\)](#), [AutoH2oDRFRegression\(\)](#), [AutoH2oGAMRegression\(\)](#), [AutoH2oGLMRegression\(\)](#), [AutoH2oMLRegression\(\)](#), [AutoLightGBMRegression\(\)](#), [AutoNLS\(\)](#), [AutoXGBoostRegression\(\)](#)

**Examples**

```
# Create some dummy correlated data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 1000,
  ID = 2,
```

```

ZIP = 0,
AddDate = FALSE,
Classification = FALSE,
MultiClass = FALSE)

# Run function
TestModel <- RemixAutoML::AutoH2oGBMRegression(

  # Compute management
  MaxMem = {gc();paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo", int
  NThreads = max(1, parallel::detectCores()-2),
  H2OShutdown = TRUE,
  H2OStartUp = TRUE,
  IfSaveModel = "mojo",

  # Model evaluation
  NumOfParDepPlots = 3,

  # Metadata arguments
  OutputSelection = c("EvalMetrics", "PDFs", "Score_TrainData"),
  model_path = normalizePath("./"),
  metadata_path = file.path(normalizePath("./")),
  ModelID = "FirstModel",
  ReturnModelObjects = TRUE,
  SaveModelObjects = FALSE,
  SaveInfoToPDF = FALSE,
  DebugMode = FALSE,

  # Data arguments
  data = data,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = "Adrian",
  FeatureColNames = names(data)[!names(data) %in% c("IDcol_1", "IDcol_2","Adrian")],
  WeightsColumn = NULL,
  TransformNumericColumns = NULL,
  Methods = c("BoxCox", "Asinh", "Asin", "Log", "LogPlus1", "Sqrt", "Logit", "YeoJohnson"),

  # ML grid tuning args
  GridTune = FALSE,
  GridStrategy = "Cartesian",
  MaxRunTimeSecs = 60*60*24,
  StoppingRounds = 10,
  MaxModelsInGrid = 2,

  # Model args
  Trees = 50,
  LearnRate = 0.10,
  LearnRateAnnealing = 1,
  eval_metric = "RMSE",
  Alpha = NULL,
  Distribution = "poisson",
  MaxDepth = 20,
  SampleRate = 0.632,
  ColSampleRate = 1,
  ColSampleRatePerTree = 1,

```

```

ColSampleRatePerTreeLevel = 1,
MinRows = 1,
NBins = 20,
NBinsCats = 1024,
NBinsTopLevel = 1024,
HistogramType = "AUTO",
CategoricalEncoding = "AUTO")

```

---

AutoH2oGLMClassifier    *AutoH2oGLMClassifier*

---

## Description

AutoH2oGLMClassifier is an automated H2O modeling framework with grid-tuning and model evaluation that runs a variety of steps. First, a stratified sampling (by the target variable) is done to create train and validation sets. Then, the function will run a random grid tune over N number of models and find which model is the best (a default model is always included in that set). Once the model is identified and built, several other outputs are generated: validation data with predictions, evaluation plot, evaluation metrics, variable importance, partial dependence calibration plots, and column names used in model fitting.

## Usage

```

AutoH2oGLMClassifier(
  OutputSelection = c("EvalMetrics", "PDFs", "Score_TrainData"),
  data = NULL,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = NULL,
  FeatureColNames = NULL,
  RandomColNumbers = NULL,
  InteractionColNumbers = NULL,
  WeightsColumn = NULL,
  MaxMem = {      gc()
    paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo",
      intern = TRUE))/1e+06)), "G") },
  NThreads = max(1, parallel::detectCores() - 2),
  ModelID = "FirstModel",
  ReturnModelObjects = TRUE,
  model_path = NULL,
  metadata_path = NULL,
  SaveModelObjects = FALSE,
  SaveInfoToPDF = FALSE,
  IfSaveModel = "mojo",
  H2OShutdown = TRUE,
  H2OStartUp = TRUE,
  DebugMode = FALSE,
  MaxModelsInGrid = 2,
  NumOfParDepPlots = 3,
  GridTune = FALSE,

```

```

GridStrategy = "Cartesian",
StoppingRounds = 10,
MaxRunTimeSecs = 3600 * 24 * 7,
Distribution = "binomial",
Link = "logit",
eval_metric = "auc",
CostMatrixWeights = c(1, 0, 0, 1),
RandomDistribution = NULL,
RandomLink = NULL,
Solver = "AUTO",
Alpha = 0.5,
Lambda = NULL,
LambdaSearch = FALSE,
NLambdas = -1,
Standardize = TRUE,
RemoveCollinearColumns = FALSE,
InterceptInclude = TRUE,
NonNegativeCoefficients = FALSE
)

```

## Arguments

OutputSelection	You can select what type of output you want returned. Choose from c("EvalMetrics", "PDFs", "Score_TrainData")
data	This is your data set for training and testing your model
TrainOnFull	Set to TRUE to train on full data
ValidationData	This is your holdout data set used in modeling either refine your hyperparameters.
TestData	This is your holdout data set. Catboost using both training and validation data in the training process so you should evaluate out of sample performance with this data set.
TargetColumnName	Either supply the target column name OR the column number where the target is located (but not mixed types).
FeatureColNames	Either supply the feature column names OR the column number where the target is located (but not mixed types)
RandomColNumbers	Random effects column number indicies
InteractionColNumbers	Column numbers of the features you want to be pairwise interacted
WeightsColumn	Column name of a weights column
MaxMem	Set the maximum amount of memory you'd like to dedicate to the model run. E.g. "32G"
NThreads	Set the number of threads you want to dedicate to the model building
ModelID	A character string to name your model and output
ReturnModelObjects	Set to TRUE to output all modeling objects (E.g. plots and evaluation metrics)
model_path	A character string of your path file to where you want your output saved

metadata_path	A character string of your path file to where you want your model evaluation output saved. If left NULL, all output will be saved to model_path.
SaveModelObjects	Set to TRUE to return all modeling objects to your environment
SaveInfoToPDF	Set to TRUE to save modeling information to PDF. If model_path or meta-data_path aren't defined then output will be saved to the working directory
IfSaveModel	Set to "mojo" to save a mojo file, otherwise "standard" to save a regular H2O model object
H2OShutdown	Set to TRUE to shutdown H2O inside the function
H2OStartUp	Defaults to TRUE which means H2O will be started inside the function
DebugMode	Set to TRUE to print steps to screen
MaxModelsInGrid	Number of models to test from grid options (1080 total possible options)
NumOfParDepPlots	Tell the function the number of partial dependence calibration plots you want to create. Calibration boxplots will only be created for numerical features (not dummy variables)
GridTune	Set to TRUE to run a grid tuning procedure. Set a number in MaxModelsInGrid to tell the procedure how many models you want to test.
GridStrategy	"RandomDiscrete" or "Cartesian"
StoppingRounds	Iterations in grid tuning
MaxRunTimeSecs	Max run time in seconds
Distribution	"binomial", "fractionalbinomial", "quasibinomial"
eval_metric	This is the metric used to identify best grid tuned model. Choose from "auc"
CostMatrixWeights	A vector with 4 elements c(True Positive Cost, False Negative Cost, False Positive Cost, True Negative Cost). Default c(1,0,0,1),
RandomDistribution	Random effects family. Defaults NULL, otherwise it will run a hierarchical glm
RandomLink	Random effects link. Defaults NULL, otherwise it will run a hierarchical glm
Solver	Default "AUTO". Options include "IRLSM", "L_BFGS", "COORDINATE_DESCENT_NAIVE", "COORDINATE_DESCENT", "GRADIENT_DESCENT_LH", "GRADIENT_DESCENT_SQERR"
Alpha	Default 0.5 Otherwise supply a value between 0 and 1. 1 is equivalent to Lasso regression. 0 is equivalent to Ridge regression. Inbetween for a blend of the two.
Lambda	Default NULL. Regularization strength.
LambdaSearch	Default FALSE.
NLambdas	Default -1
Standardize	Default TRUE. Standardize numerical columns
RemoveCollinearColumns	Default FALSE. Removes some of the linearly dependent columns
InterceptInclude	Default TRUE
NonNegativeCoefficients	Default FALSE
link	identity, logit, log, inverse, tweedie

**Value**

Saves to file and returned in list: VariableImportance.csv, Model, ValidationData.csv, Evaluation-Plot.png, EvaluationMetrics.csv, ParDepPlots.R a named list of features with partial dependence calibration plots, GridCollect, and GridList

**Author(s)**

Adrian Antico

**See Also**

Other Automated Supervised Learning - Binary Classification: [AutoCatBoostClassifier\(\)](#), [AutoH2oDRFClassifier\(\)](#), [AutoH2oGAMClassifier\(\)](#), [AutoH2oGBMClassifier\(\)](#), [AutoH2oMLClassifier\(\)](#), [AutoLightGBMClassifier\(\)](#), [AutoXGBoostClassifier\(\)](#)

**Examples**

```
# Create some dummy correlated data with numeric and categorical features
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 1000L,
  ID = 2L,
  ZIP = 0L,
  AddDate = FALSE,
  Classification = TRUE,
  MultiClass = FALSE)

# Run function
TestModel <- RemixAutoML::AutoH2oGLMClassifier(

  # Compute management
  MaxMem = {gc();paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo", int
  NThreads = max(1, parallel::detectCores()-2),
  H2OShutdown = TRUE,
  H2OStartUp = TRUE,
  IfSaveModel = "mojo",

  # Model evaluation args
  CostMatrixWeights = c(1,0,0,1),
  eval_metric = "auc",
  NumOfParDepPlots = 3,

  # Metadata args
  OutputSelection = c("EvalMetrics", "PDFs", "Score_TrainData"),
  model_path = NULL,
  metadata_path = NULL,
  ModelID = "FirstModel",
  ReturnModelObjects = TRUE,
  SaveModelObjects = FALSE,
  SaveInfoToPDF = FALSE,
  DebugMode = FALSE,

  # Data args
  data = data,
  TrainOnFull = FALSE,
  ValidationData = NULL,
```

```

TestData = NULL,
TargetColumnName = "Adrian",
FeatureColNames = names(data)[!names(data) %in%
  c("IDcol_1", "IDcol_2", "Adrian")],
RandomColNumbers = NULL,
InteractionColNumbers = NULL,
WeightsColumn = NULL,

# ML args
GridTune = FALSE,
GridStrategy = "Cartesian",
StoppingRounds = 10,
MaxRunTimeSecs = 3600 * 24 * 7,
MaxModelsInGrid = 10,
Distribution = "binomial",
Link = "logit",
RandomDistribution = NULL,
RandomLink = NULL,
Solver = "AUTO",
Alpha = 0.5,
Lambda = NULL,
LambdaSearch = FALSE,
NLambdas = -1,
Standardize = TRUE,
RemoveCollinearColumns = FALSE,
InterceptInclude = TRUE,
NonNegativeCoefficients = FALSE)

```

---

AutoH2oGLMMultiClass    *AutoH2oGLMMultiClass*

---

## Description

AutoH2oGLMMultiClass is an automated H2O modeling framework with grid-tuning and model evaluation that runs a variety of steps. First, a stratified sampling (by the target variable) is done to create train and validation sets. Then, the function will run a random grid tune over N number of models and find which model is the best (a default model is always included in that set). Once the model is identified and built, several other outputs are generated: validation data with predictions, evaluation metrics, confusion matrix, and variable importance.

## Usage

```

AutoH2oGLMMultiClass(
  OutputSelection = c("EvalMetrics", "PDFs", "Score_TrainData"),
  data = NULL,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = NULL,
  FeatureColNames = NULL,
  RandomColNumbers = NULL,
  InteractionColNumbers = NULL,

```



```

WeightsColumn = NULL,
MaxMem = {      gc()
  paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo",
    intern = TRUE))/1e+06))), "G") },
NThreads = max(1, parallel::detectCores() - 2),
ModelID = "FirstModel",
ReturnModelObjects = TRUE,
model_path = NULL,
metadata_path = NULL,
DebugMode = FALSE,
SaveModelObjects = FALSE,
SaveInfoToPDF = FALSE,
IfSaveModel = "mojo",
H2OShutdown = TRUE,
H2OStartUp = TRUE,
MaxModelsInGrid = 2,
NumOfParDepPlots = 3,
GridTune = FALSE,
GridStrategy = "Cartesian",
StoppingRounds = 10,
MaxRunTimeSecs = 3600 * 24 * 7,
Distribution = "multinomial",
Link = "family_default",
eval_metric = "logloss",
RandomDistribution = NULL,
RandomLink = NULL,
Solver = "AUTO",
Alpha = 0.5,
Lambda = NULL,
LambdaSearch = FALSE,
NLambdas = -1,
Standardize = TRUE,
RemoveCollinearColumns = FALSE,
InterceptInclude = TRUE,
NonNegativeCoefficients = FALSE
)

```

## Arguments

OutputSelection	You can select what type of output you want returned. Choose from c("EvalMetrics", "PDFs", "Score_TrainData")
data	This is your data set for training and testing your model
TrainOnFull	Set to TRUE to train on full data
ValidationData	This is your holdout data set used in modeling either refine your hyperparameters.
TestData	This is your holdout data set. Catboost using both training and validation data in the training process so you should evaluate out of sample performance with this data set.
TargetColumnName	Either supply the target column name OR the column number where the target is located (but not mixed types).

FeatureColNames	Either supply the feature column names OR the column number where the target is located (but not mixed types)
RandomColNumbers	Random effects column number indicies
InteractionColNumbers	Column numbers of the features you want to be pairwise interacted
WeightsColumn	Column name of a weights column
MaxMem	Set the maximum amount of memory you'd like to dedicate to the model run. E.g. "32G"
NThreads	Set the number of threads you want to dedicate to the model building
ModelID	A character string to name your model and output
ReturnModelObjects	Set to TRUE to output all modeling objects (E.g. plots and evaluation metrics)
model_path	A character string of your path file to where you want your output saved
metadata_path	A character string of your path file to where you want your model evaluation output saved. If left NULL, all output will be saved to model_path.
DebugMode	Set to TRUE to see a printout of each step
SaveModelObjects	Set to TRUE to return all modeling objects to your environment
SaveInfoToPDF	Set to TRUE to save insights to PDF
IfSaveModel	Set to "mojo" to save a mojo file, otherwise "standard" to save a regular H2O model object
H2OShutdown	Set to TRUE to shutdown H2O inside the function
H2OStartUp	Defaults to TRUE which means H2O will be started inside the function
MaxModelsInGrid	Number of models to test from grid options (1080 total possible options)
NumOfParDepPlots	Tell the function the number of partial dependence calibration plots you want to create. Calibration boxplots will only be created for numerical features (not dummy variables)
GridTune	Set to TRUE to run a grid tuning procedure. Set a number in MaxModelsInGrid to tell the procedure how many models you want to test.
GridStrategy	"RandomDiscrete" or "Cartesian"
StoppingRounds	Iterations in grid tuning
MaxRunTimeSecs	Max run time in seconds
Distribution	"multinomial"
eval_metric	This is the metric used to identify best grid tuned model. Choose from "logloss"
RandomDistribution	Random effects family. Defaults NULL, otherwise it will run a hierarchical glm
RandomLink	Random effects link. Defaults NULL, otherwise it will run a hierarchical glm
Solver	Default "AUTO". Options include "IRLSM", "L_BFGS", "COORDINATE_DESCENT_NAIVE", "COORDINATE_DESCENT", "GRADIENT_DESCENT_LH", "GRADIENT_DESCENT_SQERR"
Alpha	Default 0.5 Otherwise supply a value between 0 and 1. 1 is equivalent to Lasso regression. 0 is equivalent to Ridge regression. Inbetween for a blend of the two.

Lambda	Default NULL. Regularization strength.
LambdaSearch	Default FALSE.
NLambdas	Default -1
Standardize	Default TRUE. Standardize numerical columns
RemoveCollinearColumns	Default FALSE. Removes some of the linearly dependent columns
InterceptInclude	Default TRUE
NonNegativeCoefficients	Default FALSE
link	"family_default"

**Value**

Saves to file and returned in list: VariableImportance.csv, Model, ValidationData.csv, Evaluation-Metrics.csv, GridCollect, and GridList

**Author(s)**

Adrian Antico

**See Also**

Other Automated Supervised Learning - Multiclass Classification: [AutoCatBoostMultiClass\(\)](#), [AutoH2oDRFMultiClass\(\)](#), [AutoH2oGAMMultiClass\(\)](#), [AutoH2oGBMMultiClass\(\)](#), [AutoH2oMLMultiClass\(\)](#), [AutoXGBoostMultiClass\(\)](#)

**Examples**

```
# Create some dummy correlated data with numeric and categorical features
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 1000L,
  ID = 2L,
  ZIP = 0L,
  AddDate = FALSE,
  Classification = FALSE,
  MultiClass = TRUE)

# Run function
TestModel <- RemixAutoML::AutoH2oGLMMultiClass(

  # Compute management
  OutputSelection = c("EvalMetrics", "PDFs", "Score_TrainData"),
  MaxMem = {gc();paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo", inter
  NThreads = max(1, parallel::detectCores()-2)},
  H2OShutdown = TRUE,
  H2OStartUp = TRUE,
  IfSaveModel = "mojo",

  # Model evaluation:
  eval_metric = "logloss",
  NumOfParDepPlots = 3,
```

```

# Metadata arguments:
model_path = NULL,
metadata_path = NULL,
ModelID = "FirstModel",
ReturnModelObjects = TRUE,
SaveModelObjects = FALSE,
SaveInfoToPDF = FALSE,
DebugMode = FALSE,

# Data arguments:
data = data,
TrainOnFull = FALSE,
ValidationData = NULL,
TestData = NULL,
TargetColumnName = "Adrian",
FeatureColNames = names(data)[!names(data) %in% c("IDcol_1", "IDcol_2", "Adrian")],
RandomColNumbers = NULL,
InteractionColNumbers = NULL,
WeightsColumn = NULL,

# Model args
GridTune = FALSE,
GridStrategy = "Cartesian",
StoppingRounds = 10,
MaxRunTimeSecs = 3600 * 24 * 7,
MaxModelsInGrid = 10,
Distribution = "multinomial",
Link = "family_default",
RandomDistribution = NULL,
RandomLink = NULL,
Solver = "AUTO",
Alpha = 0.5,
Lambda = NULL,
LambdaSearch = FALSE,
NLambdas = -1,
Standardize = TRUE,
RemoveCollinearColumns = FALSE,
InterceptInclude = TRUE,
NonNegativeCoefficients = FALSE)

```

---

AutoH2oGLMRegression    *AutoH2oGLMRegression*

---

## Description

AutoH2oGLM is an automated H2O modeling framework with grid-tuning and model evaluation that runs a variety of steps. First, the function will run a random grid tune over N number of models and find which model is the best (a default model is always included in that set). Once the model is identified and built, several other outputs are generated: validation data with predictions, evaluation plot, evaluation boxplot, evaluation metrics, variable importance, partial dependence calibration plots, partial dependence calibration box plots, and column names used in model fitting.

**Usage**

```

AutoH2oGLMRegression(
  OutputSelection = c("EvalMetrics", "PDFs", "Score_TrainData"),
  data = NULL,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = NULL,
  FeatureColNames = NULL,
  RandomColNumbers = NULL,
  InteractionColNumbers = NULL,
  WeightsColumn = NULL,
  MaxMem = {      gc()
    paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo",
      intern = TRUE))/1e+06)), "G") },
  NThreads = max(1, parallel::detectCores() - 2),
  ModelID = "FirstModel",
  ReturnModelObjects = TRUE,
  model_path = NULL,
  metadata_path = NULL,
  SaveModelObjects = FALSE,
  SaveInfoToPDF = FALSE,
  IfSaveModel = "mojo",
  H2OShutdown = TRUE,
  H2OStartUp = TRUE,
  DebugMode = FALSE,
  TransformNumericColumns = NULL,
  Methods = c("BoxCox", "Asinh", "Log", "LogPlus1", "Sqrt", "Asin", "Logit"),
  NumOfParDepPlots = 3,
  GridTune = FALSE,
  GridStrategy = "Cartesian",
  StoppingRounds = 10,
  MaxRunTimeSecs = 3600 * 24 * 7,
  MaxModelsInGrid = 2,
  Distribution = "gaussian",
  Link = "identity",
  TweedieLinkPower = NULL,
  TweedieVariancePower = NULL,
  eval_metric = "RMSE",
  RandomDistribution = NULL,
  RandomLink = NULL,
  Solver = "AUTO",
  Alpha = 0.5,
  Lambda = NULL,
  LambdaSearch = FALSE,
  NLambdas = -1,
  Standardize = TRUE,
  RemoveCollinearColumns = FALSE,
  InterceptInclude = TRUE,
  NonNegativeCoefficients = FALSE
)

```

**Arguments**

OutputSelection	You can select what type of output you want returned. Choose from c("EvalMetrics", "PDFs", "Score_TrainData")
data	This is your data set for training and testing your model
TrainOnFull	Set to TRUE to train on full data
ValidationData	This is your holdout data set used in modeling either refine your hyperparameters.
TestData	This is your holdout data set. Catboost using both training and validation data in the training process so you should evaluate out of sample performance with this data set.
TargetColumnName	Either supply the target column name OR the column number where the target is located (but not mixed types).
FeatureColNames	Either supply the feature column names OR the column number where the target is located (but not mixed types)
RandomColNumbers	Random effects column number indicies
InteractionColNumbers	Column numbers of the features you want to be pairwise interacted
WeightsColumn	Column name of a weights column
MaxMem	Set the maximum amount of memory you'd like to dedicate to the model run. E.g. "32G"
NThreads	Set the number of threads you want to dedicate to the model building
ModelID	A character string to name your model and output
ReturnModelObjects	Set to TRUE to output all modeling objects (E.g. plots and evaluation metrics)
model_path	A character string of your path file to where you want your output saved
metadata_path	A character string of your path file to where you want your model evaluation output saved. If left NULL, all output will be saved to model_path.
SaveModelObjects	Set to TRUE to return all modeling objects to your environment
SaveInfoToPDF	Set to TRUE to save insights to PDF
IfSaveModel	Set to "mojo" to save a mojo file, otherwise "standard" to save a regular H2O model object
H2OShutdown	Set to TRUE to shutdown H2O inside the function
H2OStartup	Defaults to TRUE which means H2O will be started inside the function
DebugMode	Set to TRUE to print out steps to screen
TransformNumericColumns	Set to NULL to do nothing; otherwise supply the column names of numeric variables you want transformed
Methods	Choose from "YeoJohnson", "BoxCox", "Asinh", "Log", "LogPlus1", "Sqrt", "Asin", or "Logit". If more than one is selected, the one with the best normalization pearson statistic will be used. Identity is automatically selected and compared.

NumOfParDepPlots	Tell the function the number of partial dependence calibration plots you want to create. Calibration boxplots will only be created for numerical features (not dummy variables)
GridTune	Set to TRUE to run a grid tuning procedure. Set a number in MaxModelsInGrid to tell the procedure how many models you want to test.
GridStrategy	"RandomDiscrete" or "Cartesian"
StoppingRounds	Iterations in grid tuning
MaxRunTimeSecs	Max run time in seconds
MaxModelsInGrid	Number of models to test from grid options (1080 total possible options)
Distribution	"AUTO", "gaussian", "poisson", "gamma", "tweedie", "negativebinomial"
Link	"family_default", "identity", "log", "inverse", "tweedie"
TweedieLinkPower	See h2o docs for background
TweedieVariancePower	See h2o docs for background
eval_metric	This is the metric used to identify best grid tuned model. Choose from "MSE", "RMSE", "MAE", "RMSLE"
RandomDistribution	Random effects family. Defaults NULL, otherwise it will run a hierarchical glm
RandomLink	Random effects link. Defaults NULL, otherwise it will run a hierarchical glm
Solver	Default "AUTO". Options include "IRLSM", "L_BFGS", "COORDINATE_DESCENT_NAIVE", "COORDINATE_DESCENT", "GRADIENT_DESCENT_LH", "GRADIENT_DESCENT_SQERR"
Alpha	Default 0.5 Otherwise supply a value between 0 and 1. 1 is equivalent to Lasso regression. 0 is equivalent to Ridge regression. Inbetween for a blend of the two.
Lambda	Default NULL. Regularization strength.
LambdaSearch	Default FALSE.
NLambdas	Default -1
Standardize	Default TRUE. Standardize numerical columns
RemoveCollinearColumns	Default FALSE. Removes some of the linearly dependent columns
InterceptInclude	Default TRUE
NonNegativeCoefficients	Default FALSE

**Value**

Saves to file and returned in list: VariableImportance.csv, Model, ValidationData.csv, Evaluation-Plot.png, EvaluationBoxPlot.png, EvaluationMetrics.csv, ParDepPlots.R a named list of features with partial dependence calibration plots, ParDepBoxPlots.R, GridCollect, GridList, and Transformation metadata

**Author(s)**

Adrian Antico

**See Also**

Other Automated Supervised Learning - Regression: [AutoCatBoostRegression\(\)](#), [AutoH2oDRFRegression\(\)](#), [AutoH2oGAMRegression\(\)](#), [AutoH2oGBMRegression\(\)](#), [AutoH2oMLRegression\(\)](#), [AutoLightGBMRegression\(\)](#), [AutoNLS\(\)](#), [AutoXGBoostRegression\(\)](#)

**Examples**

```
# Create some dummy correlated data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 1000,
  ID = 2,
  ZIP = 0,
  AddDate = FALSE,
  Classification = FALSE,
  MultiClass = FALSE)

# Run function
TestModel <- RemixAutoML::AutoH2oGLMRegression(

  # Compute management
  MaxMem = {gc();paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo", int
  NThreads = max(1, parallel::detectCores()-2),
  H2OShutdown = TRUE,
  H2OStartUp = TRUE,
  IfSaveModel = "mojo",

  # Model evaluation:
  eval_metric = "RMSE",
  NumOfParDepPlots = 3,

  # Metadata arguments
  OutputSelection = c("EvalMetrics", "PDFs", "Score_TrainData"),
  model_path = NULL,
  metadata_path = NULL,
  ModelID = "FirstModel",
  ReturnModelObjects = TRUE,
  SaveModelObjects = FALSE,
  SaveInfoToPDF = FALSE,
  DebugMode = FALSE,

  # Data arguments:
  data = data,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = "Adrian",
  FeatureColNames = names(data)[!names(data) %in%
    c("IDcol_1", "IDcol_2", "Adrian")],
  RandomColNumbers = NULL,
  InteractionColNumbers = NULL,
  WeightsColumn = NULL,
  TransformNumericColumns = NULL,
  Methods = c("BoxCox", "Asinh", "Asin", "Log", "LogPlus1", "Sqrt", "Logit", "YeoJohnson"),

  # Model args
```



```

GridTune = FALSE,
GridStrategy = "Cartesian",
StoppingRounds = 10,
MaxRunTimeSecs = 3600 * 24 * 7,
MaxModelsInGrid = 10,
Distribution = "gaussian",
Link = "identity",
TweedieLinkPower = NULL,
TweedieVariancePower = NULL,
RandomDistribution = NULL,
RandomLink = NULL,
Solver = "AUTO",
Alpha = 0.5,
Lambda = NULL,
LambdaSearch = FALSE,
NLambdas = -1,
Standardize = TRUE,
RemoveCollinearColumns = FALSE,
InterceptInclude = TRUE,
NonNegativeCoefficients = FALSE)

```

---

AutoH2oMLClassifier     *AutoH2oMLClassifier*

---

## Description

AutoH2oMLClassifier is an automated H2O modeling framework with grid-tuning and model evaluation that runs a variety of steps. First, a stratified sampling (by the target variable) is done to create train and validation sets. Then, the function will run a random grid tune over N number of models and find which model is the best (a default model is always included in that set). Once the model is identified and built, several other outputs are generated: validation data with predictions, evaluation plot, evaluation metrics, variable importance, partial dependence calibration plots, and column names used in model fitting.

## Usage

```

AutoH2oMLClassifier(
  OutputSelection = c("EvalMetrics", "PDFs", "Score_TrainData"),
  data = NULL,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = NULL,
  FeatureColNames = NULL,
  ExcludeAlgos = NULL,
  eval_metric = "auc",
  CostMatrixWeights = c(1, 0, 0, 1),
  MaxMem = {
    gc()
    paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo",
      intern = TRUE))/1e+06)), "G") },
  NThreads = max(1, parallel::detectCores() - 2),
  MaxModelsInGrid = 2,

```

```

    model_path = NULL,
    metadata_path = NULL,
    ModelID = "FirstModel",
    NumOfParDepPlots = 3,
    ReturnModelObjects = TRUE,
    SaveModelObjects = FALSE,
    SaveInfoToPDF = TRUE,
    IfSaveModel = "mojo",
    H2OShutdown = TRUE,
    H2OStartUp = TRUE,
    DebugMode = FALSE
)

```

## Arguments

OutputSelection	You can select what type of output you want returned. Choose from c("EvalMetrics", "PDFs", "Score_TrainData")
data	This is your data set for training and testing your model
TrainOnFull	Set to TRUE to train on full data
ValidationData	This is your holdout data set used in modeling either refine your hyperparameters.
TestData	This is your holdout data set. Catboost using both training and validation data in the training process so you should evaluate out of sample performance with this data set.
TargetColumnName	Either supply the target column name OR the column number where the target is located (but not mixed types). Note that the target column needs to be a 0   1 numeric variable.
FeatureColNames	Either supply the feature column names OR the column number where the target is located (but not mixed types)
ExcludeAlgos	"DRF", "GLM", "XGBoost", "GBM", "DeepLearning" and "StackedEnsemble"
eval_metric	This is the metric used to identify best grid tuned model. Choose from "AUC" or "logloss"
CostMatrixWeights	A vector with 4 elements c(True Positive Cost, False Negative Cost, False Positive Cost, True Negative Cost). Default c(1,0,0,1),
MaxMem	Set the maximum amount of memory you'd like to dedicate to the model run. E.g. "32G"
NThreads	Set the number of threads you want to dedicate to the model building
MaxModelsInGrid	Number of models to test from grid options (1080 total possible options)
model_path	A character string of your path file to where you want your output saved
metadata_path	A character string of your path file to where you want your model evaluation output saved. If left NULL, all output will be saved to model_path.
ModelID	A character string to name your model and output
NumOfParDepPlots	Tell the function the number of partial dependence calibration plots you want to create.

ReturnModelObjects	Set to TRUE to output all modeling objects (E.g. plots and evaluation metrics)
SaveModelObjects	Set to TRUE to return all modeling objects to your environment
SaveInfoToPDF	Set to TRUE to print model insights to PDF
IfSaveModel	Set to "mojo" to save a mojo file, otherwise "standard" to save a regular H2O model object
H2OShutdown	Set to TRUE to shutdown H2O after running the function
H2OStartUp	Set to FALSE
DebugMode	Set to TRUE to print out steps taken

**Value**

Saves to file and returned in list: VariableImportance.csv, Model, ValidationData.csv, Evaluation-Plot.png, EvaluationMetrics.csv, ParDepPlots.R a named list of features with partial dependence calibration plots, GridCollect, and GridList

**Author(s)**

Adrian Antico

**See Also**

Other Automated Supervised Learning - Binary Classification: [AutoCatBoostClassifier\(\)](#), [AutoH2oDRFClassifier\(\)](#), [AutoH2oGAMClassifier\(\)](#), [AutoH2oGBMClassifier\(\)](#), [AutoH2oGLMClassifier\(\)](#), [AutoLightGBMClassifier\(\)](#), [AutoXGBoostClassifier\(\)](#)

**Examples**

```
# Create some dummy correlated data with numeric and categorical features
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 1000L,
  ID = 2L,
  ZIP = 0L,
  AddDate = FALSE,
  Classification = TRUE,
  MultiClass = FALSE)

TestModel <- RemixAutoML::AutoH2oMLClassifier(
  OutputSelection = c("EvalMetrics", "PDFs", "Score_TrainData"),
  data,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = "Adrian",
  FeatureColNames = names(data)[!names(data) %in% c("IDcol_1", "IDcol_2", "Adrian")],
  ExcludeAlgos = NULL,
  eval_metric = "auc",
  CostMatrixWeights = c(1,0,0,1),
  MaxMem = {gc();paste0(as.character(floor(as.numeric(system("awk 'MemFree/ {print $2}' /proc/meminfo", intern=TRUE)))
  NThreads = max(1, parallel::detectCores()-2),
  MaxModelsInGrid = 10,
  model_path = normalizePath("./"),
```

```

metadata_path = normalizePath("./"),
ModelID = "FirstModel",
NumOfParDepPlots = 3,
ReturnModelObjects = TRUE,
SaveModelObjects = FALSE,
SaveInfoToPDF = TRUE,
IfSaveModel = "mojo",
H2OShutdown = TRUE,
H2OStartUp = TRUE,
DebugMode = FALSE)

```

---

AutoH2oMLMultiClass     *AutoH2oMLMultiClass*

---

## Description

AutoH2oDRFMultiClass is an automated H2O modeling framework with grid-tuning and model evaluation that runs a variety of steps. First, a stratified sampling (by the target variable) is done to create train and validation sets. Then, the function will run a random grid tune over N number of models and find which model is the best (a default model is always included in that set). Once the model is identified and built, several other outputs are generated: validation data with predictions, evaluation metrics, confusion matrix, and variable importance.

## Usage

```

AutoH2oMLMultiClass(
  OutputSelection = c("EvalMetrics", "PDFs", "Score_TrainData"),
  data = NULL,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = NULL,
  FeatureColNames = NULL,
  ExcludeAlgos = NULL,
  eval_metric = "logloss",
  MaxMem = { gc()
    paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo",
      intern = TRUE))/1e+06)), "G") },
  NThreads = max(1, parallel::detectCores() - 2),
  MaxModelsInGrid = 2,
  model_path = NULL,
  metadata_path = NULL,
  ModelID = "FirstModel",
  ReturnModelObjects = TRUE,
  SaveModelObjects = FALSE,
  SaveInfoToPDF = TRUE,
  IfSaveModel = "mojo",
  H2OShutdown = TRUE,
  H2OStartUp = TRUE,
  DebugMode = FALSE
)

```

**Arguments**

OutputSelection	You can select what type of output you want returned. Choose from c("EvalMetrics", "PDFs", "Score_TrainData")
data	This is your data set for training and testing your model
TrainOnFull	Set to TRUE to train on full data
ValidationData	This is your holdout data set used in modeling either refine your hyperparameters.
TestData	This is your holdout data set. Catboost using both training and validation data in the training process so you should evaluate out of sample performance with this data set.
TargetColumnName	Either supply the target column name OR the column number where the target is located (but not mixed types).
FeatureColNames	Either supply the feature column names OR the column number where the target is located (but not mixed types)
ExcludeAlgos	"DRF", "GLM", "XGBoost", "GBM", "DeepLearning" and "StackedEnsemble"
eval_metric	This is the metric used to identify best grid tuned model. Choose from "logloss", "r2", "RMSE", "MSE"
MaxMem	Set the maximum amount of memory you'd like to dedicate to the model run. E.g. "32G"
NThreads	Set the number of threads you want to dedicate to the model building
MaxModelsInGrid	Number of models to test from grid options (1080 total possible options)
model_path	A character string of your path file to where you want your output saved
metadata_path	A character string of your path file to where you want your model evaluation output saved. If left NULL, all output will be saved to model_path.
ModelID	A character string to name your model and output
ReturnModelObjects	Set to TRUE to output all modeling objects (E.g. plots and evaluation metrics)
SaveModelObjects	Set to TRUE to return all modeling objects to your environment
SaveInfoToPDF	Set to TRUE to print model insights to PDF
IfSaveModel	Set to "mojo" to save a mojo file, otherwise "standard" to save a regular H2O model object
H2OShutdown	Set to TRUE to have H2O shutdown after running this function
H2OStartUp	Set to FALSE
DebugMode	Set to TRUE to get a print out of steps taken internally

**Value**

Saves to file and returned in list: VariableImportance.csv, Model, ValidationData.csv, EvaluationMetrics.csv, GridCollect, and GridList

**Author(s)**

Adrian Antico

**See Also**

Other Automated Supervised Learning - Multiclass Classification: [AutoCatBoostMultiClass\(\)](#), [AutoH2oDRFMultiClass\(\)](#), [AutoH2oGAMMultiClass\(\)](#), [AutoH2oGBMMultiClass\(\)](#), [AutoH2oGLMMultiClass\(\)](#), [AutoXGBoostMultiClass\(\)](#)

**Examples**

```
# Create some dummy correlated data with numeric and categorical features
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 1000,
  ID = 2,
  ZIP = 0,
  AddDate = FALSE,
  Classification = FALSE,
  MultiClass = TRUE)

# Run function
TestModel <- RemixAutoML::AutoH2oMLMultiClass(
  OutputSelection = c("EvalMetrics", "PDFs", "Score_TrainData"),
  data,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = "Adrian",
  FeatureColNames = names(data)[!names(data) %in% c("IDcol_1", "IDcol_2", "Adrian")],
  ExcludeAlgos = NULL,
  eval_metric = "logloss",
  MaxMem = {gc();paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo", intern=TRUE))))},
  NThreads = max(1, parallel::detectCores()-2),
  MaxModelsInGrid = 10,
  model_path = normalizePath("./"),
  metadata_path = normalizePath("./"),
  ModelID = "FirstModel",
  ReturnModelObjects = TRUE,
  SaveModelObjects = FALSE,
  SaveInfoToPDF = TRUE,
  IfSaveModel = "mojo",
  H2OShutdown = TRUE,
  H2OStartUp = TRUE,
  DebugMode = FALSE)
```

---

AutoH2oMLRegression      *AutoH2oMLRegression*

---

**Description**

AutoH2oMLRegression is an automated H2O modeling framework with grid-tuning and model evaluation that runs a variety of steps. First, the function will run a random grid tune over N number of models and find which model is the best (a default model is always included in that set). Once the model is identified and built, several other outputs are generated: validation data with predictions, evaluation plot, evaluation boxplot, evaluation metrics, variable importance, partial dependence calibration plots, partial dependence calibration box plots, and column names used in model fitting.

**Usage**

```

AutoH2oMLRegression(
  OutputSelection = c("EvalMetrics", "PDFs", "Score_TrainData"),
  data = NULL,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = NULL,
  FeatureColNames = NULL,
  ExcludeAlgos = NULL,
  TransformNumericColumns = NULL,
  Methods = c("BoxCox", "Asinh", "Log", "LogPlus1", "Sqrt", "Asin", "Logit"),
  eval_metric = "RMSE",
  MaxMem = {      gc()
    paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo",
      intern = TRUE))/1e+06)), "G") },
  NThreads = max(1, parallel::detectCores() - 2),
  model_path = NULL,
  metadata_path = NULL,
  ModelID = "FirstModel",
  NumOfParDepPlots = 3,
  ReturnModelObjects = TRUE,
  SaveModelObjects = FALSE,
  SaveInfoToPDF = TRUE,
  IfSaveModel = "mojo",
  H2OShutdown = TRUE,
  H2OStartUp = TRUE,
  DebugMode = FALSE
)

```

**Arguments**

OutputSelection	You can select what type of output you want returned. Choose from c("EvalMetrics", "PDFs", "Score_TrainData")
data	This is your data set for training and testing your model
TrainOnFull	Set to TRUE to train on full data
ValidationData	This is your holdout data set used in modeling either refine your hyperparameters.
TestData	This is your holdout data set. Catboost using both training and validation data in the training process so you should evaluate out of sample performance with this data set.
TargetColumnName	Either supply the target column name OR the column number where the target is located (but not mixed types).
FeatureColNames	Either supply the feature column names OR the column number where the target is located (but not mixed types)
ExcludeAlgos	"DRF", "GLM", "XGBoost", "GBM", "DeepLearning" and "StackedEnsemble"

TransformNumericColumns	Set to NULL to do nothing; otherwise supply the column names of numeric variables you want transformed
Methods	Choose from "YeoJohnson", "BoxCox", "Asinh", "Log", "LogPlus1", "Sqrt", "Asin", or "Logit". If more than one is selected, the one with the best normalization pearson statistic will be used. Identity is automatically selected and compared.
eval_metric	This is the metric used to identify best grid tuned model. Choose from "MSE", "RMSE", "MAE", "RMSLE"
MaxMem	Set the maximum amount of memory you'd like to dedicate to the model run. E.g. "32G"
NThreads	Set the number of threads you want to dedicate to the model building
model_path	A character string of your path file to where you want your output saved
metadata_path	A character string of your path file to where you want your model evaluation output saved. If left NULL, all output will be saved to model_path.
ModelID	A character string to name your model and output
NumOfParDepPlots	Tell the function the number of partial dependence calibration plots you want to create. Calibration boxplots will only be created for numerical features (not dummy variables)
ReturnModelObjects	Set to TRUE to output all modeling objects (E.g. plots and evaluation metrics)
SaveModelObjects	Set to TRUE to return all modeling objects to your environment
SaveInfoToPDF	Set to TRUE to save insights to PDF
IfSaveModel	Set to "mojo" to save a mojo file, otherwise "standard" to save a regular H2O model object
H2OShutdown	Set to TRUE to shutdown H2O inside the function
H2OStartup	Defaults to TRUE which means H2O will be started inside the function
DebugMode	Set to TRUE to print to screen steps taken internally

**Value**

Saves to file and returned in list: VariableImportance.csv, Model, ValidationData.csv, Evaluation-Plot.png, EvaluationBoxPlot.png, EvaluationMetrics.csv, ParDepPlots.R a named list of features with partial dependence calibration plots, ParDepBoxPlots.R, GridCollect, GridList, and Transformation metadata

**Author(s)**

Adrian Antico

**See Also**

Other Automated Supervised Learning - Regression: [AutoCatBoostRegression\(\)](#), [AutoH2oDRFRegression\(\)](#), [AutoH2oGAMRegression\(\)](#), [AutoH2oGBMRegression\(\)](#), [AutoH2oGLMRegression\(\)](#), [AutoLightGBMRegression\(\)](#), [AutoNLS\(\)](#), [AutoXGBoostRegression\(\)](#)



**Examples**

```

# Create some dummy correlated data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 1000,
  ID = 2,
  ZIP = 0,
  AddDate = FALSE,
  Classification = FALSE,
  MultiClass = FALSE)

# Run function
TestModel <- RemixAutoML::AutoH2oMLRegression(

  # Compute management
  MaxMem = {gc()};paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo", intern=TRUE))))),
  NThreads = max(1, parallel::detectCores()-2),
  H2OShutdown = TRUE,
  H2OStartUp = TRUE,
  IfSaveModel = "mojo",

  # Model evaluation
  eval_metric = "RMSE",
  NumOfParDepPlots = 3,

  # Metadata arguments
  OutputSelection = c("EvalMetrics", "PDFs", "Score_TrainData"),
  model_path = NULL,
  metadata_path = NULL,
  ModelID = "FirstModel",
  ReturnModelObjects = TRUE,
  SaveModelObjects = FALSE,
  SaveInfoToPDF = TRUE,
  DebugMode = FALSE,

  # Data arguments
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = "Adrian",
  FeatureColNames = names(data)[!names(data) %in% c("IDcol_1", "IDcol_2", "Adrian")],
  TransformNumericColumns = NULL,
  Methods = c("BoxCox", "Asinh", "Asin", "Log", "LogPlus1", "Sqrt", "Logit"),

  # Model args
  ExcludeAlgos = NULL)

```

AutoH2OMLScoring

*AutoH2OMLScoring***Description**

AutoH2OMLScoring is an automated scoring function that compliments the AutoH2oGBM\_\_() and AutoH2oDRF\_\_() models training functions. This function requires you to supply features for

scoring. It will run ModelDataPrep() to prepare your features for H2O data conversion and scoring.

## Usage

```
AutoH2OMLScoring(
  ScoringData = NULL,
  ModelObject = NULL,
  ModelType = "mojo",
  H2OShutdown = TRUE,
  H2OStartUp = TRUE,
  MaxMem = { gc()
  paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo",
    intern = TRUE))/1e+06)), "G") },
  NThreads = max(1, parallel::detectCores() - 2),
  JavaOptions = "-Xmx1g -XX:ReservedCodeCacheSize=256m",
  ModelPath = NULL,
  ModelID = NULL,
  ReturnFeatures = TRUE,
  TransformNumeric = FALSE,
  BackTransNumeric = FALSE,
  TargetColumnName = NULL,
  TransformationObject = NULL,
  TransID = NULL,
  TransPath = NULL,
  MDP_Impute = TRUE,
  MDP_CharToFactor = TRUE,
  MDP_RemoveDates = TRUE,
  MDP_MissFactor = "0",
  MDP_MissNum = -1
)
```

## Arguments

ScoringData	This is your data.table of features for scoring. Can be a single row or batch.
ModelObject	Supply a model object from AutoH2oDRF__()
ModelType	Set to either "mojo" or "standard" depending on which version you saved
H2OShutdown	Set to TRUE to shutdown H2O inside the function.
H2OStartUp	Defaults to TRUE which means H2O will be started inside the function
MaxMem	Set to you dedicated amount of memory. E.g. "28G"
NThreads	Default set to max(1, parallel::detectCores()-2)
JavaOptions	Change the default to your machines specification if needed. Default is '-Xmx1g -XX:ReservedCodeCacheSize=256m',
ModelPath	Supply your path file used in the AutoH2o__() function
ModelID	Supply the model ID used in the AutoH2o__() function
ReturnFeatures	Set to TRUE to return your features with the predicted values.
TransformNumeric	Set to TRUE if you have features that were transformed automatically from an Auto__Regression() model AND you haven't already transformed them.

BackTransNumeric	Set to TRUE to generate back-transformed predicted values. Also, if you return features, those will also be back-transformed.
TargetColumnName	Input your target column name used in training if you are utilizing the transformation service
TransformationObject	Set to NULL if you didn't use transformations or if you want the function to pull from the file output from the Auto__Regression() function. You can also supply the transformation data.table object with the transformation details versus having it pulled from file.
TransID	Set to the ID used for saving the transformation data.table object or set it to the ModelID if you are pulling from file from a build with Auto__Regression().
TransPath	Set the path file to the folder where your transformation data.table detail object is stored. If you used the Auto__Regression() to build, set it to the same path as ModelPath.
MDP_Impute	Set to TRUE if you did so for modeling and didn't do so before supplying ScoringData in this function
MDP_CharToFactor	Set to TRUE to turn your character columns to factors if you didn't do so to your ScoringData that you are supplying to this function
MDP_RemoveDates	Set to TRUE if you have date of timestamp columns in your ScoringData
MDP_MissFactor	If you set MDP_Impute to TRUE, supply the character values to replace missing values with
MDP_MissNum	If you set MDP_Impute to TRUE, supply a numeric value to replace missing values with

**Value**

A data.table of predicted values with the option to return model features as well.

**Author(s)**

Adrian Antico

**See Also**

Other Automated Model Scoring: [AutoCatBoostScoring\(\)](#), [AutoLightGBMScoring\(\)](#), [AutoXGBoostScoring\(\)](#)

**Examples**

```
## Not run:
Preds <- AutoH2OMLScoring(
  ScoringData = data,
  ModelObject = NULL,
  ModelType = "mojo",
  H2OShutdown = TRUE,
  H2OStartUp = TRUE,
  MaxMem = {gc();paste0(as.character(floor(as.numeric(system("awk '/MemFree/ {print $2}' /proc/meminfo", intern=TRUE)))
  NThreads = max(1, parallel::detectCores()-2),
  JavaOptions = '-Xmx1g -XX:ReservedCodeCacheSize=256m',
```

```

    ModelPath = normalizePath("./"),
    ModelID = "ModelTest",
    ReturnFeatures = TRUE,
    TransformNumeric = FALSE,
    BackTransNumeric = FALSE,
    TargetColumnName = NULL,
    TransformationObject = NULL,
    TransID = NULL,
    TransPath = NULL,
    MDP_Impute = TRUE,
    MDP_CharToFactor = TRUE,
    MDP_RemoveDates = TRUE,
    MDP_MissFactor = "0",
    MDP_MissNum = -1)

## End(Not run)

```

---

AutoHierarchicalFourier

*AutoHierarchicalFourier*


---

## Description

AutoHierarchicalFourier reverses the difference

## Usage

```

AutoHierarchicalFourier(
  datax = data,
  xRegs = names(XREGS),
  FourierTermS = FourierTerms,
  TimeUniT = TimeUnit,
  FC_PeriodS = FC_Periods,
  TargetColumnN = TargetColumn,
  DateColumnN = DateColumnName,
  HierarchGroups = NULL,
  IndependentGroups = NULL
)

```

## Arguments

datax	data
xRegs	The XREGS
FourierTermS	Number of fourier pairs
TimeUniT	Time unit
FC_PeriodS	Number of forecast periods
TargetColumnN	Target column name
DateColumnN	Date column name
HierarchGroups	Character vector of categorical columns to fully interact
IndependentGroups	Character vector of categorical columns to run independently

Author(s)

Adrian Antico

See Also

Other Feature Engineering: [AutoDataPartition\(\)](#), [AutoDiffLagN\(\)](#), [AutoInteraction\(\)](#), [AutoLagRollMode\(\)](#), [AutoLagRollStatsScoring\(\)](#), [AutoLagRollStats\(\)](#), [AutoTransformationCreate\(\)](#), [AutoTransformationScore\(\)](#), [AutoWord2VecModeler\(\)](#), [AutoWord2VecScoring\(\)](#), [CategoricalEncoding\(\)](#), [CreateCalendarVariables\(\)](#), [CreateHolidayVariables\(\)](#), [DummifyDT\(\)](#), [H2OAutoencoderScoring\(\)](#), [H2OAutoencoder\(\)](#), [ModelDataPrep\(\)](#), [TimeSeriesFill\(\)](#)

---

AutoInteraction	<i>AutoInteraction</i>
-----------------	------------------------

---

Description

AutoInteraction creates interaction variables from your numerical features in your data. Supply a set of column names to utilize and set the interaction level. Supply a character vector of columns to exclude and the function will ignore those features.

Usage

```
AutoInteraction(  
  data = NULL,  
  NumericVars = NULL,  
  InteractionDepth = 2,  
  Center = TRUE,  
  Scale = TRUE,  
  SkipCols = NULL,  
  Scoring = FALSE,  
  File = NULL  
)
```

Arguments

data	Source data.table
InteractionDepth	The max K in N choose K. If NULL, K will loop through 1 to length(NumVars). Default is 2 for pairwise interactions
Center	TRUE to center the data
Scale	TRUE to scale the data
SkipCols	Use this to exclude features from being created. An example could be, you build a model with all variables and then use the variable importance list to determine which features aren't necessary and pass that set of features into this argument as a character vector.
Scoring	Defaults to FALSE. Set to TRUE for generating these columns in a model scoring setting

File	When Scoring is set to TRUE you have to supply either the .Rdata list with lookup values for recreating features or a pathfile to the .Rdata file with the lookup values. If you didn't center or scale the data then this argument can be ignored.
NumVars	Names of numeric columns (if NULL, all numeric and integer columns will be used)

**Author(s)**

Adrian Antico

**See Also**

Other Feature Engineering: [AutoDataPartition\(\)](#), [AutoDiffLagN\(\)](#), [AutoHierarchicalFourier\(\)](#), [AutoLagRollMode\(\)](#), [AutoLagRollStatsScoring\(\)](#), [AutoLagRollStats\(\)](#), [AutoTransformationCreate\(\)](#), [AutoTransformationScore\(\)](#), [AutoWord2VecModeler\(\)](#), [AutoWord2VecScoring\(\)](#), [CategoricalEncoding\(\)](#), [CreateCalendarVariables\(\)](#), [CreateHolidayVariables\(\)](#), [DummifyDT\(\)](#), [H2OAutoencoderScoring\(\)](#), [H2OAutoencoder\(\)](#), [ModelDataPrep\(\)](#), [TimeSeriesFill\(\)](#)

**Examples**

```
## Not run:

#####
# Feature Engineering for Model Training
#####

# Create fake data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.70,
  N = 50000,
  ID = 2L,
  FactorCount = 2L,
  AddDate = TRUE,
  ZIP = 0L,
  TimeSeries = FALSE,
  ChainLadderData = FALSE,
  Classification = FALSE,
  MultiClass = FALSE)

# Print number of columns
print(ncol(data))

# Store names of numeric and integer cols
Cols <- names(data)[c(which(unlist(lapply(data, is.numeric))),
  which(unlist(lapply(data, is.integer))))]

# Model Training Feature Engineering
system.time(data <- RemixAutoML::AutoInteraction(
  data = data,
  NumericVars = Cols,
  InteractionDepth = 4,
  Center = TRUE,
  Scale = TRUE,
  SkipCols = NULL,
  Scoring = FALSE,
```

```

File = getwd()))

# user  system elapsed
# 0.30    0.11    0.41

# Print number of columns
print(ncol(data))

#####
# Feature Engineering for Model Scoring
#####

# Create fake data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.70,
  N = 1000,
  ID = 2L,
  FactorCount = 2L,
  AddDate = TRUE,
  ZIP = 0L,
  TimeSeries = FALSE,
  ChainLadderData = FALSE,
  Classification = FALSE,
  MultiClass = FALSE)

# Print number of columns
print(ncol(data))

# Reduce to single row to mock a scoring scenario
data <- data[1L]

# Model Scoring Feature Engineering
system.time(data <- RemixAutoML::AutoInteraction(
  data = data,
  NumericVars = names(data)[
    c(which(unlist(lapply(data, is.numeric))),
      which(unlist(lapply(data, is.integer))))],
  InteractionDepth = 4,
  Center = TRUE,
  Scale = TRUE,
  SkipCols = NULL,
  Scoring = TRUE,
  File = file.path(getwd(), "Standardize.Rdata"))))

# user  system elapsed
# 0.19    0.00    0.19

# Print number of columns
print(ncol(data))

## End(Not run)

```

**Description**

Create lags and rolling modes for categorical variables.

**Usage**

```
AutoLagRollMode(
  data,
  Lags = 1,
  ModePeriods = 0,
  Targets = NULL,
  GroupingVars = NULL,
  SortDateName = NULL,
  WindowingLag = 0,
  Type = c("Lag"),
  SimpleImpute = TRUE
)
```

**Arguments**

data	A data.table you want to run the function on
Lags	A numeric vector of the specific lags you want to have generated. You must include 1 if WindowingLag = 1.
ModePeriods	A numeric vector of window sizes
Targets	A character vector of the column names for the reference column in which you will build your lags and rolling stats
GroupingVars	A character vector of categorical variable names you will build your lags and rolling stats by
SortDateName	The column name of your date column used to sort events over time
WindowingLag	Set to 0 to build rolling stats off of target columns directly or set to 1 to build the rolling stats off of the lag-1 target
Type	List either "Lag" if you want features built on historical values or "Lead" if you want features built on future values
SimpleImpute	Set to TRUE for factor level imputation of "0" and numeric imputation of -1

**Value**

data.table of original data plus created lags, rolling stats, and time between event lags and rolling stats

**Author(s)**

Adrian Antico

**See Also**

Other Feature Engineering: [AutoDataPartition\(\)](#), [AutoDiffLagN\(\)](#), [AutoHierarchicalFourier\(\)](#), [AutoInteraction\(\)](#), [AutoLagRollStatsScoring\(\)](#), [AutoLagRollStats\(\)](#), [AutoTransformationCreate\(\)](#), [AutoTransformationScore\(\)](#), [AutoWord2VecModeler\(\)](#), [AutoWord2VecScoring\(\)](#), [CategoricalEncoding\(\)](#), [CreateCalendarVariables\(\)](#), [CreateHolidayVariables\(\)](#), [DummifyDT\(\)](#), [H2OAutoencoderScoring\(\)](#), [H2OAutoencoder\(\)](#), [ModelDataPrep\(\)](#), [TimeSeriesFill\(\)](#)



**Examples**

```

## Not run:
# NO GROUPING CASE: Create fake Panel Data----
Count <- 1L
for(Level in LETTERS) {
  datatemp <- RemixAutoML::FakeDataGenerator(
    Correlation = 0.75,
    N = 25000L,
    ID = 0L,
    ZIP = 0L,
    FactorCount = 2L,
    AddDate = TRUE,
    Classification = FALSE,
    MultiClass = FALSE)
  datatemp[, Factor1 := eval(Level)]
  if(Count == 1L) {
    data <- data.table::copy(datatemp)
  } else {
    data <- data.table::rbindlist(
      list(data, data.table::copy(datatemp)))
  }
  Count <- Count + 1L
}

# NO GROUPING CASE: Create rolling modes for categorical features
data <- RemixAutoML::AutoLagRollMode(
  data,
  Lags = seq(1,5,1),
  ModePeriods = seq(2,5,1),
  Targets = c("Factor_1"),
  GroupingVars = NULL,
  SortDateName = "DateTime",
  WindowingLag = 1,
  Type = "Lag",
  SimpleImpute = TRUE)

# GROUPING CASE: Create fake Panel Data----
Count <- 1L
for(Level in LETTERS) {
  datatemp <- RemixAutoML::FakeDataGenerator(
    Correlation = 0.75,
    N = 25000L,
    ID = 0L,
    ZIP = 0L,
    FactorCount = 2L,
    AddDate = TRUE,
    Classification = FALSE,
    MultiClass = FALSE)
  datatemp[, Factor1 := eval(Level)]
  if(Count == 1L) {
    data <- data.table::copy(datatemp)
  } else {
    data <- data.table::rbindlist(
      list(data, data.table::copy(datatemp)))
  }
  Count <- Count + 1L
}

```

```

}

# GROUPING CASE: Create rolling modes for categorical features
data <- RemixAutoML::AutoLagRollMode(
  data,
  Lags          = seq(1,5,1),
  ModePeriods   = seq(2,5,1),
  Targets       = c("Factor_1"),
  GroupingVars  = "Factor_2",
  SortDateName  = "DateTime",
  WindowingLag  = 1,
  Type          = "Lag",
  SimpleImpute  = TRUE)

## End(Not run)

```

---

AutoLagRollStats	<i>AutoLagRollStats</i>
------------------	-------------------------

---

## Description

AutoLagRollStats Builds lags and a large variety of rolling statistics with options to generate them for hierarchical categorical interactions.

## Usage

```

AutoLagRollStats(
  data,
  Targets = NULL,
  HierarchyGroups = NULL,
  IndependentGroups = NULL,
  DateColumn = NULL,
  TimeUnit = NULL,
  TimeUnitAgg = NULL,
  TimeGroups = NULL,
  TimeBetween = NULL,
  RollOnLag1 = TRUE,
  Type = "Lag",
  SimpleImpute = TRUE,
  Lags = NULL,
  MA_RollWindows = NULL,
  SD_RollWindows = NULL,
  Skew_RollWindows = NULL,
  Kurt_RollWindows = NULL,
  Quantile_RollWindows = NULL,
  Quantiles_Selected = NULL,
  Debug = FALSE
)

```

## Arguments

data                      A data.table you want to run the function on

Targets	A character vector of the column names for the reference column in which you will build your lags and rolling stats
HierarchyGroups	A vector of categorical column names that you want to have generate all lags and rolling stats done for the individual columns and their full set of interactions.
IndependentGroups	A vector of categorical column names that you want to have run independently of each other. This will mean that no interaction will be done.
DateColumn	The column name of your date column used to sort events over time
TimeUnit	List the time aggregation level for the time between events features, such as "hour", "day", "weeks", "months", "quarter", or "year"
TimeUnitAgg	List the time aggregation of your data that you want to use as a base time unit for your features. E.g. "raw" or "day"
TimeGroups	A vector of TimeUnits indicators to specify any time-aggregated GDL features you want to have returned. E.g. c("raw" (no aggregation is done), "hour", "day", "week", "month", "quarter", "year")
TimeBetween	Specify a desired name for features created for time between events. Set to NULL if you don't want time between events features created.
RollOnLag1	Set to FALSE to build rolling stats off of target columns directly or set to TRUE to build the rolling stats off of the lag-1 target
Type	List either "Lag" if you want features built on historical values or "Lead" if you want features built on future values
SimpleImpute	Set to TRUE for factor level imputation of "0" and numeric imputation of -1
Lags	A numeric vector of the specific lags you want to have generated. You must include 1 if WindowingLag = 1.
MA_RollWindows	A numeric vector of the specific rolling statistics window sizes you want to utilize in the calculations.
SD_RollWindows	A numeric vector of Standard Deviation rolling statistics window sizes you want to utilize in the calculations.
Skew_RollWindows	A numeric vector of Skewness rolling statistics window sizes you want to utilize in the calculations.
Kurt_RollWindows	A numeric vector of Kurtosis rolling statistics window sizes you want to utilize in the calculations.
Quantile_RollWindows	A numeric vector of Quantile rolling statistics window sizes you want to utilize in the calculations.
Quantiles_Selected	Select from the following c("q5", "q10", "q15", "q20", "q25", "q30", "q35", "q40", "q45", "q50", "q55", "q60", "q65", "q70", "q75", "q80", "q85", "q90", "q95")
Debug	Set to TRUE to get a print of which steps are running

**Value**

data.table of original data plus created lags, rolling stats, and time between event lags and rolling stats

**Author(s)**

Adrian Antico

**See Also**

Other Feature Engineering: [AutoDataPartition\(\)](#), [AutoDiffLagN\(\)](#), [AutoHierarchicalFourier\(\)](#), [AutoInteraction\(\)](#), [AutoLagRollMode\(\)](#), [AutoLagRollStatsScoring\(\)](#), [AutoTransformationCreate\(\)](#), [AutoTransformationScore\(\)](#), [AutoWord2VecModeler\(\)](#), [AutoWord2VecScoring\(\)](#), [CategoricalEncoding\(\)](#), [CreateCalendarVariables\(\)](#), [CreateHolidayVariables\(\)](#), [DummifyDT\(\)](#), [H2OAutoencoderScoring\(\)](#), [H2OAutoencoder\(\)](#), [ModelDataPrep\(\)](#), [TimeSeriesFill\(\)](#)

**Examples**

```
## Not run:
# Create fake Panel Data----
Count <- 1L
for(Level in LETTERS) {
  datatemp <- RemixAutoML::FakeDataGenerator(
    Correlation = 0.75,
    N = 25000L,
    ID = 0L,
    ZIP = 0L,
    FactorCount = 0L,
    AddDate = TRUE,
    Classification = FALSE,
    MultiClass = FALSE)
  datatemp[, Factor1 := eval(Level)]
  if(Count == 1L) {
    data <- data.table::copy(datatemp)
  } else {
    data <- data.table::rbindlist(
      list(data, data.table::copy(datatemp)))
  }
  Count <- Count + 1L
}

# Add scoring records
data <- RemixAutoML::AutoLagRollStats(

  # Data
  data                = data,
  DateColumn          = "DateTime",
  Targets              = "Adrian",
  HierarchyGroups     = NULL,
  IndependentGroups   = c("Factor1"),
  TimeUnitAgg         = "days",
  TimeGroups          = c("days", "weeks",
                          "months", "quarters"),
  TimeBetween         = NULL,
  TimeUnit            = "days",

  # Services
  RollOnLag1          = TRUE,
  Type                = "Lag",
  SimpleImpute        = TRUE,
```

```

# Calculated Columns
Lags = list("days" = c(seq(1,5,1)),
            "weeks" = c(seq(1,3,1)),
            "months" = c(seq(1,2,1)),
            "quarters" = c(seq(1,2,1))),
MA_RollWindows = list("days" = c(seq(1,5,1)),
                       "weeks" = c(seq(1,3,1)),
                       "months" = c(seq(1,2,1)),
                       "quarters" = c(seq(1,2,1))),
SD_RollWindows = NULL,
Skew_RollWindows = NULL,
Kurt_RollWindows = NULL,
Quantile_RollWindows = NULL,
Quantiles_Selected = NULL,
Debug = FALSE)

## End(Not run)

```

---

AutoLagRollStatsScoring

*AutoLagRollStatsScoring*


---

## Description

AutoLagRollStatsScoring Builds lags and a large variety of rolling statistics with options to generate them for hierarchical categorical interactions.

## Usage

```

AutoLagRollStatsScoring(
  data,
  RowNumsID = "temp",
  RowNumsKeep = 1,
  Targets = NULL,
  HierarchyGroups = NULL,
  IndependentGroups = NULL,
  DateColumn = NULL,
  TimeUnit = "day",
  TimeUnitAgg = "day",
  TimeGroups = "day",
  TimeBetween = NULL,
  RollOnLag1 = 1,
  Type = "Lag",
  SimpleImpute = TRUE,
  Lags = NULL,
  MA_RollWindows = NULL,
  SD_RollWindows = NULL,
  Skew_RollWindows = NULL,
  Kurt_RollWindows = NULL,
  Quantile_RollWindows = NULL,
  Quantiles_Selected = NULL,
  Debug = FALSE
)

```

**Arguments**

data	A data.table you want to run the function on
RowNumsID	The name of your column used to id the records so you can specify which rows to keep
RowNumsKeep	The RowNumsID numbers that you want to keep
Targets	A character vector of the column names for the reference column in which you will build your lags and rolling stats
HierarchyGroups	A vector of categorical column names that you want to have generate all lags and rolling stats done for the individual columns and their full set of interactions.
IndependentGroups	Only supply if you do not want HierarchyGroups. A vector of categorical column names that you want to have run independently of each other. This will mean that no interaction will be done.
DateColumn	The column name of your date column used to sort events over time
TimeUnit	List the time aggregation level for the time between events features, such as "hour", "day", "weeks", "months", "quarter", or "year"
TimeUnitAgg	List the time aggregation of your data that you want to use as a base time unit for your features. E.g. "day",
TimeGroups	A vector of TimeUnits indicators to specify any time-aggregated GDL features you want to have returned. E.g. c("hour", "day", "week", "month", "quarter", "year"). STILL NEED TO ADD these '1min', '5min', '10min', '15min', '30min', '45min'
TimeBetween	Specify a desired name for features created for time between events. Set to NULL if you don't want time between events features created.
RollOnLag1	Set to FALSE to build rolling stats off of target columns directly or set to TRUE to build the rolling stats off of the lag-1 target
Type	List either "Lag" if you want features built on historical values or "Lead" if you want features built on future values
SimpleImpute	Set to TRUE for factor level imputation of "0" and numeric imputation of -1
Lags	A numeric vector of the specific lags you want to have generated. You must include 1 if WindowingLag = 1.
MA_RollWindows	A numeric vector of the specific rolling statistics window sizes you want to utilize in the calculations.
SD_RollWindows	A numeric vector of Standard Deviation rolling statistics window sizes you want to utilize in the calculations.
Skew_RollWindows	A numeric vector of Skewness rolling statistics window sizes you want to utilize in the calculations.
Kurt_RollWindows	A numeric vector of Kurtosis rolling statistics window sizes you want to utilize in the calculations.
Quantile_RollWindows	A numeric vector of Quantile rolling statistics window sizes you want to utilize in the calculations.
Quantiles_Selected	Select from the following c("q5", "q10", "q15", "q20", "q25", "q30", "q35", "q40", "q45", "q50", "q55", "q60", "q65", "q70", "q75", "q80", "q85", "q90", "q95")
Debug	Set to TRUE to get a print out of which step you are on

**Value**

data.table of original data plus created lags, rolling stats, and time between event lags and rolling stats

**Author(s)**

Adrian Antico

**See Also**

Other Feature Engineering: [AutoDataPartition\(\)](#), [AutoDiffLagN\(\)](#), [AutoHierarchicalFourier\(\)](#), [AutoInteraction\(\)](#), [AutoLagRollMode\(\)](#), [AutoLagRollStats\(\)](#), [AutoTransformationCreate\(\)](#), [AutoTransformationScore\(\)](#), [AutoWord2VecModeler\(\)](#), [AutoWord2VecScoring\(\)](#), [CategoricalEncoding\(\)](#), [CreateCalendarVariables\(\)](#), [CreateHolidayVariables\(\)](#), [DummifyDT\(\)](#), [H2OAutoencoderScoring\(\)](#), [H2OAutoencoder\(\)](#), [ModelDataPrep\(\)](#), [TimeSeriesFill\(\)](#)

**Examples**

```
# Create fake Panel Data----
Count <- 1L
for(Level in LETTERS) {
  datatemp <- RemixAutoML::FakeDataGenerator(
    Correlation = 0.75,
    N = 25000L,
    ID = 0L,
    ZIP = 0L,
    FactorCount = 0L,
    AddDate = TRUE,
    Classification = FALSE,
    MultiClass = FALSE)
  datatemp[, Factor1 := eval(Level)]
  if(Count == 1L) {
    data <- data.table::copy(datatemp)
  } else {
    data <- data.table::rbindlist(
      list(data, data.table::copy(datatemp)))
  }
  Count <- Count + 1L
}

# Create ID columns to know which records to score
data[, ID := .N:1L, by = "Factor1"]
data.table::set(data, i = which(data[["ID"]] == 2L), j = "ID", value = 1L)

# Score records
data <- RemixAutoML::AutoLagRollStatsScoring(

  # Data
  data                = data,
  RowNumsID           = "ID",
  RowNumsKeep         = 1,
  DateColumn          = "DateTime",
  Targets             = "Adrian",
  HierarchyGroups     = c("Store", "Dept"),
  IndependentGroups   = NULL,
```

```

# Services
TimeBetween      = NULL,
TimeGroups       = c("days", "weeks", "months"),
TimeUnit         = "day",
TimeUnitAgg      = "day",
RollOnLag1       = TRUE,
Type             = "Lag",
SimpleImpute     = TRUE,

# Calculated Columns
Lags             = list("days" = c(seq(1,5,1)),
                        "weeks" = c(seq(1,3,1)),
                        "months" = c(seq(1,2,1))),
MA_RollWindows   = list("days" = c(seq(1,5,1)),
                        "weeks" = c(seq(1,3,1)),
                        "months" = c(seq(1,2,1))),
SD_RollWindows   = list("days" = c(seq(1,5,1)),
                        "weeks" = c(seq(1,3,1)),
                        "months" = c(seq(1,2,1))),
Skew_RollWindows = list("days" = c(seq(1,5,1)),
                        "weeks" = c(seq(1,3,1)),
                        "months" = c(seq(1,2,1))),
Kurt_RollWindows = list("days" = c(seq(1,5,1)),
                        "weeks" = c(seq(1,3,1)),
                        "months" = c(seq(1,2,1))),
Quantile_RollWindows = list("days" = c(seq(1,5,1)),
                             "weeks" = c(seq(1,3,1)),
                             "months" = c(seq(1,2,1))),
Quantiles_Selected = c("q5", "q10", "q95"),
Debug            = FALSE)

```

---

AutoLightGBMCARMA

*AutoLightGBMCARMA*


---

## Description

AutoLightGBMCARMA Multivariate Forecasting with calendar variables, Holiday counts, holiday lags, holiday moving averages, differencing, transformations, interaction-based categorical encoding using target variable and features to generate various time-based aggregated lags, moving averages, moving standard deviations, moving skewness, moving kurtosis, moving quantiles, parallelized interaction-based fourier pairs by grouping variables, and Trend Variables.

## Usage

```

AutoLightGBMCARMA(
  data = NULL,
  XREGS = NULL,
  TimeWeights = NULL,
  NonNegativePred = FALSE,
  RoundPreds = FALSE,
  TrainOnFull = FALSE,
  TargetColumnName = NULL,

```



```

DateColumnName = NULL,
HierarchGroups = NULL,
GroupVariables = NULL,
FC_Periods = 5,
NThreads = max(1, parallel::detectCores() - 2L),
SaveDataPath = NULL,
PDFOutputPath = NULL,
TimeUnit = "week",
TimeGroups = c("weeks", "months"),
TargetTransformation = FALSE,
Methods = c("Asinh", "Log", "LogPlus1", "Sqrt", "Asin", "Logit"),
EncodingMethod = "binary",
AnomalyDetection = NULL,
Lags = c(1:5),
MA_Periods = c(1:5),
SD_Periods = NULL,
Skew_Periods = NULL,
Kurt_Periods = NULL,
Quantile_Periods = NULL,
Quantiles_Selected = NULL,
Difference = TRUE,
FourierTerms = 0,
CalendarVariables = c("second", "minute", "hour", "wday", "mday", "yday", "week",
  "wom", "isoweek", "month", "quarter", "year"),
HolidayVariable = c("USPublicHolidays", "EasterGroup", "ChristmasGroup",
  "OtherEccelesticalFeasts"),
HolidayLookback = NULL,
HolidayLags = 1L,
HolidayMovingAverages = 3L,
TimeTrendVariable = FALSE,
DataTruncate = FALSE,
ZeroPadSeries = NULL,
SplitRatios = c(1 - 10/100, 10/100),
PartitionType = "random",
Timer = TRUE,
DebugMode = FALSE,
GridTune = FALSE,
GridEvalMetric = "mae",
ModelCount = 30L,
MaxRunsWithoutNewWinner = 20L,
MaxRunMinutes = 24L * 60L,
Device_Type = "cpu",
LossFunction = "regression",
EvalMetric = "mae",
Input_Model = NULL,
Task = "train",
Boosting = "gbdt",
LinearTree = FALSE,
Trees = 1000,
ETA = 0.1,
Num_Leaves = 31,
Deterministic = TRUE,

```

```

Force_Col_Wise = FALSE,
Force_Row_Wise = FALSE,
Max_Depth = 6,
Min_Data_In_Leaf = 20,
Min_Sum_Hessian_In_Leaf = 0.001,
Bagging_Freq = 1,
Bagging_Fraction = 1,
Feature_Fraction = 1,
Feature_Fraction_Bynode = 1,
Lambda_L1 = 0,
Lambda_L2 = 0,
Extra_Trees = FALSE,
Early_Stopping_Round = 10,
First_Metric_Only = TRUE,
Max_Delta_Step = 0,
Linear_Lambda = 0,
Min_Gain_To_Split = 0,
Drop_Rate_Dart = 0.1,
Max_Drop_Dart = 50,
Skip_Drop_Dart = 0.5,
Uniform_Drop_Dart = FALSE,
Top_Rate_Goss = FALSE,
Other_Rate_Goss = FALSE,
Monotone_Constraints = NULL,
Monotone_Constraints_method = "advanced",
Monotone_Penalty = 0,
Forced_splits_Filename = NULL,
Refit_Decay_Rate = 0.9,
Path_Smooth = 0,
Max_Bin = 255,
Min_Data_In_Bin = 3,
Data_Random_Seed = 1,
Is_Enable_Sparse = TRUE,
Enable_Bundle = TRUE,
Use_Missing = TRUE,
Zero_As_Missing = FALSE,
Two_Round = FALSE,
Convert_Model = NULL,
Convert_Model_Language = "cpp",
Boost_From_Average = TRUE,
Alpha = 0.9,
Fair_C = 1,
Poisson_Max_Delta_Step = 0.7,
Tweedie_Variance_Power = 1.5,
Lambdarank_Truncation_Level = 30,
Is_Provide_Training_Metric = TRUE,
Eval_At = c(1, 2, 3, 4, 5),
Num_Machines = 1,
Gpu_Platform_Id = -1,
Gpu_Device_Id = -1,
Gpu_Use_Dp = TRUE,
Num_Gpu = 1

```

)

**Arguments**

data	Supply your full series data set here
XREGS	Additional data to use for model development and forecasting. Data needs to be a complete series which means both the historical and forward looking values over the specified forecast window needs to be supplied.
TimeWeights	Supply a value that will be multiplied by the time trend value
NonNegativePred	TRUE or FALSE
RoundPreds	Rounding predictions to an integer value. TRUE or FALSE. Defaults to FALSE
TrainOnFull	Set to TRUE to train on full data
TargetColumnName	List the column name of your target variables column. E.g. 'Target'
DateColumnName	List the column name of your date column. E.g. 'DateTime'
HierarchGroups	= NULL Character vector or NULL with names of the columns that form the interaction hierarchy
GroupVariables	Defaults to NULL. Use NULL when you have a single series. Add in GroupVariables when you have a series for every level of a group or multiple groups.
FC_Periods	Set the number of periods you want to have forecasts for. E.g. 52 for weekly data to forecast a year ahead
NThreads	Set the maximum number of threads you'd like to dedicate to the model run. E.g. 8
SaveDataPath	Path to save modeling data
PDFOutputPath	Supply a path to save model insights to PDF
TimeUnit	List the time unit your data is aggregated by. E.g. '1min', '5min', '10min', '15min', '30min', 'hour', 'day', 'week', 'month', 'quarter', 'year'
TimeGroups	Select time aggregations for adding various time aggregated GDL features.
TargetTransformation	Run AutoTransformationCreate() to find best transformation for the target variable. Tests YeoJohnson, BoxCox, and Asigh (also Asin and Logit for proportion target variables).
Methods	Choose from 'YeoJohnson', 'BoxCox', 'Asinh', 'Log', 'LogPlus1', 'Sqrt', 'Asin', or 'Logit'. If more than one is selected, the one with the best normalization pearson statistic will be used. Identity is automatically selected and compared.
EncodingMethod	Choose from 'binary', 'm_estimator', 'credibility', 'woe', 'target_encoding', 'poly_encode', 'backward_difference', 'helmert'
AnomalyDetection	NULL for not using the service. Other, provide a list, e.g. AnomalyDetection = list('tstat_high' = 4, tstat_low = -4)
Lags	Select the periods for all lag variables you want to create. E.g. c(1:5,52) or list('day' = c(1:10), 'weeks' = c(1:4))
MA_Periods	Select the periods for all moving average variables you want to create. E.g. c(1:5,52) or list('day' = c(2:10), 'weeks' = c(2:4))
SD_Periods	Select the periods for all moving standard deviation variables you want to create. E.g. c(1:5,52) or list('day' = c(2:10), 'weeks' = c(2:4))

Skew_Periods	Select the periods for all moving skewness variables you want to create. E.g. <code>c(1:5,52)</code> or <code>list('day' = c(2:10), 'weeks' = c(2:4))</code>
Kurt_Periods	Select the periods for all moving kurtosis variables you want to create. E.g. <code>c(1:5,52)</code> or <code>list('day' = c(2:10), 'weeks' = c(2:4))</code>
Quantile_Periods	Select the periods for all moving quantiles variables you want to create. E.g. <code>c(1:5,52)</code> or <code>list('day' = c(2:10), 'weeks' = c(2:4))</code>
Quantiles_Selected	Select from the following <code>c('q5','q10','q15','q20','q25','q30','q35','q40','q45','q50','q55','q60','q65')</code>
Difference	Set to TRUE to put the I in ARIMA
FourierTerms	Set to the max number of pairs
CalendarVariables	NULL, or select from 'second', 'minute', 'hour', 'wday', 'mday', 'yday', 'week', 'wom', 'isoweek', 'month', 'quarter', 'year'
HolidayVariable	NULL, or select from 'USPublicHolidays', 'EasterGroup', 'ChristmasGroup', 'OtherEcclesticalFeasts'
HolidayLookback	Number of days in range to compute number of holidays from a given date in the data. If NULL, the number of days are computed for you.
HolidayLags	Number of lags for the holiday counts
HolidayMovingAverages	Number of moving averages for holiday counts
TimeTrendVariable	Set to TRUE to have a time trend variable added to the model. Time trend is numeric variable indicating the numeric value of each record in the time series (by group). Time trend starts at 1 for the earliest point in time and increments by one for each success time point.
DataTruncate	Set to TRUE to remove records with missing values from the lags and moving average features created
ZeroPadSeries	NULL to do nothing. Otherwise, set to 'maxmax', 'minmax', 'maxmin', 'minmin'. See <a href="#">TimeSeriesFill</a> for explanations of each type
SplitRatios	E.g <code>c(0.7,0.2,0.1)</code> for train, validation, and test sets
PartitionType	Select 'random' for random data partitioning 'time' for partitioning by time frames
Timer	Setting to TRUE prints out the forecast number while it is building
DebugMode	Setting to TRUE generates printout of all header code comments during run time of function
GridTune	Set to TRUE to run a grid tune
GridEvalMetric	This is the metric used to find the threshold 'poisson', 'mae', 'mape', 'mse', 'msle', 'kl', 'cs', 'r2'
ModelCount	Set the number of models to try in the grid tune
MaxRunsWithoutNewWinner	Number of consecutive runs without a new winner in order to terminate procedure
MaxRunMinutes	Default 24L*60L # ML Args begin

```

Device_Type      = 'CPU'
LossFunction     = 'regression'
EvalMetric       = 'mae'
Input_Model      = NULL
Task             = 'train'
Boosting         = 'gbdt'
LinearTree       = FALSE
Trees            = 1000
ETA              = 0.10
Num_Leaves       = 31
Deterministic    = TRUE
                 # Learning Parameters # https://lightgbm.readthedocs.io/en/latest/Parameters.html#learning-control-parameters
Force_Col_Wise   = FALSE
Force_Row_Wise   = FALSE
Max_Depth        = 6
Min_Data_In_Leaf = 20
Min_Sum_Hessian_In_Leaf = 0.001
Bagging_Freq     = 1.0
Bagging_Fraction = 1.0
Feature_Fraction = 1.0
Feature_Fraction_Bynode = 1.0
Lambda_L1        = 0.0
Lambda_L2        = 0.0
Extra_Trees      = FALSE
Early_Stopping_Round = 10
First_Metric_Only = TRUE
Max_Delta_Step   = 0.0
Linear_Lambda    = 0.0
Min_Gain_To_Split = 0
Drop_Rate_Dart   = 0.10
Max_Drop_Dart    = 50
Skip_Drop_Dart   = 0.50
Uniform_Drop_Dart = FALSE
Top_Rate_Goss    = FALSE

```

```

Other_Rate_Goss
    = FALSE
Monotone_Constraints
    = NULL
Monotone_Constraints_method
    = 'advanced'
Monotone_Penalty
    = 0.0
Forced_splits_Filename
    = NULL
Refit_Decay_Rate
    = 0.90
Path_Smooth
    = 0.0
    # IO Dataset Parameters # https://lightgbm.readthedocs.io/en/latest/Parameters.html#io-
    # parameters
Max_Bin
    = 255
Min_Data_In_Bin
    = 3
Data_Random_Seed
    = 1
Is_Enable_Sparse
    = TRUE
Enable_Bundle
    = TRUE
Use_Missing
    = TRUE
Zero_As_Missing
    = FALSE
Two_Round
    = FALSE
    # Convert Parameters
Convert_Model
    = NULL
Convert_Model_Language
    = 'cpp'
    # Objective Parameters # https://lightgbm.readthedocs.io/en/latest/Parameters.html#objective-
    # parameters
Boost_From_Average
    = TRUE
Alpha
    = 0.90
Fair_C
    = 1.0
Poisson_Max_Delta_Step
    = 0.70
Tweedie_Variance_Power
    = 1.5
Lambdarank_Truncation_Level
    = 30
    # Metric Parameters (metric is in Core) # https://lightgbm.readthedocs.io/en/latest/Parameters.html#m
    # parameters
Is_Provide_Training_Metric
    = TRUE,

```

```

Eval_At      = c(1,2,3,4,5)
              # Network Parameters # https://lightgbm.readthedocs.io/en/latest/Parameters.html#network-parameters
Num_Machines = 1
              # GPU Parameters
Gpu_Platform_Id
              = -1
Gpu_Device_Id = -1
Gpu_Use_Dp    = TRUE
Num_Gpu       = 1
TreeMethod    Choose from 'hist', 'gpu_hist'
#             https://lightgbm.readthedocs.io/en/latest/Parameters.html#gpu-parameters

```

**Value**

See examples

**Author(s)**

Adrian Antico

**See Also**

Other Automated Panel Data Forecasting: [AutoCatBoostCARMA\(\)](#), [AutoCatBoostHurdleCARMA\(\)](#), [AutoCatBoostVectorCARMA\(\)](#), [AutoH2OCARMA\(\)](#), [AutoLightGBMHurdleCARMA\(\)](#), [AutoXGBoostCARMA\(\)](#), [AutoXGBoostHurdleCARMA\(\)](#)

**Examples**

```

## Not run:

# Load data
data <- data.table::fread('https://www.dropbox.com/s/2str3ek4f4cheqi/walmart_train.csv?dl=1')

# Ensure series have no missing dates (also remove series with more than 25% missing values)
data <- RemixAutoML::TimeSeriesFill(
  data,
  DateColumnName = 'Date',
  GroupVariables = c('Store', 'Dept'),
  TimeUnit = 'weeks',
  FillType = 'maxmax',
  MaxMissingPercent = 0.25,
  SimpleImpute = TRUE)

# Set negative numbers to 0
data <- data[, Weekly_Sales := data.table::fifelse(Weekly_Sales < 0, 0, Weekly_Sales)]

# Remove IsHoliday column
data[, IsHoliday := NULL]

# Create xregs (this is the include the categorical variables instead of utilizing only the interaction of them)
xregs <- data[, .SD, .SDcols = c('Date', 'Store', 'Dept')]

```

```

# Change data types
data[, ':= ' (Store = as.character(Store), Dept = as.character(Dept))]
xregs[, ':= ' (Store = as.character(Store), Dept = as.character(Dept))]

# Build forecast
Results <- AutoLightGBMCARMA(

  # Data Artifacts
  data = data,
  NonNegativePred = FALSE,
  RoundPreds = FALSE,
  TargetColumnName = 'Weekly_Sales',
  DateColumnName = 'Date',
  HierarchGroups = NULL,
  GroupVariables = c('Store', 'Dept'),
  TimeUnit = 'weeks',
  TimeGroups = c('weeks', 'months'),

  # Data Wrangling Features
  EncodingMethod = 'binary',
  ZeroPadSeries = NULL,
  DataTruncate = FALSE,
  SplitRatios = c(1 - 10 / 138, 10 / 138),
  PartitionType = 'timeseries',
  AnomalyDetection = NULL,

  # Productionize
  FC_Periods = 0,
  TrainOnFull = FALSE,
  NThreads = 8,
  Timer = TRUE,
  DebugMode = FALSE,
  SaveDataPath = NULL,
  PDFOutputPath = NULL,

  # Target Transformations
  TargetTransformation = TRUE,
  Methods = c('BoxCox', 'Asinh', 'Asin', 'Log',
              'LogPlus1', 'Sqrt', 'Logit', 'YeoJohnson'),
  Difference = FALSE,

  # Features
  Lags = list('weeks' = seq(1L, 10L, 1L),
              'months' = seq(1L, 5L, 1L)),
  MA_Periods = list('weeks' = seq(5L, 20L, 5L),
                    'months' = seq(2L, 10L, 2L)),
  SD_Periods = NULL,
  Skew_Periods = NULL,
  Kurt_Periods = NULL,
  Quantile_Periods = NULL,
  Quantiles_Selected = c('q5', 'q95'),
  XREGS = xregs,
  FourierTerms = 4,
  CalendarVariables = c('week', 'wom', 'month', 'quarter'),
  HolidayVariable = c('USPublicHolidays', 'EasterGroup',
                     'ChristmasGroup', 'OtherEcclesticalFeasts'),
  HolidayLookback = NULL,

```



```

HolidayLags = 1,
HolidayMovingAverages = 1:2,
TimeTrendVariable = TRUE,

# ML eval args
TreeMethod = 'hist',
EvalMetric = 'RMSE',
LossFunction = 'reg:squarederror',

# Grid tuning args
GridTune = FALSE,
GridEvalMetric = 'mae',
ModelCount = 30L,
MaxRunsWithoutNewWinner = 20L,
MaxRunMinutes = 24L*60L,

# LightGBM Args
Device_Type = TaskType,
LossFunction = 'regression',
EvalMetric = 'MAE',
Input_Model = NULL,
Task = 'train',
Boosting = 'gbdt',
LinearTree = FALSE,
Trees = 1000,
ETA = 0.10,
Num_Leaves = 31,
Deterministic = TRUE,

# Learning Parameters
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#learning-control-parameters
Force_Col_Wise = FALSE,
Force_Row_Wise = FALSE,
Max_Depth = 6,
Min_Data_In_Leaf = 20,
Min_Sum_Hessian_In_Leaf = 0.001,
Bagging_Freq = 1.0,
Bagging_Fraction = 1.0,
Feature_Fraction = 1.0,
Feature_Fraction_Bynode = 1.0,
Lambda_L1 = 0.0,
Lambda_L2 = 0.0,
Extra_Trees = FALSE,
Early_Stopping_Round = 10,
First_Metric_Only = TRUE,
Max_Delta_Step = 0.0,
Linear_Lambda = 0.0,
Min_Gain_To_Split = 0,
Drop_Rate_Dart = 0.10,
Max_Drop_Dart = 50,
Skip_Drop_Dart = 0.50,
Uniform_Drop_Dart = FALSE,
Top_Rate_Goss = FALSE,
Other_Rate_Goss = FALSE,
Monotone_Constraints = NULL,
Monotone_Constraints_Method = 'advanced',
Monotone_Penalty = 0.0,

```

```

Forcedsplits_Filename = NULL, # use for AutoStack option; .json file
Refit_Decay_Rate = 0.90,
Path_Smooth = 0.0,

# IO Dataset Parameters
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#io-parameters
Max_Bin = 255,
Min_Data_In_Bin = 3,
Data_Random_Seed = 1,
Is_Enable_Sparse = TRUE,
Enable_Bundle = TRUE,
Use_Missing = TRUE,
Zero_As_Missing = FALSE,
Two_Round = FALSE,

# Convert Parameters
Convert_Model = NULL,
Convert_Model_Language = 'cpp',

# Objective Parameters
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#objective-parameters
Boost_From_Average = TRUE,
Alpha = 0.90,
Fair_C = 1.0,
Poisson_Max_Delta_Step = 0.70,
Tweedie_Variance_Power = 1.5,
Lambdarank_Truncation_Level = 30,

# Metric Parameters (metric is in Core)
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#metric-parameters
Is_Provide_Training_Metric = TRUE,
Eval_At = c(1,2,3,4,5),

# Network Parameters
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#network-parameters
Num_Machines = 1,

# GPU Parameters
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#gpu-parameters
Gpu_Platform_Id = -1,
Gpu_Device_Id = -1,
Gpu_Use_Dp = TRUE,
Num_Gpu = 1)

UpdateMetrics <- print(
  Results$ModelInformation$EvaluationMetrics[
    Metric == 'MSE', MetricValue := sqrt(MetricValue)])
print(UpdateMetrics)
Results$ModelInformation$EvaluationMetricsByGroup[order(-R2_Metric)]
Results$ModelInformation$EvaluationMetricsByGroup[order(MAE_Metric)]
Results$ModelInformation$EvaluationMetricsByGroup[order(MSE_Metric)]
Results$ModelInformation$EvaluationMetricsByGroup[order(MAPE_Metric)]

## End(Not run)

```

---

AutoLightGBMClassifier

*AutoLightGBMClassifier*


---

## Description

AutoLightGBMClassifier is an automated lightgbm modeling framework with grid-tuning and model evaluation that runs a variety of steps. First, the function will run a random grid tune over N number of models and find which model is the best (a default model is always included in that set). Once the model is identified and built, several other outputs are generated: validation data with predictions, evaluation plot, evaluation boxplot, evaluation metrics, variable importance, partial dependence calibration plots, partial dependence calibration box plots, and column names used in model fitting.

## Usage

```
AutoLightGBMClassifier(
  data = NULL,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = NULL,
  FeatureColNames = NULL,
  PrimaryDateColumn = NULL,
  IDcols = NULL,
  WeightsColumnName = NULL,
  CostMatrixWeights = c(1, 0, 0, 1),
  EncodingMethod = "credibility",
  OutputSelection = c("Importances", "EvalPlots", "EvalMetrics", "Score_TrainData"),
  model_path = NULL,
  metadata_path = NULL,
  DebugMode = FALSE,
  SaveInfoToPDF = FALSE,
  ModelID = "TestModel",
  ReturnFactorLevels = TRUE,
  ReturnModelObjects = TRUE,
  SaveModelObjects = FALSE,
  NumOfParDepPlots = 3L,
  Verbose = 0L,
  GridTune = FALSE,
  grid_eval_metric = "Utility",
  BaselineComparison = "default",
  MaxModelsInGrid = 10L,
  MaxRunsWithoutNewWinner = 20L,
  MaxRunMinutes = 24L * 60L,
  PassInGrid = NULL,
  input_model = NULL,
  task = "train",
  device_type = "CPU",
  NThreads = parallel::detectCores()/2,
  objective = "binary",
  metric = "binary_logloss",
```

```
boosting = "gbdt",
LinearTree = FALSE,
Trees = 50L,
eta = NULL,
num_leaves = 31,
deterministic = TRUE,
force_col_wise = FALSE,
force_row_wise = FALSE,
max_depth = NULL,
min_data_in_leaf = 20,
min_sum_hessian_in_leaf = 0.001,
bagging_freq = 0,
bagging_fraction = 1,
feature_fraction = 1,
feature_fraction_bynode = 1,
extra_trees = FALSE,
early_stopping_round = 10,
first_metric_only = TRUE,
max_delta_step = 0,
lambda_l1 = 0,
lambda_l2 = 0,
linear_lambda = 0,
min_gain_to_split = 0,
drop_rate_dart = 0.1,
max_drop_dart = 50,
skip_drop_dart = 0.5,
uniform_drop_dart = FALSE,
top_rate_goss = FALSE,
other_rate_goss = FALSE,
monotone_constraints = NULL,
monotone_constraints_method = "advanced",
monotone_penalty = 0,
forced_splits_filename = NULL,
refit_decay_rate = 0.9,
path_smooth = 0,
max_bin = 255,
min_data_in_bin = 3,
data_random_seed = 1,
is_enable_sparse = TRUE,
enable_bundle = TRUE,
use_missing = TRUE,
zero_as_missing = FALSE,
two_round = FALSE,
convert_model = NULL,
convert_model_language = "cpp",
boost_from_average = TRUE,
is_unbalance = FALSE,
scale_pos_weight = 1,
is_provide_training_metric = TRUE,
eval_at = c(1, 2, 3, 4, 5),
num_machines = 1,
gpu_platform_id = -1,
```

```

    gpu_device_id = -1,
    gpu_use_dp = TRUE,
    num_gpu = 1
)

```

## Arguments

<code>data</code>	This is your data set for training and testing your model
<code>TrainOnFull</code>	Set to TRUE to train on full data
<code>ValidationData</code>	This is your holdout data set used in modeling either refine your hyperparameters.
<code>TestData</code>	This is your holdout data set.
<code>TargetColumnName</code>	Either supply the target column name OR the column number where the target is located (but not mixed types).
<code>FeatureColNames</code>	Either supply the feature column names OR the column number where the target is located (but not mixed types)
<code>PrimaryDateColumn</code>	Supply a date or datetime column for catboost to utilize time as its basis for handling categorical features, instead of random shuffling
<code>IDcols</code>	A vector of column names or column numbers to keep in your data but not include in the modeling.
<code>WeightsColumnName</code>	Supply a column name for your weights column. Leave NULL otherwise
<code>EncodingMethod</code>	Choose from 'binary', 'm_estimator', 'credibility', 'woe', 'target_encoding', 'poly_encode', 'backward_difference', 'helmert'
<code>OutputSelection</code>	You can select what type of output you want returned. Choose from c("Importances", "EvalPlots", "EvalMetrics", "PDFs", "Score_TrainData")
<code>model_path</code>	A character string of your path file to where you want your output saved
<code>metadata_path</code>	A character string of your path file to where you want your model evaluation output saved. If left NULL, all output will be saved to model_path.
<code>DebugMode</code>	Set to TRUE to get a print out of the steps taken throughout the function
<code>SaveInfoToPDF</code>	Set to TRUE to save model insights to pdf
<code>ModelID</code>	A character string to name your model and output
<code>ReturnFactorLevels</code>	Set to TRUE to have the factor levels returned with the other model objects
<code>ReturnModelObjects</code>	Set to TRUE to output all modeling objects (E.g. plots and evaluation metrics)
<code>SaveModelObjects</code>	Set to TRUE to return all modeling objects to your environment
<code>NumOfParDepPlots</code>	Tell the function the number of partial dependence calibration plots you want to create.
<code>Verbose</code>	Set to 0 if you want to suppress model evaluation updates in training
<code>GridTune</code>	Set to TRUE to run a grid tuning procedure. Set a number in MaxModelsInGrid to tell the procedure how many models you want to test.

```

grid_eval_metric
    "mae", "mape", "rmse", "r2". Case sensitive
BaselineComparison
    Set to either "default" or "best". Default is to compare each successive model
    build to the baseline model using max trees (from function args). Best makes
    the comparison to the current best model.
    # Core parameters https://lightgbm.readthedocs.io/en/latest/Parameters.html#core-
    parameter
MaxModelsInGrid
    Number of models to test from grid options (243 total possible options)
MaxRunsWithoutNewWinner
    Runs without new winner to end procedure
MaxRunMinutes
    In minutes
PassInGrid
    Default is NULL. Provide a data.table of grid options from a previous run.
input_model
    = NULL, # continue training a model that is stored to fil
task
    'train' or 'refit'
device_type
    'cpu' or 'gpu'
NThreads
    only list up to number of cores, not threads. parallel::detectCores() / 2
objective
    'binary'
metric
    'binary_logloss', 'average_precision', 'auc', 'map', 'binary_error', 'auc_mu'
boosting
    'gbdt', 'rf', 'dart', 'goss'
LinearTree
    FALSE
Trees
    50L
eta
    NULL
num_leaves
    31
deterministic
    TRUE
    # Learning Parameters https://lightgbm.readthedocs.io/en/latest/Parameters.html#learning-
    control-parameter
force_col_wise
    FALSE
force_row_wise
    FALSE
max_depth
    NULL
min_data_in_leaf
    20
min_sum_hessian_in_leaf
    0.001
bagging_freq
    0
bagging_fraction
    1.0
feature_fraction
    1.0
feature_fraction_bynode
    1.0
extra_trees
    FALSE
early_stopping_round
    10

```

```

first_metric_only
    TRUE
max_delta_step 0.0
lambda_l1      0.0
lambda_l2      0.0
linear_lambda  0.0
min_gain_to_split
    0
drop_rate_dart 0.10
max_drop_dart  50
skip_drop_dart 0.50
uniform_drop_dart
    FALSE
top_rate_goss  FALSE
other_rate_goss
    FALSE
monotone_constraints
    "gbdt_prediction.cpp"
monotone_constraints_method
    'advanced'
monotone_penalty
    0.0
forced_splits_filename
    NULL # use for AutoStack option; json fil
refit_decay_rate
    0.90
path_smooth    0.0
               # IO Dataset Parameters https://lightgbm.readthedocs.io/en/latest/Parameters.html#io-
               parameters
max_bin        255
min_data_in_bin
    3
data_random_seed
    1
is_enable_sparse
    TRUE
enable_bundle  TRUE
use_missing    TRUE
zero_as_missing
    FALSE
two_round      FALSE
               # Convert Parameters # https://lightgbm.readthedocs.io/en/latest/Parameters.html#convert-
               parameters
convert_model  'gbdt_prediction.cpp'
convert_model_language
    'cpp'
               # Objective Parameters https://lightgbm.readthedocs.io/en/latest/Parameters.html#objective-
               parameters

```

```

boost_from_average      TRUE
is_unbalance            FALSE
scale_pos_weight        1.0
                        # Metric Parameters (metric is in Core)
is_provide_training_metric
                        TRUE
eval_at                 c(1,2,3,4,5)
                        # Network Parameter
num_machines            1
                        # GPU Parameter
gpu_platform_id         -1
gpu_device_id           -1
gpu_use_dp              TRUE
num_gpu                 1

```

**Value**

Saves to file and returned in list: VariableImportance.csv, Model, ValidationData.csv, Evaluation-Plot.png, EvaluationBoxPlot.png, EvaluationMetrics.csv, ParDepPlots.R a named list of features with partial dependence calibration plots, ParDepBoxPlots.R, GridCollect, and GridList

**Author(s)**

Adrian Antico

**See Also**

Other Automated Supervised Learning - Binary Classification: [AutoCatBoostClassifier\(\)](#), [AutoH2oDRFClassifier\(\)](#), [AutoH2oGAMClassifier\(\)](#), [AutoH2oGBMClassifier\(\)](#), [AutoH2oGLMClassifier\(\)](#), [AutoH2oMLClassifier\(\)](#), [AutoXGBoostClassifier\(\)](#)

**Examples**

```

## Not run:
# Create some dummy correlated data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 1000,
  ID = 2,
  ZIP = 0,
  AddDate = FALSE,
  Classification = TRUE,
  MultiClass = FALSE)

# Run function
TestModel <- RemixAutoML::AutoLightGBMClassifier(

  # Metadata args
  OutputSelection = c('Importances', 'EvalPlots', 'EvalMetrics', 'Score_TrainData'),

```



```

model_path = normalizePath("./"),
metadata_path = NULL,
ModelID = "Test_Model_1",
NumOfParDepPlots = 3L,
EncodingMethod = "credibility",
ReturnFactorLevels = TRUE,
ReturnModelObjects = TRUE,
SaveModelObjects = FALSE,
SaveInfoToPDF = FALSE,
DebugMode = FALSE,

# Data args
data = data,
TrainOnFull = FALSE,
ValidationData = NULL,
TestData = NULL,
TargetColumnName = "Adrian",
FeatureColNames = names(data)[!names(data) %in% c("IDcol_1", "IDcol_2", "Adrian")],
PrimaryDateColumn = NULL,
WeightsColumnName = NULL,
IDcols = c("IDcol_1", "IDcol_2"),

# Grid parameters
GridTune = FALSE,
grid_eval_metric = 'Utility',
BaselineComparison = 'default',
MaxModelsInGrid = 10L,
MaxRunsWithoutNewWinner = 20L,
MaxRunMinutes = 24L*60L,
PassInGrid = NULL,

# Core parameters
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#core-parameters
input_model = NULL, # continue training a model that is stored to file
task = "train",
device_type = 'CPU',
NThreads = parallel::detectCores() / 2,
objective = 'binary',
metric = 'binary_logloss',
boosting = 'gbdt',
LinearTree = FALSE,
Trees = 50L,
eta = NULL,
num_leaves = 31,
deterministic = TRUE,

# Learning Parameters
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#learning-control-parameters
force_col_wise = FALSE,
force_row_wise = FALSE,
max_depth = NULL,
min_data_in_leaf = 20,
min_sum_hessian_in_leaf = 0.001,
bagging_freq = 0,
bagging_fraction = 1.0,
feature_fraction = 1.0,
feature_fraction_bynode = 1.0,

```

```

extra_trees = FALSE,
early_stopping_round = 10,
first_metric_only = TRUE,
max_delta_step = 0.0,
lambda_l1 = 0.0,
lambda_l2 = 0.0,
linear_lambda = 0.0,
min_gain_to_split = 0,
drop_rate_dart = 0.10,
max_drop_dart = 50,
skip_drop_dart = 0.50,
uniform_drop_dart = FALSE,
top_rate_goss = FALSE,
other_rate_goss = FALSE,
monotone_constraints = NULL,
monotone_constraints_method = "advanced",
monotone_penalty = 0.0,
forced_splits_filename = NULL, # use for AutoStack option; .json file
refit_decay_rate = 0.90,
path_smooth = 0.0,

# IO Dataset Parameters
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#io-parameters
max_bin = 255,
min_data_in_bin = 3,
data_random_seed = 1,
is_enable_sparse = TRUE,
enable_bundle = TRUE,
use_missing = TRUE,
zero_as_missing = FALSE,
two_round = FALSE,

# Convert Parameters
convert_model = NULL,
convert_model_language = "cpp",

# Objective Parameters
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#objective-parameters
boost_from_average = TRUE,
is_unbalance = FALSE,
scale_pos_weight = 1.0,

# Metric Parameters (metric is in Core)
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#metric-parameters
is_provide_training_metric = TRUE,
eval_at = c(1,2,3,4,5),

# Network Parameters
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#network-parameters
num_machines = 1,

# GPU Parameters
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#gpu-parameters
gpu_platform_id = -1,
gpu_device_id = -1,
gpu_use_dp = TRUE,
num_gpu = 1)

```

```
## End(Not run)
```

---

```
AutoLightGBMFunnelCARMA
```

```
AutoLightGBMFunnelCARMA
```

---

## Description

AutoLightGBMFunnelCARMA is a forecasting model for cohort funnel forecasting for grouped data or non-grouped data

## Usage

```
AutoLightGBMFunnelCARMA(
  data,
  GroupVariables = NULL,
  BaseFunnelMeasure = NULL,
  ConversionMeasure = NULL,
  ConversionRateMeasure = NULL,
  CohortPeriodsVariable = NULL,
  CalendarDate = NULL,
  CohortDate = NULL,
  EncodingMethod = "credibility",
  OutputSelection = c("Importances", "EvalPlots", "EvalMetrics", "Score_TrainData"),
  WeightsColumnName = NULL,
  TruncateDate = NULL,
  PartitionRatios = c(0.7, 0.2, 0.1),
  TimeUnit = c("day"),
  CalendarTimeGroups = c("day", "week", "month"),
  CohortTimeGroups = c("day", "week", "month"),
  TransformTargetVariable = TRUE,
  TransformMethods = c("Identity", "YeoJohnson"),
  AnomalyDetection = list(tstat_high = 3, tstat_low = -2),
  Jobs = c("Evaluate", "Train"),
  SaveModelObjects = TRUE,
  ModelID = "Segment_ID",
  ModelPath = NULL,
  MetaDataPath = NULL,
  DebugMode = FALSE,
  CalendarVariables = c("wday", "mday", "yday", "week", "isoweek", "month", "quarter",
    "year"),
  HolidayGroups = c("USPublicHolidays", "EasterGroup", "ChristmasGroup",
    "OtherEcclesticalFeasts"),
  HolidayLookback = NULL,
  CohortHolidayLags = c(1L, 2L, 7L),
  CohortHolidayMovingAverages = c(3L, 7L),
  CalendarHolidayLags = c(1L, 2L, 7L),
  CalendarHolidayMovingAverages = c(3L, 7L),
  ImputeRollStats = -0.001,
  CalendarLags = list(day = c(1L, 7L, 21L), week = c(1L, 4L, 52L), month = c(1L, 6L,
```

```

    12L)),
CalendarMovingAverages = list(day = c(1L, 7L, 21L), week = c(1L, 4L, 52L), month =
    c(1L, 6L, 12L)),
CalendarStandardDeviations = NULL,
CalendarSkews = NULL,
CalendarKurts = NULL,
CalendarQuantiles = NULL,
CalendarQuantilesSelected = "q50",
CohortLags = list(day = c(1L, 7L, 21L), week = c(1L, 4L, 52L), month = c(1L, 6L,
    12L)),
CohortMovingAverages = list(day = c(1L, 7L, 21L), week = c(1L, 4L, 52L), month =
    c(1L, 6L, 12L)),
CohortStandardDeviations = NULL,
CohortSkews = NULL,
CohortKurts = NULL,
CohortQuantiles = NULL,
CohortQuantilesSelected = "q50",
PassInGrid = NULL,
GridTune = FALSE,
BaselineComparison = "default",
MaxModelsInGrid = 25L,
MaxRunMinutes = 180L,
MaxRunsWithoutNewWinner = 10L,
LossFunction = "regression",
EvalMetric = "mae",
GridEvalMetric = "mae",
NumOfParDepPlots = 1L,
Device_Type = "CPU",
Input_Model = NULL,
Task = "train",
Boosting = "gbdt",
LinearTree = FALSE,
Trees = 1000,
ETA = 0.1,
Num_Leaves = 31,
Deterministic = TRUE,
NThreads = parallel::detectCores()/2,
SaveInfoToPDF = FALSE,
Force_Col_Wise = FALSE,
Force_Row_Wise = FALSE,
Max_Depth = 6,
Min_Data_In_Leaf = 20,
Min_Sum_Hessian_In_Leaf = 0.001,
Bagging_Freq = 1,
Bagging_Fraction = 1,
Feature_Fraction = 1,
Feature_Fraction_Bynode = 1,
Lambda_L1 = 0,
Lambda_L2 = 0,
Extra_Trees = FALSE,
Early_Stopping_Round = 10,
First_Metric_Only = TRUE,

```

```

    Max_Delta_Step = 0,
    Linear_Lambda = 0,
    Min_Gain_To_Split = 0,
    Drop_Rate_Dart = 0.1,
    Max_Drop_Dart = 50,
    Skip_Drop_Dart = 0.5,
    Uniform_Drop_Dart = FALSE,
    Top_Rate_Goss = FALSE,
    Other_Rate_Goss = FALSE,
    Monotone_Constraints = NULL,
    Monotone_Constraints_method = "advanced",
    Monotone_Penalty = 0,
    Forcedsplits_Filename = NULL,
    Refit_Decay_Rate = 0.9,
    Path_Smooth = 0,
    Max_Bin = 255,
    Min_Data_In_Bin = 3,
    Data_Random_Seed = 1,
    Is_Enable_Sparse = TRUE,
    Enable_Bundle = TRUE,
    Use_Missing = TRUE,
    Zero_As_Missing = FALSE,
    Two_Round = FALSE,
    Convert_Model = NULL,
    Convert_Model_Language = "cpp",
    Boost_From_Average = TRUE,
    Alpha = 0.9,
    Fair_C = 1,
    Poisson_Max_Delta_Step = 0.7,
    Tweedie_Variance_Power = 1.5,
    Lambdarank_Truncation_Level = 30,
    Is_Provide_Training_Metric = TRUE,
    Eval_At = c(1, 2, 3, 4, 5),
    Num_Machines = 1,
    Gpu_Platform_Id = -1,
    Gpu_Device_Id = -1,
    Gpu_Use_Dp = TRUE,
    Num_Gpu = 1
)

```

## Arguments

**data** data object

**BaseFunnelMeasure**

E.g. "Leads". This value should be a forward looking variable. Say you want to forecast ConversionMeasure 2 months into the future. You should have two months into the future of values of BaseFunnelMeasure

**ConversionMeasure**

E.g. "Conversions". Rate is derived as conversions over leads by cohort periods out

**ConversionRateMeasure**

Conversions over Leads for every cohort

CohortPeriodsVariable	Numeric. Numerical value of the the number of periods since cohort base date.
CalendarDate	The name of your date column that represents the calendar date
CohortDate	The name of your date column that represents the cohort date
OutputSelection	<code>= c('Importances', 'EvalPlots', 'EvalMetrics', 'Score_TrainData')</code>
WeightsColumnName	<code>= NULL</code>
TruncateDate	NULL. Supply a date to represent the earliest point in time you want in your data. Filtering takes place before partitioning data so feature engineering can include as many non null values as possible.
PartitionRatios	Requires three values for train, validation, and test data sets
TimeUnit	Base time unit of data. "days", "weeks", "months", "quarters", "years"
CalendarTimeGroups	TimeUnit value must be included. If you want to generate lags and moving averages in several time based aggregations, choose from "days", "weeks", "months", "quarters", "years".
CohortTimeGroups	TimeUnit value must be included. If you want to generate lags and moving averages in several time based aggregations, choose from "days", "weeks", "months", "quarters", "years".
TransformTargetVariable	TRUE or FALSE
TransformMethods	Choose from "Identity", "BoxCox", "Asinh", "Asin", "Log", "LogPlus1", "Logit", "YeoJohnson"
AnomalyDetection	Provide a named list. See examples
Jobs	Default is "eval" and "train"
SaveModelObjects	Set to TRUE to return all modeling objects to your environment
ModelID	A character string to name your model and output
ModelPath	Path to where you want your models saved
MetaDataPath	Path to where you want your metadata saved. If NULL, function will try ModelPath if it is not NULL.
DebugMode	Internal use
CalendarVariables	"wday", "mday", "yday", "week", "isoweek", "month", "quarter", "year"
HolidayGroups	<code>c("USPublicHolidays", "EasterGroup", "ChristmasGroup", "OtherEcclesticalFeasts")</code>
HolidayLookback	Number of days in range to compute number of holidays from a given date in the data. If NULL, the number of days are computed for you.
CohortHolidayLags	<code>c(1L, 2L, 7L),</code>
CohortHolidayMovingAverages	<code>c(3L, 7L),</code>

CalendarHolidayLags	c(1L, 2L, 7L),
CalendarHolidayMovingAverages	= c(3L, 7L),
ImputeRollStats	Constant value to fill NA after running AutoLagRollStats()
CalendarLags	List of the form list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))
CalendarMovingAverages	List of the form list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))
CalendarStandardDeviations	List of the form list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))
CalendarSkews	List of the form list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))
CalendarKurts	List of the form list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))
CalendarQuantiles	List of the form list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))
CalendarQuantilesSelected	Supply a vector of "q5", "q10", "q15", "q20", "q25", "q30", "q35", "q40", "q45", "q50", "q55", "q60", "q65", "q70", "q75", "q80", "q85", "q90", "q95"
CohortLags	List of the form list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))
CohortMovingAverages	List of the form list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))
CohortStandardDeviations	List of the form list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))
CohortSkews	List of the form list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))
CohortKurts	List of the form list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))
CohortQuantiles	List of the form list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))
CohortQuantilesSelected	Supply a vector of "q5", "q10", "q15", "q20", "q25", "q30", "q35", "q40", "q45", "q50", "q55", "q60", "q65", "q70", "q75", "q80", "q85", "q90", "q95" # Grid tuning
PassInGrid	Defaults to NULL. Pass in a single row of grid from a previous output as a data.table (they are collected as data.tables)
GridTune	Set to TRUE to run a grid tuning procedure. Set a number in MaxModelsInGrid to tell the procedure how many models you want to test.

## BaselineComparison

Set to either "default" or "best". Default is to compare each successive model build to the baseline model using max trees (from function args). Best makes the comparison to the current best model.

## MaxModelsInGrid

Number of models to test from grid options

MaxRunMinutes Maximum number of minutes to let this run

## MaxRunsWithoutNewWinner

Number of models built before calling it quits

# ML Args begin

LossFunction = 'regression'

EvalMetric = 'mae'

## NumOfParDepPlots

Tell the function the number of partial dependence calibration plots you want to create. Calibration boxplots will only be created for numerical features (not dummy variables)

Device\_Type = 'CPU'

Input\_Model = NULL

Task = 'train'

Boosting = 'gbdt'

LinearTree = FALSE

Trees = 1000

ETA = 0.10

Num\_Leaves = 31

Deterministic = TRUE

# Learning Parameters # <https://lightgbm.readthedocs.io/en/latest/Parameters.html#learning-control-parameters>

NThreads = parallel::detectCores() / 2

Force\_Col\_Wise = FALSE

Force\_Row\_Wise = FALSE

Max\_Depth = 6

## Min\_Data\_In\_Leaf

= 20

## Min\_Sum\_Hessian\_In\_Leaf

= 0.001

Bagging\_Freq = 1.0

## Bagging\_Fraction

= 1.0

## Feature\_Fraction

= 1.0

## Feature\_Fraction\_Bynode

= 1.0

Lambda\_L1 = 0.0

Lambda\_L2 = 0.0

Extra\_Trees = FALSE



```

Early_Stopping_Round
    = 10
First_Metric_Only
    = TRUE
Max_Delta_Step = 0.0
Linear_Lambda  = 0.0
Min_Gain_To_Split
    = 0
Drop_Rate_Dart = 0.10
Max_Drop_Dart  = 50
Skip_Drop_Dart = 0.50
Uniform_Drop_Dart
    = FALSE
Top_Rate_Goss  = FALSE
Other_Rate_Goss
    = FALSE
Monotone_Constraints
    = NULL
Monotone_Constraints_method
    = 'advanced'
Monotone_Penalty
    = 0.0
Forced_splits_Filename
    = NULL
Refit_Decay_Rate
    = 0.90
Path_Smooth    = 0.0
                # IO Dataset Parameters # https://lightgbm.readthedocs.io/en/latest/Parameters.html#io-
                parameters
Max_Bin        = 255
Min_Data_In_Bin
    = 3
Data_Random_Seed
    = 1
Is_Enable_Sparse
    = TRUE
Enable_Bundle  = TRUE
Use_Missing    = TRUE
Zero_As_Missing
    = FALSE
Two_Round      = FALSE
                # Convert Parameters
Convert_Model  = NULL
Convert_Model_Language
    = 'cpp'
                # Objective Parameters # https://lightgbm.readthedocs.io/en/latest/Parameters.html#objective-
                parameters

```

```

Boost_From_Average
      = TRUE
Alpha
      = 0.90
Fair_C
      = 1.0
Poisson_Max_Delta_Step
      = 0.70
Tweedie_Variance_Power
      = 1.5
Lambdarank_Truncation_Level
      = 30
      # Metric Parameters (metric is in Core) # https://lightgbm.readthedocs.io/en/latest/Parameters.html#metric-parameters
Is_Provide_Training_Metric
      = TRUE,
Eval_At
      = c(1,2,3,4,5)
      # Network Parameters # https://lightgbm.readthedocs.io/en/latest/Parameters.html#network-parameters
Num_Machines
      = 1
      # GPU Parameters
Gpu_Platform_Id
      = -1
Gpu_Device_Id
      = -1
Gpu_Use_Dp
      = TRUE
Num_Gpu
      = 1
#
      https://lightgbm.readthedocs.io/en/latest/Parameters.html#gpu-parameters

```

**Author(s)**

Adrian Antico

**See Also**

Other Automated Funnel Data Forecasting: [AutoCatBoostFunnelCARMAScoring\(\)](#), [AutoCatBoostFunnelCARMA\(\)](#), [AutoLightGBMFunnelCARMAScoring\(\)](#), [AutoXGBoostFunnelCARMAScoring\(\)](#), [AutoXGBoostFunnelCARMA\(\)](#)

**Examples**

```

## Not run:
# Create Fake Data
data <- RemixAutoML::FakeDataGenerator(ChainLadderData = TRUE)

# Subset data for training
ModelDataBase <- data[CalendarDateColumn < '2020-01-01' & CohortDateColumn < '2020-01-01']
ModelData <- data.table::copy(ModelDataBase)

# Train Funne Model
TestModel <- RemixAutoML::AutoLightGBMFunnelCARMA(

  # Data Arguments
  data = ModelData,
  GroupVariables = NULL,

```

```

BaseFunnelMeasure = "Leads", # if you have XREGS, supply vector such as c("Leads", "XREGS1", "XREGS2")
ConversionMeasure = "Appointments",
ConversionRateMeasure = NULL,
CohortPeriodsVariable = "CohortDays",
WeightsColumnName = NULL,
CalendarDate = "CalendarDateColumn",
CohortDate = "CohortDateColumn",
PartitionRatios = c(0.70,0.20,0.10),
TruncateDate = NULL,
TimeUnit = "days",
TransformTargetVariable = TRUE,
TransformMethods = c("Asinh","Asin","Log","LogPlus1","Sqrt","Logit"),
AnomalyDetection = list(tstat_high = 3, tstat_low = -2),

# MetaData Arguments
Jobs = c("eval","train"),
SaveModelObjects = FALSE,
ModelID = "ModelTest",
ModelPath = getwd(),
MetaDataPath = NULL,
DebugMode = TRUE,
NumOfParDepPlots = 1L,
EncodingMethod = "credibility",
NThreads = parallel::detectCores(),

# Feature Engineering Arguments
CalendarTimeGroups = c("days","weeks","months"),
CohortTimeGroups = c("days", "weeks"),
CalendarVariables = c("wday","mday","yday","week","month","quarter","year"),
HolidayGroups = c("USPublicHolidays","EasterGroup","ChristmasGroup","OtherEcclesticalFeasts"),
HolidayLookback = NULL,
CohortHolidayLags = c(1L,2L,7L),
CohortHolidayMovingAverages = c(3L,7L),
CalendarHolidayLags = c(1L,2L,7L),
CalendarHolidayMovingAverages = c(3L,7L),

# Time Series Features
ImputeRollStats = -0.001,
CalendarLags = list("day" = c(1L,2L,7L,35L,42L), "week" = c(5L,6L,10L,12L,25L,26L)),
CalendarMovingAverages = list("day" = c(7L,14L,35L,42L), "week" = c(5L,6L,10L,12L,20L,24L), "month" = c(6L,12L,24L,36L)),
CalendarStandardDeviations = NULL,
CalendarSkews = NULL,
CalendarKurts = NULL,
CalendarQuantiles = NULL,
CalendarQuantilesSelected = "q50",
CohortLags = list("day" = c(1L,2L,7L,35L,42L), "week" = c(5L,6L)),
CohortMovingAverages = list("day" = c(7L,14L,35L,42L), "week" = c(5L,6L), "month" = c(1L,2L)),
CohortStandardDeviations = NULL,
CohortSkews = NULL,
CohortKurts = NULL,
CohortQuantiles = NULL,
CohortQuantilesSelected = "q50",

# ML Grid Tuning
PassInGrid = NULL,
GridTune = FALSE,
BaselineComparison = "default",

```

```

MaxModelsInGrid = 25L,
MaxRunMinutes = 180L,
MaxRunsWithoutNewWinner = 10L,

# ML Setup Parameters
LossFunction = 'regression',
EvalMetric = 'mae',
GridEvalMetric = 'mae',

# LightGBM Args
Device_Type = 'CPU',
Input_Model = NULL,
Task = 'train',
Boosting = 'gbdt',
LinearTree = FALSE,
Trees = 50,
ETA = 0.10,
Num_Leaves = 31,
Deterministic = TRUE,

# Learning Parameters
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#learning-control-parameters
Force_Col_Wise = FALSE,
Force_Row_Wise = FALSE,
Max_Depth = 6,
Min_Data_In_Leaf = 20,
Min_Sum_Hessian_In_Leaf = 0.001,
Bagging_Freq = 1.0,
Bagging_Fraction = 1.0,
Feature_Fraction = 1.0,
Feature_Fraction_Bynode = 1.0,
Lambda_L1 = 0.0,
Lambda_L2 = 0.0,
Extra_Trees = FALSE,
Early_Stopping_Round = 10,
First_Metric_Only = TRUE,
Max_Delta_Step = 0.0,
Linear_Lambda = 0.0,
Min_Gain_To_Split = 0,
Drop_Rate_Dart = 0.10,
Max_Drop_Dart = 50,
Skip_Drop_Dart = 0.50,
Uniform_Drop_Dart = FALSE,
Top_Rate_Goss = FALSE,
Other_Rate_Goss = FALSE,
Monotone_Constraints = NULL,
Monotone_Constraints_method = 'advanced',
Monotone_Penalty = 0.0,
Forcedsplits_Filename = NULL, # use for AutoStack option; .json file
Refit_Decay_Rate = 0.90,
Path_Smooth = 0.0,

# IO Dataset Parameters
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#io-parameters
Max_Bin = 255,
Min_Data_In_Bin = 3,
Data_Random_Seed = 1,

```

```

Is_Enable_Sparse = TRUE,
Enable_Bundle = TRUE,
Use_Missing = TRUE,
Zero_As_Missing = FALSE,
Two_Round = FALSE,

# Convert Parameters
Convert_Model = NULL,
Convert_Model_Language = 'cpp',

# Objective Parameters
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#objective-parameters
Boost_From_Average = TRUE,
Alpha = 0.90,
Fair_C = 1.0,
Poisson_Max_Delta_Step = 0.70,
Tweedie_Variance_Power = 1.5,
Lambdarank_Truncation_Level = 30,

# Metric Parameters (metric is in Core)
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#metric-parameters
Is_Provide_Training_Metric = TRUE,
Eval_At = c(1,2,3,4,5),

# Network Parameters
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#network-parameters
Num_Machines = 1,

# GPU Parameters
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#gpu-parameters
Gpu_Platform_Id = -1,
Gpu_Device_Id = -1,
Gpu_Use_Dp = TRUE,
Num_Gpu = 1)

# Separate out the Base Funnel Measures Data
LeadsData <- data[, lapply(.SD, data.table::first), .SDcols = c("Leads"), by = c("CalendarDateColumn")]
ModelData <- ModelDataBase[, Leads := NULL]

# Forecast Funnel Model
Test <- RemixAutoML::AutoLightGBMFunnelCARMAScoring(
  TrainData = ModelData,
  ForwardLookingData = LeadsData,
  TrainEndDate = ModelData[, max(CalendarDateColumn)],
  ForecastEndDate = LeadsData[, max(CalendarDateColumn)],
  TrainOutput = TestModel$ModelOutput,
  ArgsList = TestModel$ArgsList,
  ModelPath = NULL,
  MaxCohortPeriod = 15,
  DebugMode = TRUE)

## End(Not run)

```

---

AutoLightGBMFunnelCARMAScoring

*AutoLightGBMFunnelCARMAScoring*


---

**Description**

AutoLightGBMFunnelCARMAScoring for generating forecasts

**Usage**

```
AutoLightGBMFunnelCARMAScoring(
  TrainData,
  ForwardLookingData = NULL,
  TrainEndDate = NULL,
  ForecastEndDate = NULL,
  ArgsList = NULL,
  TrainOutput = NULL,
  ModelPath = NULL,
  MaxCohortPeriod = NULL,
  DebugMode = FALSE
)
```

**Arguments**

TrainData	Data utilized in training. Do not put the BaseFunnelMeasure in this data set. Put it in the ForwardLookingData object
ForwardLookingData	Base funnel measure data. Needs to cover the span of the forecast horizon
TrainEndDate	Max date from the training data
ForecastEndDate	Max date to forecast out to
ArgsList	Output list from AutoCatBoostFunnelCARMA
TrainOutput	Pass in the model object to speed up forecasting
ModelPath	Path to model location
MaxCohortPeriod	Max cohort periods to utilize when forecasting
DebugMode	For debugging issues

**Author(s)**

Adrian Antico

**See Also**

Other Automated Funnel Data Forecasting: [AutoCatBoostFunnelCARMAScoring\(\)](#), [AutoCatBoostFunnelCARMA\(\)](#), [AutoLightGBMFunnelCARMA\(\)](#), [AutoXGBoostFunnelCARMAScoring\(\)](#), [AutoXGBoostFunnelCARMA\(\)](#)

**Examples**

```
## Not run:
# Create Fake Data
data <- RemixAutoML::FakeDataGenerator(ChainLadderData = TRUE)

# Subset data for training
ModelDataBase <- data[CalendarDateColumn < '2020-01-01' & CohortDateColumn < '2020-01-01']
ModelData <- data.table::copy(ModelDataBase)
```

```

# Train Funne Model
TestModel <- RemixAutoML::AutoLightGBMFunnelCARMA(

  # Data Arguments
  data = ModelData,
  GroupVariables = NULL,
  BaseFunnelMeasure = "Leads", # if you have XREGS, supply vector such as c("Leads", "XREGS1", "XREGS2")
  ConversionMeasure = "Appointments",
  ConversionRateMeasure = NULL,
  CohortPeriodsVariable = "CohortDays",
  WeightsColumnName = NULL,
  CalendarDate = "CalendarDateColumn",
  CohortDate = "CohortDateColumn",
  PartitionRatios = c(0.70,0.20,0.10),
  TruncateDate = NULL,
  TimeUnit = "days",
  TransformTargetVariable = TRUE,
  TransformMethods = c("Asinh","Asin","Log","LogPlus1","Sqrt","Logit"),
  AnomalyDetection = list(tstat_high = 3, tstat_low = -2),

  # MetaData Arguments
  Jobs = c("eval","train"),
  SaveModelObjects = FALSE,
  ModelID = "ModelTest",
  ModelPath = getwd(),
  MetaDataPath = NULL,
  DebugMode = TRUE,
  NumOfParDepPlots = 1L,
  EncodingMethod = "credibility",
  NThreads = parallel::detectCores(),

  # Feature Engineering Arguments
  CalendarTimeGroups = c("days","weeks","months"),
  CohortTimeGroups = c("days", "weeks"),
  CalendarVariables = c("wday","mday","yday","week","month","quarter","year"),
  HolidayGroups = c("USPublicHolidays","EasterGroup","ChristmasGroup","OtherEcclesticalFeasts"),
  HolidayLookback = NULL,
  CohortHolidayLags = c(1L,2L,7L),
  CohortHolidayMovingAverages = c(3L,7L),
  CalendarHolidayLags = c(1L,2L,7L),
  CalendarHolidayMovingAverages = c(3L,7L),

  # Time Series Features
  ImputeRollStats = -0.001,
  CalendarLags = list("day" = c(1L,2L,7L,35L,42L), "week" = c(5L,6L,10L,12L,25L,26L)),
  CalendarMovingAverages = list("day" = c(7L,14L,35L,42L), "week" = c(5L,6L,10L,12L,20L,24L), "month" = c(6L,12L,24L)),
  CalendarStandardDeviations = NULL,
  CalendarSkews = NULL,
  CalendarKurts = NULL,
  CalendarQuantiles = NULL,
  CalendarQuantilesSelected = "q50",
  CohortLags = list("day" = c(1L,2L,7L,35L,42L), "week" = c(5L,6L)),
  CohortMovingAverages = list("day" = c(7L,14L,35L,42L), "week" = c(5L,6L), "month" = c(1L,2L)),
  CohortStandardDeviations = NULL,
  CohortSkews = NULL,
  CohortKurts = NULL,
  CohortQuantiles = NULL,

```

```

CohortQuantilesSelected = "q50",

# ML Grid Tuning
PassInGrid = NULL,
GridTune = FALSE,
BaselineComparison = "default",
MaxModelsInGrid = 25L,
MaxRunMinutes = 180L,
MaxRunsWithoutNewWinner = 10L,

# ML Setup Parameters
LossFunction = 'regression',
EvalMetric = 'mae',
GridEvalMetric = 'mae',

# LightGBM Args
Device_Type = 'CPU',
Input_Model = NULL,
Task = 'train',
Boosting = 'gbdt',
LinearTree = FALSE,
Trees = 50,
ETA = 0.10,
Num_Leaves = 31,
Deterministic = TRUE,

# Learning Parameters
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#learning-control-parameters
Force_Col_Wise = FALSE,
Force_Row_Wise = FALSE,
Max_Depth = 6,
Min_Data_In_Leaf = 20,
Min_Sum_Hessian_In_Leaf = 0.001,
Bagging_Freq = 1.0,
Bagging_Fraction = 1.0,
Feature_Fraction = 1.0,
Feature_Fraction_Bynode = 1.0,
Lambda_L1 = 0.0,
Lambda_L2 = 0.0,
Extra_Trees = FALSE,
Early_Stopping_Round = 10,
First_Metric_Only = TRUE,
Max_Delta_Step = 0.0,
Linear_Lambda = 0.0,
Min_Gain_To_Split = 0,
Drop_Rate_Dart = 0.10,
Max_Drop_Dart = 50,
Skip_Drop_Dart = 0.50,
Uniform_Drop_Dart = FALSE,
Top_Rate_Goss = FALSE,
Other_Rate_Goss = FALSE,
Monotone_Constraints = NULL,
Monotone_Constraints_method = 'advanced',
Monotone_Penalty = 0.0,
Forced_splits_Filename = NULL, # use for AutoStack option; .json file
Refit_Decay_Rate = 0.90,
Path_Smooth = 0.0,

```



```

# IO Dataset Parameters
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#io-parameters
Max_Bin = 255,
Min_Data_In_Bin = 3,
Data_Random_Seed = 1,
Is_Enable_Sparse = TRUE,
Enable_Bundle = TRUE,
Use_Missing = TRUE,
Zero_As_Missing = FALSE,
Two_Round = FALSE,

# Convert Parameters
Convert_Model = NULL,
Convert_Model_Language = 'cpp',

# Objective Parameters
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#objective-parameters
Boost_From_Average = TRUE,
Alpha = 0.90,
Fair_C = 1.0,
Poisson_Max_Delta_Step = 0.70,
Tweedie_Variance_Power = 1.5,
Lambdarank_Truncation_Level = 30,

# Metric Parameters (metric is in Core)
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#metric-parameters
Is_Provide_Training_Metric = TRUE,
Eval_At = c(1,2,3,4,5),

# Network Parameters
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#network-parameters
Num_Machines = 1,

# GPU Parameters
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#gpu-parameters
Gpu_Platform_Id = -1,
Gpu_Device_Id = -1,
Gpu_Use_Dp = TRUE,
Num_Gpu = 1)

# Separate out the Base Funnel Measures Data
LeadsData <- data[, lapply(.SD, data.table::first), .SDcols = c("Leads"), by = c("CalendarDateColumn")]
ModelData <- ModelDataBase[, Leads := NULL]

# Forecast Funnel Model
Test <- RemixAutoML::AutoLightGBMFunnelCARMAScoring(
  TrainData = ModelData,
  ForwardLookingData = LeadsData,
  TrainEndDate = ModelData[, max(CalendarDateColumn)],
  ForecastEndDate = LeadsData[, max(CalendarDateColumn)],
  TrainOutput = TestModel$ModelOutput,
  ArgsList = TestModel$ArgsList,
  ModelPath = NULL,
  MaxCohortPeriod = 15,
  DebugMode = TRUE)

```

```
## End(Not run)
```

---

```
AutoLightGBMHurdleCARMA
```

```
AutoLightGBMHurdleCARMA
```

---

## Description

AutoLightGBMHurdleCARMA is an intermittent demand, Multivariate Forecasting algorithms with calendar variables, Holiday counts, holiday lags, holiday moving averages, differencing, transformations, interaction-based categorical encoding using target variable and features to generate various time-based aggregated lags, moving averages, moving standard deviations, moving skewness, moving kurtosis, moving quantiles, parallelized interaction-based fourier pairs by grouping variables, and Trend Variables.

## Usage

```
AutoLightGBMHurdleCARMA(
  data,
  NonNegativePred = FALSE,
  Threshold = NULL,
  RoundPreds = FALSE,
  TrainOnFull = FALSE,
  TargetColumnName = "Target",
  DateColumnName = "DateTime",
  HierarchGroups = NULL,
  GroupVariables = NULL,
  EncodingMethod = "credibility",
  TimeWeights = 1,
  FC_Periods = 30,
  TimeUnit = "week",
  TimeGroups = c("weeks", "months"),
  NumOfParDepPlots = 10L,
  TargetTransformation = FALSE,
  Methods = c("BoxCox", "Asinh", "Log", "LogPlus1", "Sqrt", "Asin", "Logit"),
  AnomalyDetection = NULL,
  XREGS = NULL,
  Lags = c(1L:5L),
  MA_Periods = c(2L:5L),
  SD_Periods = NULL,
  Skew_Periods = NULL,
  Kurt_Periods = NULL,
  Quantile_Periods = NULL,
  Quantiles_Selected = c("q5", "q95"),
  Difference = TRUE,
  FourierTerms = 6L,
  CalendarVariables = c("second", "minute", "hour", "wday", "mday", "yday", "week",
    "wom", "isoweek", "month", "quarter", "year"),
  HolidayVariable = c("USPublicHolidays", "EasterGroup", "ChristmasGroup",
    "OtherEcclesticalFeasts"),
```

```

HolidayLookback = NULL,
HolidayLags = 1L,
HolidayMovingAverages = 1L:2L,
TimeTrendVariable = FALSE,
ZeroPadSeries = NULL,
DataTruncate = FALSE,
SplitRatios = c(0.7, 0.2, 0.1),
PartitionType = "timeseries",
Timer = TRUE,
DebugMode = FALSE,
EvalMetric = "RMSE",
GridTune = FALSE,
PassInGrid = NULL,
ModelCount = 100,
MaxRunsWithoutNewWinner = 50,
MaxRunMinutes = 24L * 60L,
input_model = list(classifier = NULL, regression = NULL),
task = list(classifier = "train", regression = "train"),
device_type = list(classifier = "CPU", regression = "CPU"),
objective = list(classifier = "binary", regression = "regression"),
metric = list(classifier = "binary_logloss", regression = "rmse"),
boosting = list(classifier = "gbdt", regression = "gbdt"),
LinearTree = list(classifier = FALSE, regression = FALSE),
Trees = list(classifier = 1000L, regression = 1000L),
eta = list(classifier = NULL, regression = NULL),
num_leaves = list(classifier = 31, regression = 31),
deterministic = list(classifier = TRUE, regression = TRUE),
force_col_wise = list(classifier = FALSE, regression = FALSE),
force_row_wise = list(classifier = FALSE, regression = FALSE),
max_depth = list(classifier = NULL, regression = NULL),
min_data_in_leaf = list(classifier = 20, regression = 20),
min_sum_hessian_in_leaf = list(classifier = 0.001, regression = 0.001),
bagging_freq = list(classifier = 0, regression = 0),
bagging_fraction = list(classifier = 1, regression = 1),
feature_fraction = list(classifier = 1, regression = 1),
feature_fraction_bynode = list(classifier = 1, regression = 1),
extra_trees = list(classifier = FALSE, regression = FALSE),
early_stopping_round = list(classifier = 10, regression = 10),
first_metric_only = list(classifier = TRUE, regression = TRUE),
max_delta_step = list(classifier = 0, regression = 0),
lambda_l1 = list(classifier = 0, regression = 0),
lambda_l2 = list(classifier = 0, regression = 0),
linear_lambda = list(classifier = 0, regression = 0),
min_gain_to_split = list(classifier = 0, regression = 0),
drop_rate_dart = list(classifier = 0.1, regression = 0.1),
max_drop_dart = list(classifier = 50, regression = 50),
skip_drop_dart = list(classifier = 0.5, regression = 0.5),
uniform_drop_dart = list(classifier = FALSE, regression = FALSE),
top_rate_goss = list(classifier = FALSE, regression = FALSE),
other_rate_goss = list(classifier = FALSE, regression = FALSE),
monotone_constraints = list(classifier = NULL, regression = NULL),
monotone_constraints_method = list(classifier = "advanced", regression = "advanced"),

```

```

monotone_penalty = list(classifier = 0, regression = 0),
forced_splits_filename = list(classifier = NULL, regression = NULL),
refit_decay_rate = list(classifier = 0.9, regression = 0.9),
path_smooth = list(classifier = 0, regression = 0),
max_bin = list(classifier = 255, regression = 255),
min_data_in_bin = list(classifier = 3, regression = 3),
data_random_seed = list(classifier = 1, regression = 1),
is_enable_sparse = list(classifier = TRUE, regression = TRUE),
enable_bundle = list(classifier = TRUE, regression = TRUE),
use_missing = list(classifier = TRUE, regression = TRUE),
zero_as_missing = list(classifier = FALSE, regression = FALSE),
two_round = list(classifier = FALSE, regression = FALSE),
convert_model = list(classifier = NULL, regression = NULL),
convert_model_language = list(classifier = "cpp", regression = "cpp"),
boost_from_average = list(classifier = TRUE, regression = TRUE),
is_unbalance = list(classifier = FALSE, regression = FALSE),
scale_pos_weight = list(classifier = 1, regression = 1),
is_provide_training_metric = list(classifier = TRUE, regression = TRUE),
eval_at = list(classifier = c(1, 2, 3, 4, 5), regression = c(1, 2, 3, 4, 5)),
num_machines = list(classifier = 1, regression = 1),
gpu_platform_id = list(classifier = -1, regression = -1),
gpu_device_id = list(classifier = -1, regression = -1),
gpu_use_dp = list(classifier = TRUE, regression = TRUE),
num_gpu = list(classifier = 1, regression = 1)
)

```

## Arguments

data	Supply your full series data set here
NonNegativePred	TRUE or FALSE
Threshold	Select confusion matrix measure to optimize for pulling in threshold. Choose from 'MCC', 'Acc', 'TPR', 'TNR', 'FNR', 'FPR', 'FDR', 'FOR', 'F1_Score', 'F2_Score', 'F0.5_Score', 'NPV', 'PPV', 'ThreatScore', 'Utility'
RoundPreds	Rounding predictions to an integer value. TRUE or FALSE. Defaults to FALSE
TrainOnFull	Set to TRUE to train on full data
TargetColumnName	List the column name of your target variables column. E.g. 'Target'
DateColumnName	List the column name of your date column. E.g. 'DateTime'
HierarchGroups	Vector of hierachy categorical columns.
GroupVariables	Defaults to NULL. Use NULL when you have a single series. Add in Group-Variables when you have a series for every level of a group or multiple groups.
EncodingMethod	Choose from 'binary', 'poly_encode', 'backward_difference', 'helmert' for multiclass cases and additionally 'm_estimator', 'credibility', 'woe', 'target_encoding' for classification use cases.
TimeWeights	Timeweights creation. Supply a value, such as 0.9999
FC_Periods	Set the number of periods you want to have forecasts for. E.g. 52 for weekly data to forecast a year ahead
TimeUnit	List the time unit your data is aggregated by. E.g. '1min', '5min', '10min', '15min', '30min', 'hour', 'day', 'week', 'month', 'quarter', 'year'.

TimeGroups	Select time aggregations for adding various time aggregated GDL features.
NumOfParDepPlots	Supply a number for the number of partial dependence plots you want returned
TargetTransformation	Run AutoTransformationCreate() to find best transformation for the target variable. Tests YeoJohnson, BoxCox, and Asigh (also Asin and Logit for proportion target variables).
Methods	Choose from 'YeoJohnson', 'BoxCox', 'Asinh', 'Log', 'LogPlus1', 'Sqrt', 'Asin', or 'Logit'. If more than one is selected, the one with the best normalization pearson statistic will be used. Identity is automatically selected and compared.
AnomalyDetection	NULL for not using the service. Other, provide a list, e.g. AnomalyDetection = list('tstat_high' = 4, tstat_low = -4)
XREGS	Additional data to use for model development and forecasting. Data needs to be a complete series which means both the historical and forward looking values over the specified forecast window needs to be supplied.
Lags	Select the periods for all lag variables you want to create. E.g. c(1:5,52)
MA_Periods	Select the periods for all moving average variables you want to create. E.g. c(1:5,52)
SD_Periods	Select the periods for all moving standard deviation variables you want to create. E.g. c(1:5,52)
Skew_Periods	Select the periods for all moving skewness variables you want to create. E.g. c(1:5,52)
Kurt_Periods	Select the periods for all moving kurtosis variables you want to create. E.g. c(1:5,52)
Quantile_Periods	Select the periods for all moving quantiles variables you want to create. E.g. c(1:5,52)
Quantiles_Selected	Select from the following 'q5', 'q10', 'q15', 'q20', 'q25', 'q30', 'q35', 'q40', 'q45', 'q50', 'q55', 'q60', 'q65', 'q70', 'q75', 'q80', 'q85', 'q90', 'q95'
Difference	Puts the I in ARIMA for single series and grouped series.
FourierTerms	Set to the max number of pairs. E.g. 2 means to generate two pairs for by each group level and interactions if hierarchy is enabled.
CalendarVariables	NULL, or select from 'second', 'minute', 'hour', 'wday', 'mday', 'yday', 'week', 'isoweek', 'month', 'quarter', 'year'
HolidayVariable	NULL, or select from 'USPublicHolidays', 'EasterGroup', 'ChristmasGroup', 'OtherEcclestialFeasts'
HolidayLookback	Number of days in range to compute number of holidays from a given date in the data. If NULL, the number of days are computed for you.
HolidayLags	Number of lags to build off of the holiday count variable.
HolidayMovingAverages	Number of moving averages to build off of the holiday count variable.

TimeTrendVariable	Set to TRUE to have a time trend variable added to the model. Time trend is numeric variable indicating the numeric value of each record in the time series (by group). Time trend starts at 1 for the earliest point in time and increments by one for each success time point.
ZeroPadSeries	Set to 'all', 'inner', or NULL. See TimeSeriesFill for explanation
DataTruncate	Set to TRUE to remove records with missing values from the lags and moving average features created
SplitRatios	E.g c(0.7,0.2,0.1) for train, validation, and test sets
PartitionType	Select 'random' for random data partitioning 'timeseries' for partitioning by time frames
Timer	Set to FALSE to turn off the updating print statements for progress
DebugMode	Defaults to FALSE. Set to TRUE to get a print statement of each high level comment in function
EvalMetric	Select from 'RMSE', 'MAE', 'MAPE', 'Poisson', 'Quantile', 'LogLinQuantile', 'Lq', 'NumErrors', 'SMAPE', 'R2', 'MSLE', 'MedianAbsoluteError'
GridTune	Set to TRUE to run a grid tune
PassInGrid	Defaults to NULL
ModelCount	Set the number of models to try in the grid tune
MaxRunsWithoutNewWinner	Default is 50
MaxRunMinutes	Default is 60*60 # Core parameters <a href="https://lightgbm.readthedocs.io/en/latest/Parameters.html#core-parameter">https://lightgbm.readthedocs.io/en/latest/Parameters.html#core-parameter</a>
input_model	= NULL, # continue training a model that is stored to fil
task	'train' or 'refit'
device_type	'cpu' or 'gpu'
objective	'binary'
metric	'binary_logloss', 'average_precision', 'auc', 'map', 'binary_error', 'auc_mu'
boosting	'gbdt', 'rf', 'dart', 'goss'
LinearTree	FALSE
Trees	50L
eta	NULL
num_leaves	31
deterministic	TRUE # Learning Parameters <a href="https://lightgbm.readthedocs.io/en/latest/Parameters.html#learning-control-parameter">https://lightgbm.readthedocs.io/en/latest/Parameters.html#learning-control-parameter</a>
force_col_wise	FALSE
force_row_wise	FALSE
max_depth	NULL
min_data_in_leaf	20
min_sum_hessian_in_leaf	0.001

```

bagging_freq    0
bagging_fraction
                1.0
feature_fraction
                1.0
feature_fraction_bynode
                1.0
extra_trees     FALSE
early_stopping_round
                10
first_metric_only
                TRUE
max_delta_step  0.0
lambda_l1       0.0
lambda_l2       0.0
linear_lambda   0.0
min_gain_to_split
                0
drop_rate_dart  0.10
max_drop_dart   50
skip_drop_dart  0.50
uniform_drop_dart
                FALSE
top_rate_goss   FALSE
other_rate_goss
                FALSE
monotone_constraints
                "gbdt_prediction.cpp"
monotone_constraints_method
                'advanced'
monotone_penalty
                0.0
forced_splits_filename
                NULL # use for AutoStack option; .json fil
refit_decay_rate
                0.90
path_smooth     0.0
                # IO Dataset Parameters https://lightgbm.readthedocs.io/en/latest/Parameters.html#io-parameters
max_bin         255
min_data_in_bin
                3
data_random_seed
                1
is_enable_sparse
                TRUE
enable_bundle   TRUE

```

```

use_missing      TRUE
zero_as_missing  FALSE

two_round        FALSE
                 # Convert Parameters # https://lightgbm.readthedocs.io/en/latest/Parameters.html#convert-parameters
convert_model    'gbdt_prediction.cpp'
convert_model_language
                 'cpp'
                 # Objective Parameters https://lightgbm.readthedocs.io/en/latest/Parameters.html#objective-parameters
boost_from_average
                 TRUE

is_unbalance     FALSE
scale_pos_weight 1.0
                 # Metric Parameters (metric is in Core)
is_provide_training_metric
                 TRUE

eval_at          c(1,2,3,4,5)
                 # Network Parameter

num_machines     1
                 # GPU Parameter
gpu_platform_id  -1

gpu_device_id    -1
gpu_use_dp       TRUE
num_gpu          1
NThreads         only list up to number of cores, not threads. parallel::detectCores() / 2

```

**Value**

Returns a data.table of original series and forecasts, the catboost model objects (everything returned from AutoCatBoostRegression()), a time series forecast plot, and transformation info if you set TargetTransformation to TRUE. The time series forecast plot will plot your single series or aggregate your data to a single series and create a plot from that.

**Author(s)**

Adrian Antico

**See Also**

Other Automated Panel Data Forecasting: [AutoCatBoostCARMA\(\)](#), [AutoCatBoostHurdleCARMA\(\)](#), [AutoCatBoostVectorCARMA\(\)](#), [AutoH2OCARMA\(\)](#), [AutoLightGBMCARMA\(\)](#), [AutoXGBoostCARMA\(\)](#), [AutoXGBoostHurdleCARMA\(\)](#)



**Examples**

```
## Not run:

# Single group variable and xregs ----

# Load Walmart Data from Dropbox----
data <- data.table::fread(
  'https://www.dropbox.com/s/2str3ek4f4cheqi/walmart_train.csv?dl=1')

# Subset for Stores / Departments With Full Series
data <- data[, Counts := .N, by = c('Store','Dept')][Counts == 143][
  , Counts := NULL]

# Subset Columns (remove IsHoliday column)----
keep <- c('Store','Dept','Date','Weekly_Sales')
data <- data[, ..keep]
data <- data[Store == 1][, Store := NULL]
xregs <- data.table::copy(data)
data.table::setnames(xregs, 'Dept', 'GroupVar')
data.table::setnames(xregs, 'Weekly_Sales', 'Other')
data <- data[as.Date(Date) < as.Date('2012-09-28')]

# Add zeros for testing
data[runif(.N) < 0.25, Weekly_Sales := 0]

# Build forecast
CatBoostResults <- RemixAutoML::AutoLightGBMHurdleCARMA(

  # data args
  data = data, # TwoGroup_Data,
  TargetColumnName = 'Weekly_Sales',
  DateColumnName = 'Date',
  HierarchGroups = NULL,
  GroupVariables = c('Dept'),
  EncodingMethod = "credibility",
  TimeWeights = 1,
  TimeUnit = 'weeks',
  TimeGroups = c('weeks','months'),

  # Production args
  TrainOnFull = FALSE,
  SplitRatios = c(1 - 20 / 138, 10 / 138, 10 / 138),
  PartitionType = 'random',
  FC_Periods = 4,
  Timer = TRUE,
  DebugMode = TRUE,

  # Target transformations
  TargetTransformation = TRUE,
  Methods = c('BoxCox', 'Asinh', 'Asin', 'Log',
    'LogPlus1', 'Sqrt', 'Logit', 'YeoJohnson'),
  Difference = FALSE,
  NonNegativePred = FALSE,
  RoundPreds = FALSE,

  # Date features
```

```

CalendarVariables = c('week', 'wom', 'month', 'quarter'),
HolidayVariable = c('USPublicHolidays',
  'EasterGroup',
  'ChristmasGroup', 'OtherEcclesticalFeasts'),
HolidayLookback = NULL,
HolidayLags = 1,
HolidayMovingAverages = 1:2,

# Time series features
Lags = list('weeks' = seq(2L, 10L, 2L),
  'months' = c(1:3)),
MA_Periods = list('weeks' = seq(2L, 10L, 2L),
  'months' = c(2,3)),
SD_Periods = NULL,
Skew_Periods = NULL,
Kurt_Periods = NULL,
Quantile_Periods = NULL,
Quantiles_Selected = c('q5', 'q95'),

# Bonus features
AnomalyDetection = NULL,
XREGS = xregs,
FourierTerms = 2,
TimeTrendVariable = TRUE,
ZeroPadSeries = NULL,
DataTruncate = FALSE,

# ML Args
NumOfParDepPlots = 100L,
EvalMetric = 'RMSE',
GridTune = FALSE,
PassInGrid = NULL,
ModelCount = 5,
MaxRunsWithoutNewWinner = 50,
MaxRunMinutes = 60*60,

# Core parameters https://lightgbm.readthedocs.io/en/latest/Parameters.html#core-parameters
input_model = list('classifier' = NULL, 'regression' = NULL),
task = list('classifier' = 'train', 'regression' = 'train'),
device_type = list('classifier' = 'CPU', 'regression' = 'CPU'),
objective = list('classifier' = 'binary', 'regression' = 'regression'),
metric = list('classifier' = 'binary_logloss', 'regression' = 'rmse'),
boosting = list('classifier' = 'gbdt', 'regression' = 'gbdt'),
LinearTree = list('classifier' = FALSE, 'regression' = FALSE),
Trees = list('classifier' = 1000L, 'regression' = 1000L),
eta = list('classifier' = NULL, 'regression' = NULL),
num_leaves = list('classifier' = 31, 'regression' = 31),
deterministic = list('classifier' = TRUE, 'regression' = TRUE),

# Learning Parameters https://lightgbm.readthedocs.io/en/latest/Parameters.html#learning-control-parameter
force_col_wise = list('classifier' = FALSE, 'regression' = FALSE),
force_row_wise = list('classifier' = FALSE, 'regression' = FALSE),
max_depth = list('classifier' = NULL, 'regression' = NULL),
min_data_in_leaf = list('classifier' = 20, 'regression' = 20),
min_sum_hessian_in_leaf = list('classifier' = 0.001, 'regression' = 0.001),
bagging_freq = list('classifier' = 0, 'regression' = 0),
bagging_fraction = list('classifier' = 1.0, 'regression' = 1.0),

```

```

feature_fraction = list('classifier' = 1.0, 'regression' = 1.0),
feature_fraction_bynode = list('classifier' = 1.0, 'regression' = 1.0),
extra_trees = list('classifier' = FALSE, 'regression' = FALSE),
early_stopping_round = list('classifier' = 10, 'regression' = 10),
first_metric_only = list('classifier' = TRUE, 'regression' = TRUE),
max_delta_step = list('classifier' = 0.0, 'regression' = 0.0),
lambda_l1 = list('classifier' = 0.0, 'regression' = 0.0),
lambda_l2 = list('classifier' = 0.0, 'regression' = 0.0),
linear_lambda = list('classifier' = 0.0, 'regression' = 0.0),
min_gain_to_split = list('classifier' = 0, 'regression' = 0),
drop_rate_dart = list('classifier' = 0.10, 'regression' = 0.10),
max_drop_dart = list('classifier' = 50, 'regression' = 50),
skip_drop_dart = list('classifier' = 0.50, 'regression' = 0.50),
uniform_drop_dart = list('classifier' = FALSE, 'regression' = FALSE),
top_rate_goss = list('classifier' = FALSE, 'regression' = FALSE),
other_rate_goss = list('classifier' = FALSE, 'regression' = FALSE),
monotone_constraints = list('classifier' = NULL, 'regression' = NULL),
monotone_constraints_method = list('classifier' = 'advanced', 'regression' = 'advanced'),
monotone_penalty = list('classifier' = 0.0, 'regression' = 0.0),
forced_splits_filename = list('classifier' = NULL, 'regression' = NULL),
refit_decay_rate = list('classifier' = 0.90, 'regression' = 0.90),
path_smooth = list('classifier' = 0.0, 'regression' = 0.0),

# IO Dataset Parameters
max_bin = list('classifier' = 255, 'regression' = 255),
min_data_in_bin = list('classifier' = 3, 'regression' = 3),
data_random_seed = list('classifier' = 1, 'regression' = 1),
is_enable_sparse = list('classifier' = TRUE, 'regression' = TRUE),
enable_bundle = list('classifier' = TRUE, 'regression' = TRUE),
use_missing = list('classifier' = TRUE, 'regression' = TRUE),
zero_as_missing = list('classifier' = FALSE, 'regression' = FALSE),
two_round = list('classifier' = FALSE, 'regression' = FALSE),

# Convert Parameters
convert_model = list('classifier' = NULL, 'regression' = NULL),
convert_model_language = list('classifier' = "cpp", 'regression' = "cpp"),

# Objective Parameters
boost_from_average = list('classifier' = TRUE, 'regression' = TRUE),
is_unbalance = list('classifier' = FALSE, 'regression' = FALSE),
scale_pos_weight = list('classifier' = 1.0, 'regression' = 1.0),

# Metric Parameters (metric is in Core)
is_provide_training_metric = list('classifier' = TRUE, 'regression' = TRUE),
eval_at = list('classifier' = c(1,2,3,4,5), 'regression' = c(1,2,3,4,5)),

# Network Parameters
num_machines = list('classifier' = 1, 'regression' = 1),

# GPU Parameters
gpu_platform_id = list('classifier' = -1, 'regression' = -1),
gpu_device_id = list('classifier' = -1, 'regression' = -1),
gpu_use_dp = list('classifier' = TRUE, 'regression' = TRUE),
num_gpu = list('classifier' = 1, 'regression' = 1))

# Two group variables and xregs

```

```

# Load Walmart Data from Dropbox----
data <- data.table::fread(
  'https://www.dropbox.com/s/2str3ek4f4cheqi/walmart_train.csv?dl=1')

# Subset for Stores / Departments With Full Series
data <- data[, Counts := .N, by = c('Store','Dept')][Counts == 143][
  , Counts := NULL]

# Put negative values at 0
data[, Weekly_Sales := data.table::fifelse(Weekly_Sales < 0, 0, Weekly_Sales)]

# Subset Columns (remove IsHoliday column)----
keep <- c('Store','Dept','Date','Weekly_Sales')
data <- data[, ..keep]
data <- data[Store %in% c(1,2)]

xregs <- data.table::copy(data)
xregs[, GroupVar := do.call(paste, c(.SD, sep = ' ')), .SDcols = c('Store','Dept')]
xregs[, c('Store','Dept') := NULL]
data.table::setnames(xregs, 'Weekly_Sales', 'Other')
xregs[, Other := jitter(Other, factor = 25)]
data <- data[as.Date(Date) < as.Date('2012-09-28')]

# Add some zeros for testing
data[runif(.N) < 0.25, Weekly_Sales := 0]

# Build forecast
Output <- RemixAutoML::AutoLightGBMHurdleCARMA(

  # data args
  data = data,
  TargetColumnName = 'Weekly_Sales',
  DateColumnName = 'Date',
  HierarchGroups = NULL,
  GroupVariables = c('Store','Dept'),
  EncodingMethod = "credibility",
  TimeWeights = 1,
  TimeUnit = 'weeks',
  TimeGroups = c('weeks','months'),

  # Production args
  TrainOnFull = TRUE,
  SplitRatios = c(1 - 20 / 138, 10 / 138, 10 / 138),
  PartitionType = 'random',
  FC_Periods = 4,
  Timer = TRUE,
  DebugMode = TRUE,

  # Target transformations
  TargetTransformation = TRUE,
  Methods = c('BoxCox', 'Asinh', 'Asin', 'Log',
    'LogPlus1', 'Sqrt', 'Logit', 'YeoJohnson'),
  Difference = FALSE,
  NonNegativePred = FALSE,
  Threshold = NULL,
  RoundPreds = FALSE,

```

```

# Date features
CalendarVariables = c('week', 'wom', 'month', 'quarter'),
HolidayVariable = c('USPublicHolidays',
                    'EasterGroup',
                    'ChristmasGroup', 'OtherEcclesticalFeasts'),
HolidayLookback = NULL,
HolidayLags = 1,
HolidayMovingAverages = 1:2,

# Time series features
Lags = list('weeks' = seq(2L, 10L, 2L),
            'months' = c(1:3)),
MA_Periods = list('weeks' = seq(2L, 10L, 2L),
                  'months' = c(2,3)),
SD_Periods = NULL,
Skew_Periods = NULL,
Kurt_Periods = NULL,
Quantile_Periods = NULL,
Quantiles_Selected = c('q5', 'q95'),

# Bonus features
AnomalyDetection = NULL,
XREGS = xregs,
FourierTerms = 2,
TimeTrendVariable = TRUE,
ZeroPadSeries = NULL,
DataTruncate = FALSE,

# ML Args
NumOfParDepPlots = 100L,
EvalMetric = 'RMSE',
GridTune = FALSE,
PassInGrid = NULL,
ModelCount = 5,
MaxRunsWithoutNewWinner = 50,
MaxRunMinutes = 60*60,

# Core parameters https://lightgbm.readthedocs.io/en/latest/Parameters.html#core-parameters
input_model = list('classifier' = NULL, 'regression' = NULL),
task = list('classifier' = 'train', 'regression' = 'train'),
device_type = list('classifier' = 'CPU', 'regression' = 'CPU'),
objective = list('classifier' = 'binary', 'regression' = 'regression'),
metric = list('classifier' = 'binary_logloss', 'regression' = 'rmse'),
boosting = list('classifier' = 'gbdt', 'regression' = 'gbdt'),
LinearTree = list('classifier' = FALSE, 'regression' = FALSE),
Trees = list('classifier' = 1000L, 'regression' = 1000L),
eta = list('classifier' = NULL, 'regression' = NULL),
num_leaves = list('classifier' = 31, 'regression' = 31),
deterministic = list('classifier' = TRUE, 'regression' = TRUE),

# Learning Parameters https://lightgbm.readthedocs.io/en/latest/Parameters.html#learning-control-parameter
force_col_wise = list('classifier' = FALSE, 'regression' = FALSE),
force_row_wise = list('classifier' = FALSE, 'regression' = FALSE),
max_depth = list('classifier' = NULL, 'regression' = NULL),
min_data_in_leaf = list('classifier' = 20, 'regression' = 20),
min_sum_hessian_in_leaf = list('classifier' = 0.001, 'regression' = 0.001),
bagging_freq = list('classifier' = 0, 'regression' = 0),

```

```

bagging_fraction = list('classifier' = 1.0, 'regression' = 1.0),
feature_fraction = list('classifier' = 1.0, 'regression' = 1.0),
feature_fraction_bynode = list('classifier' = 1.0, 'regression' = 1.0),
extra_trees = list('classifier' = FALSE, 'regression' = FALSE),
early_stopping_round = list('classifier' = 10, 'regression' = 10),
first_metric_only = list('classifier' = TRUE, 'regression' = TRUE),
max_delta_step = list('classifier' = 0.0, 'regression' = 0.0),
lambda_l1 = list('classifier' = 0.0, 'regression' = 0.0),
lambda_l2 = list('classifier' = 0.0, 'regression' = 0.0),
linear_lambda = list('classifier' = 0.0, 'regression' = 0.0),
min_gain_to_split = list('classifier' = 0, 'regression' = 0),
drop_rate_dart = list('classifier' = 0.10, 'regression' = 0.10),
max_drop_dart = list('classifier' = 50, 'regression' = 50),
skip_drop_dart = list('classifier' = 0.50, 'regression' = 0.50),
uniform_drop_dart = list('classifier' = FALSE, 'regression' = FALSE),
top_rate_goss = list('classifier' = FALSE, 'regression' = FALSE),
other_rate_goss = list('classifier' = FALSE, 'regression' = FALSE),
monotone_constraints = list('classifier' = NULL, 'regression' = NULL),
monotone_constraints_method = list('classifier' = 'advanced', 'regression' = 'advanced'),
monotone_penalty = list('classifier' = 0.0, 'regression' = 0.0),
forced_splits_filename = list('classifier' = NULL, 'regression' = NULL),
refit_decay_rate = list('classifier' = 0.90, 'regression' = 0.90),
path_smooth = list('classifier' = 0.0, 'regression' = 0.0),

# IO Dataset Parameters
max_bin = list('classifier' = 255, 'regression' = 255),
min_data_in_bin = list('classifier' = 3, 'regression' = 3),
data_random_seed = list('classifier' = 1, 'regression' = 1),
is_enable_sparse = list('classifier' = TRUE, 'regression' = TRUE),
enable_bundle = list('classifier' = TRUE, 'regression' = TRUE),
use_missing = list('classifier' = TRUE, 'regression' = TRUE),
zero_as_missing = list('classifier' = FALSE, 'regression' = FALSE),
two_round = list('classifier' = FALSE, 'regression' = FALSE),

# Convert Parameters
convert_model = list('classifier' = NULL, 'regression' = NULL),
convert_model_language = list('classifier' = "cpp", 'regression' = "cpp"),

# Objective Parameters
boost_from_average = list('classifier' = TRUE, 'regression' = TRUE),
is_unbalance = list('classifier' = FALSE, 'regression' = FALSE),
scale_pos_weight = list('classifier' = 1.0, 'regression' = 1.0),

# Metric Parameters (metric is in Core)
is_provide_training_metric = list('classifier' = TRUE, 'regression' = TRUE),
eval_at = list('classifier' = c(1,2,3,4,5), 'regression' = c(1,2,3,4,5)),

# Network Parameters
num_machines = list('classifier' = 1, 'regression' = 1),

# GPU Parameters
gpu_platform_id = list('classifier' = -1, 'regression' = -1),
gpu_device_id = list('classifier' = -1, 'regression' = -1),
gpu_use_dp = list('classifier' = TRUE, 'regression' = TRUE),
num_gpu = list('classifier' = 1, 'regression' = 1))

## End(Not run)

```

---

AutoLightGBMHurdleModel

*AutoLightGBMHurdleModel*


---

## Description

AutoLightGBMHurdleModel is generalized hurdle modeling framework

## Usage

```
AutoLightGBMHurdleModel(
  TrainOnFull = FALSE,
  PassInGrid = NULL,
  NThreads = max(1L, parallel::detectCores() - 2L),
  ModelID = "ModelTest",
  Paths = NULL,
  MetaDataPaths = NULL,
  data,
  ValidationData = NULL,
  TestData = NULL,
  Buckets = 0L,
  TargetColumnName = NULL,
  FeatureColNames = NULL,
  PrimaryDateColumn = NULL,
  WeightsColumnName = NULL,
  ClassWeights = c(1, 1),
  IDcols = NULL,
  DebugMode = FALSE,
  EncodingMethod = "credibility",
  TransformNumericColumns = NULL,
  Methods = c("Asinh", "Asin", "Log", "LogPlus1", "Sqrt", "Logit"),
  SplitRatios = c(0.7, 0.2, 0.1),
  SaveModelObjects = FALSE,
  ReturnModelObjects = TRUE,
  NumOfParDepPlots = 1L,
  GridTune = FALSE,
  grid_eval_metric = "accuracy",
  MaxModelsInGrid = 1L,
  BaselineComparison = "default",
  MaxRunsWithoutNewWinner = 10L,
  MaxRunMinutes = 60L,
  input_model = list(classifier = NULL, regression = NULL),
  task = list(classifier = "train", regression = "train"),
  device_type = list(classifier = "CPU", regression = "CPU"),
  objective = list(classifier = "binary", regression = "regression"),
  metric = list(classifier = "binary_logloss", regression = "rmse"),
  boosting = list(classifier = "gbdt", regression = "gbdt"),
  LinearTree = list(classifier = FALSE, regression = FALSE),
  Trees = list(classifier = 1000L, regression = 1000L),
  eta = list(classifier = NULL, regression = NULL),
  num_leaves = list(classifier = 31, regression = 31),
```

```

deterministic = list(classifier = TRUE, regression = TRUE),
force_col_wise = list(classifier = FALSE, regression = FALSE),
force_row_wise = list(classifier = FALSE, regression = FALSE),
max_depth = list(classifier = NULL, regression = NULL),
min_data_in_leaf = list(classifier = 20, regression = 20),
min_sum_hessian_in_leaf = list(classifier = 0.001, regression = 0.001),
bagging_freq = list(classifier = 0, regression = 0),
bagging_fraction = list(classifier = 1, regression = 1),
feature_fraction = list(classifier = 1, regression = 1),
feature_fraction_bynode = list(classifier = 1, regression = 1),
extra_trees = list(classifier = FALSE, regression = FALSE),
early_stopping_round = list(classifier = 10, regression = 10),
first_metric_only = list(classifier = TRUE, regression = TRUE),
max_delta_step = list(classifier = 0, regression = 0),
lambda_l1 = list(classifier = 0, regression = 0),
lambda_l2 = list(classifier = 0, regression = 0),
linear_lambda = list(classifier = 0, regression = 0),
min_gain_to_split = list(classifier = 0, regression = 0),
drop_rate_dart = list(classifier = 0.1, regression = 0.1),
max_drop_dart = list(classifier = 50, regression = 50),
skip_drop_dart = list(classifier = 0.5, regression = 0.5),
uniform_drop_dart = list(classifier = FALSE, regression = FALSE),
top_rate_goss = list(classifier = FALSE, regression = FALSE),
other_rate_goss = list(classifier = FALSE, regression = FALSE),
monotone_constraints = list(classifier = NULL, regression = NULL),
monotone_constraints_method = list(classifier = "advanced", regression = "advanced"),
monotone_penalty = list(classifier = 0, regression = 0),
forced_splits_filename = list(classifier = NULL, regression = NULL),
refit_decay_rate = list(classifier = 0.9, regression = 0.9),
path_smooth = list(classifier = 0, regression = 0),
max_bin = list(classifier = 255, regression = 255),
min_data_in_bin = list(classifier = 3, regression = 3),
data_random_seed = list(classifier = 1, regression = 1),
is_enable_sparse = list(classifier = TRUE, regression = TRUE),
enable_bundle = list(classifier = TRUE, regression = TRUE),
use_missing = list(classifier = TRUE, regression = TRUE),
zero_as_missing = list(classifier = FALSE, regression = FALSE),
two_round = list(classifier = FALSE, regression = FALSE),
convert_model = list(classifier = NULL, regression = NULL),
convert_model_language = list(classifier = "cpp", regression = "cpp"),
boost_from_average = list(classifier = TRUE, regression = TRUE),
is_unbalance = list(classifier = FALSE, regression = FALSE),
scale_pos_weight = list(classifier = 1, regression = 1),
is_provide_training_metric = list(classifier = TRUE, regression = TRUE),
eval_at = list(classifier = c(1, 2, 3, 4, 5), regression = c(1, 2, 3, 4, 5)),
num_machines = list(classifier = 1, regression = 1),
gpu_platform_id = list(classifier = -1, regression = -1),
gpu_device_id = list(classifier = -1, regression = -1),
gpu_use_dp = list(classifier = TRUE, regression = TRUE),
num_gpu = list(classifier = 1, regression = 1)
)

```



**Arguments**

TrainOnFull	Set to TRUE to train model on 100 percent of data
PassInGrid	Pass in a grid for changing up the parameter settings for catboost # Core parameters <a href="https://lightgbm.readthedocs.io/en/latest/Parameters.html#core-parameter">https://lightgbm.readthedocs.io/en/latest/Parameters.html#core-parameter</a>
NThreads	only list up to number of cores, not threads. <code>parallel::detectCores() / 2</code>
ModelID	Define a character name for your models
Paths	The path to your folder where you want your model information saved
MetaDataPaths	A character string of your path file to where you want your model evaluation output saved. If left NULL, all output will be saved to Paths.
data	Source training data. Do not include a column that has the class labels for the buckets as they are created internally.
ValidationData	Source validation data. Do not include a column that has the class labels for the buckets as they are created internally.
TestData	Source test data. Do not include a column that has the class labels for the buckets as they are created internally.
Buckets	A numeric vector of the buckets used for subsetting the data. NOTE: the final Bucket value will first create a subset of data that is less than the value and a second one thereafter for data greater than the bucket value.
TargetColumnName	Supply the column name or number for the target variable
FeatureColNames	Supply the column names or number of the features (not included the Primary-DateColumn)
PrimaryDateColumn	Date column for sorting
WeightsColumnName	Weights column name
ClassWeights	Look up the classifier model help file
IDcols	Includes PrimaryDateColumn and any other columns you want returned in the validation data with predictions
DebugMode	For debugging
EncodingMethod	Choose from 'binary', 'poly_encode', 'backward_difference', 'helmert' for multiclass cases and additionally 'm_estimator', 'credibility', 'woe', 'target_encoding' for classification use cases.
TransformNumericColumns	Transform numeric column inside the AutoCatBoostRegression() function
Methods	Choose from 'Asinh', 'Asin', 'Log', 'LogPlus1', 'Sqrt', 'Logit'
SplitRatios	Supply vector of partition ratios. For example, <code>c(0.70,0.20,0,10)</code>
SaveModelObjects	Set to TRUE to save the model objects to file in the folders listed in Paths
ReturnModelObjects	Set to TRUE to return all model objects
NumOfParDepPlots	Set to pull back N number of partial dependence calibration plots.

GridTune	Set to TRUE if you want to grid tune the models
grid_eval_metric	Select the metric to optimize in grid tuning. "accuracy", "microauc", "logloss"
MaxModelsInGrid	Set to a numeric value for the number of models to try in grid tune
BaselineComparison	"default"
MaxRunsWithoutNewWinner	Number of runs without a new winner before stopping the grid tuning
MaxRunMinutes	Max number of minutes to allow the grid tuning to run for
input_model	= NULL, # continue training a model that is stored to fil
task	'train' or 'refit'
device_type	'cpu' or 'gpu'
objective	'binary'
metric	'binary_logloss', 'average_precision', 'auc', 'map', 'binary_error', 'auc_mu'
boosting	'gbdt', 'rf', 'dart', 'goss'
LinearTree	FALSE
Trees	50L
eta	NULL
num_leaves	31
deterministic	TRUE
	# Learning Parameters <a href="https://lightgbm.readthedocs.io/en/latest/Parameters.html#learning-control-parameter">https://lightgbm.readthedocs.io/en/latest/Parameters.html#learning-control-parameter</a>
force_col_wise	FALSE
force_row_wise	FALSE
max_depth	NULL
min_data_in_leaf	20
min_sum_hessian_in_leaf	0.001
bagging_freq	0
bagging_fraction	1.0
feature_fraction	1.0
feature_fraction_bynode	1.0
extra_trees	FALSE
early_stopping_round	10
first_metric_only	TRUE
max_delta_step	0.0
lambda_l1	0.0
lambda_l2	0.0

```

linear_lambda 0.0
min_gain_to_split
0
drop_rate_dart 0.10
max_drop_dart 50
skip_drop_dart 0.50
uniform_drop_dart
FALSE
top_rate_goss FALSE
other_rate_goss
FALSE
monotone_constraints
"gbdt_prediction.cpp"
monotone_constraints_method
'advanced'
monotone_penalty
0.0
forced_splits_filename
NULL # use for AutoStack option; .json fil
refit_decay_rate
0.90
path_smooth 0.0
# IO Dataset Parameters https://lightgbm.readthedocs.io/en/latest/Parameters.html#io-
parameters
max_bin 255
min_data_in_bin
3
data_random_seed
1
is_enable_sparse
TRUE
enable_bundle TRUE
use_missing TRUE
zero_as_missing
FALSE
two_round FALSE
# Convert Parameters # https://lightgbm.readthedocs.io/en/latest/Parameters.html#convert-
parameters
convert_model 'gbdt_prediction.cpp'
convert_model_language
'cpp'
# Objective Parameters https://lightgbm.readthedocs.io/en/latest/Parameters.html#objective-
parameters
boost_from_average
TRUE
is_unbalance FALSE

```

```

scale_pos_weight
    1.0
    # Metric Parameters (metric is in Core)
is_provide_training_metric
    TRUE
eval_at
    c(1,2,3,4,5)
    # Network Parameter
num_machines
    1
    # GPU Parameter
gpu_platform_id
    -1
gpu_device_id
    -1
gpu_use_dp
    TRUE
num_gpu
    1

```

**Author(s)**

Adrian Antico

**See Also**

Other Supervised Learning - Hurdle Modeling: [AutoCatBoostHurdleModel\(\)](#), [AutoH2oDRFHurdleModel\(\)](#), [AutoH2oGBMHurdleModel\(\)](#), [AutoXGBoostHurdleModel\(\)](#)

**Examples**

```

## Not run:
# Test data.table
LightGBM_QA <- data.table::CJ(
  TOF = c(TRUE,FALSE),
  Classification = c(TRUE,FALSE),
  Success = "Failure",
  ScoreSuccess = "Failure",
  PartitionInFunction = c(TRUE,FALSE), sorted = FALSE
)

# Remove impossible combinations
LightGBM_QA <- LightGBM_QA[!(PartitionInFunction & TOF)]
LightGBM_QA[, RunNumber := seq_len(.N)]

# Path File
Path <- getwd()

#      TOF Classification Success PartitionInFunction RunNumber
# 1:  TRUE           TRUE Failure                FALSE         1
# 2:  TRUE           FALSE Failure                FALSE         2
# 3:  FALSE          TRUE Failure                TRUE          3
# 4:  FALSE          TRUE Failure                FALSE         4
# 5:  FALSE          FALSE Failure                TRUE          5
# 6:  FALSE          FALSE Failure                FALSE         6

# AutoCatBoostHurdleModel
# run = 1

```

```

# run = 6
for(run in seq_len(LightGBM_QA[,.N])) {

  # Define values
  tof <- LightGBM_QA[run, TOF]
  PartitionInFunction <- LightGBM_QA[run, PartitionInFunction]
  Classify <- LightGBM_QA[run, Classification]
  Tar <- "Adrian"

  # Get data
  if(Classify) {
    data <- RemixAutoML::FakeDataGenerator(N = 15000, ZIP = 1)
  } else {
    data <- RemixAutoML::FakeDataGenerator(N = 100000, ZIP = 2)
  }

  # Partition Data
  if(!tof && !PartitionInFunction) {
    Sets <- RemixAutoML::AutoDataPartition(
      data = data,
      NumDataSets = 3,
      Ratios = c(0.7,0.2,0.1),
      PartitionType = "random",
      StratifyColumnNames = "Adrian",
      TimeColumnName = NULL)
    TTrainData <- Sets$TrainData
    VValidationData <- Sets$ValidationData
    TTestData <- Sets$TestData
    rm(Sets)
  } else {
    TTrainData <- data.table::copy(data)
    VValidationData <- NULL
    TTestData <- NULL
  }

  # Run function
  TestModel <- tryCatch({RemixAutoML::AutoLightGBMHurdleModel(

    # Operationalization
    ModelID = 'ModelTest',
    SaveModelObjects = FALSE,
    ReturnModelObjects = TRUE,
    NThreads = parallel::detectCores(),

    # Data related args
    data = TTrainData,
    ValidationData = VValidationData,
    PrimaryDateColumn = "DateTime",
    TestData = TTestData,
    WeightsColumnName = NULL,
    TrainOnFull = tof,
    Buckets = if(Classify) 0L else c(0,2,3),
    TargetColumnName = "Adrian",
    FeatureColNames = names(TTrainData)[!names(data) %in% c("Adrian","IDcol_1","IDcol_2","IDcol_3","IDcol_4",
    IDcols = c("IDcol_1","IDcol_2","IDcol_3","IDcol_4","IDcol_5","DateTime"),
    DebugMode = TRUE,

```

```

# Metadata args
EncodingMethod = "credibility",
Paths = getwd(),
MetaDataPaths = NULL,
TransformNumericColumns = NULL,
Methods = c('Asinh', 'Asin', 'Log', 'LogPlus1', 'Logit'),
ClassWeights = c(1,1),
SplitRatios = if(PartitionInFunction) c(0.70, 0.20, 0.10) else NULL,
NumOfParDepPlots = 10L,

# Grid tuning setup
PassInGrid = NULL,
GridTune = FALSE,
BaselineComparison = 'default',
MaxModelsInGrid = 1L,
MaxRunsWithoutNewWinner = 20L,
MaxRunMinutes = 60L*60L,

# LightGBM parameters
task = list('classifier' = 'train', 'regression' = 'train'),
device_type = list('classifier' = 'CPU', 'regression' = 'CPU'),
objective = if(Classify) list('classifier' = 'binary', 'regression' = 'regression') else list('classifier' = 'regression', 'regression' = 'regression'),
metric = if(Classify) list('classifier' = 'binary_logloss', 'regression' = 'rmse') else list('classifier' = 'multi_logloss', 'regression' = 'rmse'),

boosting = list('classifier' = 'gbdt', 'regression' = 'gbdt'),
LinearTree = list('classifier' = FALSE, 'regression' = FALSE),
Trees = list('classifier' = 50L, 'regression' = 50L),
eta = list('classifier' = NULL, 'regression' = NULL),
num_leaves = list('classifier' = 31, 'regression' = 31),
deterministic = list('classifier' = TRUE, 'regression' = TRUE),

# Learning Parameters
force_col_wise = list('classifier' = FALSE, 'regression' = FALSE),
force_row_wise = list('classifier' = FALSE, 'regression' = FALSE),
max_depth = list('classifier' = NULL, 'regression' = NULL),
min_data_in_leaf = list('classifier' = 20, 'regression' = 20),
min_sum_hessian_in_leaf = list('classifier' = 0.001, 'regression' = 0.001),
bagging_freq = list('classifier' = 0, 'regression' = 0),
bagging_fraction = list('classifier' = 1.0, 'regression' = 1.0),
feature_fraction = list('classifier' = 1.0, 'regression' = 1.0),
feature_fraction_bynode = list('classifier' = 1.0, 'regression' = 1.0),
extra_trees = list('classifier' = FALSE, 'regression' = FALSE),
early_stopping_round = list('classifier' = 10, 'regression' = 10),
first_metric_only = list('classifier' = TRUE, 'regression' = TRUE),
max_delta_step = list('classifier' = 0.0, 'regression' = 0.0),
lambda_l1 = list('classifier' = 0.0, 'regression' = 0.0),
lambda_l2 = list('classifier' = 0.0, 'regression' = 0.0),
linear_lambda = list('classifier' = 0.0, 'regression' = 0.0),
min_gain_to_split = list('classifier' = 0, 'regression' = 0),
drop_rate_dart = list('classifier' = 0.10, 'regression' = 0.10),
max_drop_dart = list('classifier' = 50, 'regression' = 50),
skip_drop_dart = list('classifier' = 0.50, 'regression' = 0.50),
uniform_drop_dart = list('classifier' = FALSE, 'regression' = FALSE),
top_rate_goss = list('classifier' = FALSE, 'regression' = FALSE),
other_rate_goss = list('classifier' = FALSE, 'regression' = FALSE),
monotone_constraints = list('classifier' = NULL, 'regression' = NULL),

```

```

monotone_constraints_method = list('classifier' = 'advanced', 'regression' = 'advanced'),
monotone_penalty = list('classifier' = 0.0, 'regression' = 0.0),
forced_splits_filename = list('classifier' = NULL, 'regression' = NULL),
refit_decay_rate = list('classifier' = 0.90, 'regression' = 0.90),
path_smooth = list('classifier' = 0.0, 'regression' = 0.0),

# IO Dataset Parameters
max_bin = list('classifier' = 255, 'regression' = 255),
min_data_in_bin = list('classifier' = 3, 'regression' = 3),
data_random_seed = list('classifier' = 1, 'regression' = 1),
is_enable_sparse = list('classifier' = TRUE, 'regression' = TRUE),
enable_bundle = list('classifier' = TRUE, 'regression' = TRUE),
use_missing = list('classifier' = TRUE, 'regression' = TRUE),
zero_as_missing = list('classifier' = FALSE, 'regression' = FALSE),
two_round = list('classifier' = FALSE, 'regression' = FALSE),

# Convert Parameters
convert_model = list('classifier' = NULL, 'regression' = NULL),
convert_model_language = list('classifier' = "cpp", 'regression' = "cpp"),

# Objective Parameters
boost_from_average = list('classifier' = TRUE, 'regression' = TRUE),
is_unbalance = list('classifier' = FALSE, 'regression' = FALSE),
scale_pos_weight = list('classifier' = 1.0, 'regression' = 1.0),

# Metric Parameters (metric is in Core)
is_provide_training_metric = list('classifier' = TRUE, 'regression' = TRUE),
eval_at = list('classifier' = c(1,2,3,4,5), 'regression' = c(1,2,3,4,5)),

# Network Parameters
num_machines = list('classifier' = 1, 'regression' = 1),

# GPU Parameters
gpu_platform_id = list('classifier' = -1, 'regression' = -1),
gpu_device_id = list('classifier' = -1, 'regression' = -1),
gpu_use_dp = list('classifier' = TRUE, 'regression' = TRUE),
num_gpu = list('classifier' = 1, 'regression' = 1)), error = function(x) NULL)

# Outcome
if(!is.null(TestModel)) LightGBM_QA[run, Success := "Success"]
data.table::fwrite(LightGBM_QA, file = "C:/Users/Bizon/Documents/GitHub/QA_Code/QA_CSV/AutoLightGBMHurdleModel.csv")

# Remove Target Variable
TTrainData[, c("Target_Buckets", "Adrian") := NULL]

# Score CatBoost Hurdle Model
Output <- tryCatch({RemixAutoML::AutoLightGBMHurdleModelScoring(
  TestData = TTrainData,
  Path = Path,
  ModelID = "ModelTest",
  ModelList = TestModel$ModelList,
  ArgsList = TestModel$ArgsList,
  Threshold = NULL)}, error = function(x) NULL)

# Outcome
if(!is.null(Output)) LightGBM_QA[run, Score := "Success"]
TestModel <- NULL

```

```

Output <- NULL
TTrainData <- NULL
VValidationData <- NULL
TTestData <- NULL
gc(); Sys.sleep(5)
data.table::fwrite(LightGBM_QA, file = file.path(Path, "AutoLightGBMHurdleModel_QA.csv"))
}

## End(Not run)

```

---

AutoLightGBMHurdleModelScoring

*AutoLightGBMHurdleModelScoring*


---

## Description

AutoLightGBMHurdleModelScoring can score AutoLightGBMHurdleModel() models

## Usage

```

AutoLightGBMHurdleModelScoring(
  TestData = NULL,
  Path = NULL,
  ModelID = NULL,
  ArgsList = NULL,
  ModelList = NULL,
  Threshold = NULL,
  CARMA = FALSE
)

```

## Arguments

TestData	scoring data.table
Path	Supply if ArgsList is NULL or ModelList is null.
ModelID	Supply if ArgsList is NULL or ModelList is null. Same as used in model training.
ArgsList	Output from the hurdle model
ModelList	Output from the hurdle model
Threshold	NULL to use raw probabilities to predict. Otherwise, supply a threshold
CARMA	Keep FALSE. Used for CARMA functions internals

## Value

A data.table with the final predicted value, the intermediate model predictions, and your source data

## Author(s)

Adrian Antico



**See Also**

Other Automated Model Hurdle Modeling: [AutoCatBoostHurdleModelScoring\(\)](#), [AutoXGBoostHurdleModelScoring\(\)](#)

**Examples**

```
## Not run:

# Define file path
Path <- getwd()

# Create hurdle data with correlated features
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.70,
  N = 25000,
  ID = 3,
  FactorCount = 2L,
  AddDate = TRUE,
  ZIP = 1,
  Classification = FALSE,
  MultiClass = FALSE)

# Define features
Features <- names(data)[!names(data) %in%
  c("Adrian", "IDcol_1", "IDcol_2", "IDcol_3", "DateTime")]

Output <- RemixAutoML::AutoLightGBMHurdleModel(

  # Operationalization args
  TrainOnFull = FALSE,
  PassInGrid = NULL,

  # Metadata args
  NThreads = max(1L, parallel::detectCores()-2L),
  ModelID = "ModelTest",
  Paths = normalizePath("./"),
  MetaDataPaths = NULL,

  # data args
  data,
  ValidationData = NULL,
  TestData = NULL,
  Buckets = 0L,
  TargetColumnName = NULL,
  FeatureColNames = NULL,
  PrimaryDateColumn = NULL,
  WeightsColumnName = NULL,
  IDcols = NULL,
  ClassWeights = c(1,1),
  DebugMode = FALSE,

  # options
  EncodingMethod = "credibility",
  TransformNumericColumns = NULL,
  Methods = c('Asinh', 'Asin', 'Log', 'LogPlus1', 'Sqrt', 'Logit'),
  SplitRatios = c(0.70, 0.20, 0.10),
  ReturnModelObjects = TRUE,
```

```

SaveModelObjects = FALSE,
NumOfParDepPlots = 10L,

# grid tuning args
GridTune = FALSE,
grid_eval_metric = "accuracy",
MaxModelsInGrid = 1L,
BaselineComparison = "default",
MaxRunsWithoutNewWinner = 10L,
MaxRunMinutes = 60L,

# Core parameters https://lightgbm.readthedocs.io/en/latest/Parameters.html#core-parameters
input_model = list('classifier' = NULL, 'regression' = NULL),
task = list('classifier' = 'train', 'regression' = 'train'),
device_type = list('classifier' = 'CPU', 'regression' = 'CPU'),
objective = list('classifier' = 'binary', 'regression' = 'regression'),
metric = list('classifier' = 'binary_logloss', 'regression' = 'rmse'),
boosting = list('classifier' = 'gbdt', 'regression' = 'gbdt'),
LinearTree = list('classifier' = FALSE, 'regression' = FALSE),
Trees = list('classifier' = 1000L, 'regression' = 1000L),
eta = list('classifier' = NULL, 'regression' = NULL),
num_leaves = list('classifier' = 31, 'regression' = 31),
deterministic = list('classifier' = TRUE, 'regression' = TRUE),

# Learning Parameters https://lightgbm.readthedocs.io/en/latest/Parameters.html#learning-control-parameters
force_col_wise = list('classifier' = FALSE, 'regression' = FALSE),
force_row_wise = list('classifier' = FALSE, 'regression' = FALSE),
max_depth = list('classifier' = NULL, 'regression' = NULL),
min_data_in_leaf = list('classifier' = 20, 'regression' = 20),
min_sum_hessian_in_leaf = list('classifier' = 0.001, 'regression' = 0.001),
bagging_freq = list('classifier' = 0, 'regression' = 0),
bagging_fraction = list('classifier' = 1.0, 'regression' = 1.0),
feature_fraction = list('classifier' = 1.0, 'regression' = 1.0),
feature_fraction_bynode = list('classifier' = 1.0, 'regression' = 1.0),
extra_trees = list('classifier' = FALSE, 'regression' = FALSE),
early_stopping_round = list('classifier' = 10, 'regression' = 10),
first_metric_only = list('classifier' = TRUE, 'regression' = TRUE),
max_delta_step = list('classifier' = 0.0, 'regression' = 0.0),
lambda_l1 = list('classifier' = 0.0, 'regression' = 0.0),
lambda_l2 = list('classifier' = 0.0, 'regression' = 0.0),
linear_lambda = list('classifier' = 0.0, 'regression' = 0.0),
min_gain_to_split = list('classifier' = 0, 'regression' = 0),
drop_rate_dart = list('classifier' = 0.10, 'regression' = 0.10),
max_drop_dart = list('classifier' = 50, 'regression' = 50),
skip_drop_dart = list('classifier' = 0.50, 'regression' = 0.50),
uniform_drop_dart = list('classifier' = FALSE, 'regression' = FALSE),
top_rate_goss = list('classifier' = FALSE, 'regression' = FALSE),
other_rate_goss = list('classifier' = FALSE, 'regression' = FALSE),
monotone_constraints = list('classifier' = NULL, 'regression' = NULL),
monotone_constraints_method = list('classifier' = 'advanced', 'regression' = 'advanced'),
monotone_penalty = list('classifier' = 0.0, 'regression' = 0.0),
forced_splits_filename = list('classifier' = NULL, 'regression' = NULL),
refit_decay_rate = list('classifier' = 0.90, 'regression' = 0.90),
path_smooth = list('classifier' = 0.0, 'regression' = 0.0),

# IO Dataset Parameters
max_bin = list('classifier' = 255, 'regression' = 255),

```

```

min_data_in_bin = list('classifier' = 3, 'regression' = 3),
data_random_seed = list('classifier' = 1, 'regression' = 1),
is_enable_sparse = list('classifier' = TRUE, 'regression' = TRUE),
enable_bundle = list('classifier' = TRUE, 'regression' = TRUE),
use_missing = list('classifier' = TRUE, 'regression' = TRUE),
zero_as_missing = list('classifier' = FALSE, 'regression' = FALSE),
two_round = list('classifier' = FALSE, 'regression' = FALSE),

# Convert Parameters
convert_model = list('classifier' = NULL, 'regression' = NULL),
convert_model_language = list('classifier' = "cpp", 'regression' = "cpp"),

# Objective Parameters
boost_from_average = list('classifier' = TRUE, 'regression' = TRUE),
is_unbalance = list('classifier' = FALSE, 'regression' = FALSE),
scale_pos_weight = list('classifier' = 1.0, 'regression' = 1.0),

# Metric Parameters (metric is in Core)
is_provide_training_metric = list('classifier' = TRUE, 'regression' = TRUE),
eval_at = list('classifier' = c(1,2,3,4,5), 'regression' = c(1,2,3,4,5)),

# Network Parameters
num_machines = list('classifier' = 1, 'regression' = 1),

# GPU Parameters
gpu_platform_id = list('classifier' = -1, 'regression' = -1),
gpu_device_id = list('classifier' = -1, 'regression' = -1),
gpu_use_dp = list('classifier' = TRUE, 'regression' = TRUE),
num_gpu = list('classifier' = 1, 'regression' = 1))

# Score XGBoost Hurdle Model
HurdleScores <- RemixAutoML::AutoLightGBMHurdleModelScoring(
  TestData = data,
  Path = Path,
  ModelID = "ModelTest",
  ModelList = NULL,
  ArgsList = NULL,
  Threshold = NULL)

## End(Not run)

```

---

AutoLightGBMMultiClass

*AutoLightGBMMultiClass*


---

## Description

AutoLightGBMMultiClass is an automated lightgbm modeling framework with grid-tuning and model evaluation that runs a variety of steps. First, the function will run a random grid tune over N number of models and find which model is the best (a default model is always included in that set). Once the model is identified and built, several other outputs are generated: validation data with predictions, evaluation plot, evaluation boxplot, evaluation metrics, variable importance, partial dependence calibration plots, partial dependence calibration box plots, and column names used in model fitting.

**Usage**

```

AutoLightGBMMultiClass(
  data = NULL,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = NULL,
  FeatureColNames = NULL,
  PrimaryDateColumn = NULL,
  IDcols = NULL,
  WeightsColumnName = NULL,
  CostMatrixWeights = c(1, 0, 0, 1),
  EncodingMethod = "credibility",
  OutputSelection = c("Importances", "EvalPlots", "EvalMetrics", "Score_TrainData"),
  model_path = NULL,
  metadata_path = NULL,
  DebugMode = FALSE,
  SaveInfoToPDF = FALSE,
  ModelID = "TestModel",
  ReturnFactorLevels = TRUE,
  ReturnModelObjects = TRUE,
  SaveModelObjects = FALSE,
  NumOfParDepPlots = 3L,
  Verbose = 0L,
  GridTune = FALSE,
  grid_eval_metric = "microauc",
  BaselineComparison = "default",
  MaxModelsInGrid = 10L,
  MaxRunsWithoutNewWinner = 20L,
  MaxRunMinutes = 24L * 60L,
  PassInGrid = NULL,
  input_model = NULL,
  task = "train",
  device_type = "CPU",
  NThreads = parallel::detectCores()/2,
  objective = "multiclass",
  multi_error_top_k = 1,
  metric = "multi_logloss",
  boosting = "gbdt",
  LinearTree = FALSE,
  Trees = 50L,
  eta = NULL,
  num_leaves = 31,
  deterministic = TRUE,
  force_col_wise = FALSE,
  force_row_wise = FALSE,
  max_depth = NULL,
  min_data_in_leaf = 20,
  min_sum_hessian_in_leaf = 0.001,
  bagging_freq = 0,
  bagging_fraction = 1,
  feature_fraction = 1,

```

```

feature_fraction_bynode = 1,
extra_trees = FALSE,
early_stopping_round = 10,
first_metric_only = TRUE,
max_delta_step = 0,
lambda_l1 = 0,
lambda_l2 = 0,
linear_lambda = 0,
min_gain_to_split = 0,
drop_rate_dart = 0.1,
max_drop_dart = 50,
skip_drop_dart = 0.5,
uniform_drop_dart = FALSE,
top_rate_goss = FALSE,
other_rate_goss = FALSE,
monotone_constraints = NULL,
monotone_constraints_method = "advanced",
monotone_penalty = 0,
forced_splits_filename = NULL,
refit_decay_rate = 0.9,
path_smooth = 0,
max_bin = 255,
min_data_in_bin = 3,
data_random_seed = 1,
is_enable_sparse = TRUE,
enable_bundle = TRUE,
use_missing = TRUE,
zero_as_missing = FALSE,
two_round = FALSE,
convert_model = NULL,
convert_model_language = "cpp",
boost_from_average = TRUE,
is_unbalance = FALSE,
scale_pos_weight = 1,
is_provide_training_metric = TRUE,
eval_at = c(1, 2, 3, 4, 5),
num_machines = 1,
gpu_platform_id = -1,
gpu_device_id = -1,
gpu_use_dp = TRUE,
num_gpu = 1
)

```

### Arguments

<code>data</code>	This is your data set for training and testing your model
<code>TrainOnFull</code>	Set to TRUE to train on full data
<code>ValidationData</code>	This is your holdout data set used in modeling either refine your hyperparameters.
<code>TestData</code>	This is your holdout data set.
<code>TargetColumnName</code>	Either supply the target column name OR the column number where the target

	is located (but not mixed types).
FeatureColNames	Either supply the feature column names OR the column number where the target is located (but not mixed types)
PrimaryDateColumn	Supply a date or datetime column for catboost to utilize time as its basis for handling categorical features, instead of random shuffling
IDcols	A vector of column names or column numbers to keep in your data but not include in the modeling.
WeightsColumnName	Supply a column name for your weights column. Leave NULL otherwise
EncodingMethod	Choose from 'binary', 'm_estimator', 'credibility', 'woe', 'target_encoding', 'poly_encode', 'backward_difference', 'helmert'
OutputSelection	You can select what type of output you want returned. Choose from c("Importances", "EvalPlots", "EvalMetrics", "PDFs", "Score_TrainData")
model_path	A character string of your path file to where you want your output saved
metadata_path	A character string of your path file to where you want your model evaluation output saved. If left NULL, all output will be saved to model_path.
DebugMode	Set to TRUE to get a print out of the steps taken throughout the function
SaveInfoToPDF	Set to TRUE to save model insights to pdf
ModelID	A character string to name your model and output
ReturnFactorLevels	Set to TRUE to have the factor levels returned with the other model objects
ReturnModelObjects	Set to TRUE to output all modeling objects (E.g. plots and evaluation metrics)
SaveModelObjects	Set to TRUE to return all modeling objects to your environment
NumOfParDepPlots	Tell the function the number of partial dependence calibration plots you want to create.
Verbose	Set to 0 if you want to suppress model evaluation updates in training
GridTune	Set to TRUE to run a grid tuning procedure. Set a number in MaxModelsInGrid to tell the procedure how many models you want to test.
grid_eval_metric	"mae", "mape", "rmse", "r2". Case sensitive
BaselineComparison	Set to either "default" or "best". Default is to compare each successive model build to the baseline model using max trees (from function args). Best makes the comparison to the current best model. # Core parameters <a href="https://lightgbm.readthedocs.io/en/latest/Parameters.html#core-parameter">https://lightgbm.readthedocs.io/en/latest/Parameters.html#core-parameter</a>
MaxModelsInGrid	Number of models to test from grid options (243 total possible options)
MaxRunsWithoutNewWinner	Runs without new winner to end procedure
MaxRunMinutes	In minutes

PassInGrid	Default is NULL. Provide a data.table of grid options from a previous run.
input_model	= NULL, # continue training a model that is stored to fil
task	'train' or 'refit'
device_type	'cpu' or 'gpu'
NThreads	only list up to number of cores, not threads. parallel::detectCores() / 2
objective	'multiclass', 'multiclassova'
multi_error_top_k	Default 1. Counts a prediction as correct if the chosen label is in the top K labels. K = 1 == multi_error
metric	'multi_logloss', 'multi_error', 'kullback_leibler', 'cross_entropy', 'cross_entropy_lambda'
boosting	'gbdt', 'rf', 'dart', 'goss'
LinearTree	FALSE
Trees	50L
eta	NULL
num_leaves	31
deterministic	TRUE # Learning Parameters <a href="https://lightgbm.readthedocs.io/en/latest/Parameters.html#learning-control-parameter">https://lightgbm.readthedocs.io/en/latest/Parameters.html#learning-control-parameter</a>
force_col_wise	FALSE
force_row_wise	FALSE
max_depth	NULL
min_data_in_leaf	20
min_sum_hessian_in_leaf	0.001
bagging_freq	0
bagging_fraction	1.0
feature_fraction	1.0
feature_fraction_bynode	1.0
extra_trees	FALSE
early_stopping_round	10
first_metric_only	TRUE
max_delta_step	0.0
lambda_l1	0.0
lambda_l2	0.0
linear_lambda	0.0
min_gain_to_split	0
drop_rate_dart	0.10

```

max_drop_dart    50
skip_drop_dart   0.50
uniform_drop_dart
                  FALSE
top_rate_goss    FALSE
other_rate_goss
                  FALSE
monotone_constraints
                  "gbdt_prediction.cpp"
monotone_constraints_method
                  'advanced'
monotone_penalty
                  0.0
forced_splits_filename
                  NULL # use for AutoStack option; .json fil
refit_decay_rate
                  0.90
path_smooth      0.0
                  # IO Dataset Parameters https://lightgbm.readthedocs.io/en/latest/Parameters.html#io-parameters
max_bin          255
min_data_in_bin
                  3
data_random_seed
                  1
is_enable_sparse
                  TRUE
enable_bundle    TRUE
use_missing      TRUE
zero_as_missing
                  FALSE
two_round        FALSE
                  # Convert Parameters # https://lightgbm.readthedocs.io/en/latest/Parameters.html#convert-parameters
convert_model    'gbdt_prediction.cpp'
convert_model_language
                  'cpp'
                  # Objective Parameters https://lightgbm.readthedocs.io/en/latest/Parameters.html#objective-parameters
boost_from_average
                  TRUE
is_unbalance     FALSE
scale_pos_weight
                  1.0
                  # Metric Parameters (metric is in Core)
is_provide_training_metric
                  TRUE

```



```

eval_at      c(1,2,3,4,5)
              # Network Parameter

num_machines 1
              # GPU Parameter

gpu_platform_id
              -1

gpu_device_id -1

gpu_use_dp    TRUE

num_gpu       1

```

**Value**

Saves to file and returned in list: VariableImportance.csv, Model, ValidationData.csv, Evaluation-Plot.png, EvaluationBoxPlot.png, EvaluationMetrics.csv, ParDepPlots.R a named list of features with partial dependence calibration plots, ParDepBoxPlots.R, GridCollect, and GridList

**Author(s)**

Adrian Antico

**Examples**

```

## Not run:
# Create some dummy correlated data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 1000,
  ID = 2,
  ZIP = 0,
  AddDate = FALSE,
  Classification = FALSE,
  MultiClass = FALSE)

# Run function
TestModel <- RemixAutoML::AutoLightGBMMultiClass(

  # Metadata args
  OutputSelection = c("Importances", "EvalPlots", "EvalMetrics", "Score_TrainData"),
  model_path = normalizePath("./"),
  metadata_path = NULL,
  ModelID = "Test_Model_1",
  NumOfParDepPlots = 3L,
  EncodingMethod = "credibility",
  ReturnFactorLevels = TRUE,
  ReturnModelObjects = TRUE,
  SaveModelObjects = FALSE,
  SaveInfoToPDF = FALSE,
  DebugMode = FALSE,

  # Data args
  data = data,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,

```

```

TargetColumnName = "Adrian",
FeatureColNames = names(data)[!names(data) %in% c("IDcol_1", "IDcol_2", "Adrian")],
PrimaryDateColumn = NULL,
WeightsColumnName = NULL,
IDcols = c("IDcol_1", "IDcol_2"),

# Grid parameters
GridTune = FALSE,
grid_eval_metric = 'microauc',
BaselineComparison = 'default',
MaxModelsInGrid = 10L,
MaxRunsWithoutNewWinner = 20L,
MaxRunMinutes = 24L*60L,
PassInGrid = NULL,

# Core parameters
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#core-parameters
input_model = NULL, # continue training a model that is stored to file
task = "train",
device_type = 'CPU',
NThreads = parallel::detectCores() / 2,
objective = 'multiclass',
multi_error_top_k = 1,
metric = 'multi_logloss',
boosting = 'gbdt',
LinearTree = FALSE,
Trees = 50L,
eta = NULL,
num_leaves = 31,
deterministic = TRUE,

# Learning Parameters
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#learning-control-parameters
force_col_wise = FALSE,
force_row_wise = FALSE,
max_depth = NULL,
min_data_in_leaf = 20,
min_sum_hessian_in_leaf = 0.001,
bagging_freq = 0,
bagging_fraction = 1.0,
feature_fraction = 1.0,
feature_fraction_bynode = 1.0,
extra_trees = FALSE,
early_stopping_round = 10,
first_metric_only = TRUE,
max_delta_step = 0.0,
lambda_l1 = 0.0,
lambda_l2 = 0.0,
linear_lambda = 0.0,
min_gain_to_split = 0,
drop_rate_dart = 0.10,
max_drop_dart = 50,
skip_drop_dart = 0.50,
uniform_drop_dart = FALSE,
top_rate_goss = FALSE,
other_rate_goss = FALSE,
monotone_constraints = NULL,

```

```

monotone_constraints_method = "advanced",
monotone_penalty = 0.0,
forced_splits_filename = NULL, # use for AutoStack option; .json file
refit_decay_rate = 0.90,
path_smooth = 0.0,

# IO Dataset Parameters
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#io-parameters
max_bin = 255,
min_data_in_bin = 3,
data_random_seed = 1,
is_enable_sparse = TRUE,
enable_bundle = TRUE,
use_missing = TRUE,
zero_as_missing = FALSE,
two_round = FALSE,

# Convert Parameters
convert_model = NULL,
convert_model_language = "cpp",

# Objective Parameters
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#objective-parameters
boost_from_average = TRUE,
is_unbalance = FALSE,
scale_pos_weight = 1.0,

# Metric Parameters (metric is in Core)
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#metric-parameters
is_provide_training_metric = TRUE,
eval_at = c(1,2,3,4,5),

# Network Parameters
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#network-parameters
num_machines = 1,

# GPU Parameters
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#gpu-parameters
gpu_platform_id = -1,
gpu_device_id = -1,
gpu_use_dp = TRUE,
num_gpu = 1)

## End(Not run)

```

---

AutoLightGBMRegression

*AutoLightGBMRegression*


---

## Description

AutoLightGBMRegression is an automated lightgbm modeling framework with grid-tuning and model evaluation that runs a variety of steps. First, the function will run a random grid tune over N number of models and find which model is the best (a default model is always included in that set).

Once the model is identified and built, several other outputs are generated: validation data with predictions, evaluation plot, evaluation boxplot, evaluation metrics, variable importance, partial dependence calibration plots, partial dependence calibration box plots, and column names used in model fitting.

## Usage

```
AutoLightGBMRegression(
  data = NULL,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = NULL,
  FeatureColNames = NULL,
  PrimaryDateColumn = NULL,
  WeightsColumnName = NULL,
  IDcols = NULL,
  OutputSelection = c("Importances", "EvalPlots", "EvalMetrics", "Score_TrainData"),
  model_path = NULL,
  metadata_path = NULL,
  DebugMode = FALSE,
  SaveInfoToPDF = FALSE,
  ModelID = "TestModel",
  ReturnFactorLevels = TRUE,
  ReturnModelObjects = TRUE,
  SaveModelObjects = FALSE,
  EncodingMethod = "credibility",
  TransformNumericColumns = NULL,
  Methods = c("Asinh", "Log", "LogPlus1", "Sqrt", "Asin", "Logit"),
  Verbose = 0L,
  NumOfParDepPlots = 3L,
  GridTune = FALSE,
  grid_eval_metric = "r2",
  BaselineComparison = "default",
  MaxModelsInGrid = 10L,
  MaxRunsWithoutNewWinner = 20L,
  MaxRunMinutes = 24L * 60L,
  PassInGrid = NULL,
  input_model = NULL,
  task = "train",
  device_type = "CPU",
  NThreads = parallel::detectCores()/2,
  objective = "regression",
  metric = "rmse",
  boosting = "gbdt",
  LinearTree = FALSE,
  Trees = 50L,
  eta = NULL,
  num_leaves = 31,
  deterministic = TRUE,
  force_col_wise = FALSE,
  force_row_wise = FALSE,
  max_depth = NULL,
```

```
min_data_in_leaf = 20,  
min_sum_hessian_in_leaf = 0.001,  
bagging_freq = 0,  
bagging_fraction = 1,  
feature_fraction = 1,  
feature_fraction_bynode = 1,  
extra_trees = FALSE,  
early_stopping_round = 10,  
first_metric_only = TRUE,  
max_delta_step = 0,  
lambda_l1 = 0,  
lambda_l2 = 0,  
linear_lambda = 0,  
min_gain_to_split = 0,  
drop_rate_dart = 0.1,  
max_drop_dart = 50,  
skip_drop_dart = 0.5,  
uniform_drop_dart = FALSE,  
top_rate_goss = FALSE,  
other_rate_goss = FALSE,  
monotone_constraints = NULL,  
monotone_constraints_method = "advanced",  
monotone_penalty = 0,  
forced_splits_filename = NULL,  
refit_decay_rate = 0.9,  
path_smooth = 0,  
max_bin = 255,  
min_data_in_bin = 3,  
data_random_seed = 1,  
is_enable_sparse = TRUE,  
enable_bundle = TRUE,  
use_missing = TRUE,  
zero_as_missing = FALSE,  
two_round = FALSE,  
convert_model = NULL,  
convert_model_language = "cpp",  
boost_from_average = TRUE,  
alpha = 0.9,  
fair_c = 1,  
poisson_max_delta_step = 0.7,  
tweedie_variance_power = 1.5,  
lambdarank_truncation_level = 30,  
is_provide_training_metric = TRUE,  
eval_at = c(1, 2, 3, 4, 5),  
num_machines = 1,  
gpu_platform_id = -1,  
gpu_device_id = -1,  
gpu_use_dp = TRUE,  
num_gpu = 1  
)
```

**Arguments**

<code>data</code>	This is your data set for training and testing your model
<code>TrainOnFull</code>	Set to TRUE to train on full data
<code>ValidationData</code>	This is your holdout data set used in modeling either refine your hyperparameters.
<code>TestData</code>	This is your holdout data set.
<code>TargetColumnName</code>	Either supply the target column name OR the column number where the target is located (but not mixed types).
<code>FeatureColNames</code>	Either supply the feature column names OR the column number where the target is located (but not mixed types)
<code>PrimaryDateColumn</code>	Supply a date or datetime column for catboost to utilize time as its basis for handling categorical features, instead of random shuffling
<code>WeightsColumnName</code>	Supply a column name for your weights column. Leave NULL otherwise
<code>IDcols</code>	A vector of column names or column numbers to keep in your data but not include in the modeling.
<code>OutputSelection</code>	You can select what type of output you want returned. Choose from <code>c('Importances', 'EvalPlots', 'EvalMetrics', 'PDFs', 'Score_TrainData')</code>
<code>model_path</code>	A character string of your path file to where you want your output saved
<code>metadata_path</code>	A character string of your path file to where you want your model evaluation output saved. If left NULL, all output will be saved to <code>model_path</code> .
<code>DebugMode</code>	Set to TRUE to get a print out of the steps taken throughout the function
<code>SaveInfoToPDF</code>	Set to TRUE to save model insights to pdf
<code>ModelID</code>	A character string to name your model and output
<code>ReturnFactorLevels</code>	Set to TRUE to have the factor levels returned with the other model objects
<code>ReturnModelObjects</code>	Set to TRUE to output all modeling objects (E.g. plots and evaluation metrics)
<code>SaveModelObjects</code>	Set to TRUE to return all modeling objects to your environment
<code>EncodingMethod</code>	Choose from <code>'binary', 'm_estimator', 'credibility', 'woe', 'target_encoding', 'poly_encode', 'backward_difference', 'helmert'</code>
<code>TransformNumericColumns</code>	Set to NULL to do nothing; otherwise supply the column names of numeric variables you want transformed
<code>Methods</code>	Choose from <code>'BoxCox', 'Asinh', 'Asin', 'Log', 'LogPlus1', 'Sqrt', 'Logit', 'YeoJohnson'</code> . Function will determine if one cannot be used because of the underlying data.
<code>Verbose</code>	Set to 0 if you want to suppress model evaluation updates in training
<code>NumOfParDepPlots</code>	Tell the function the number of partial dependence calibration plots you want to create.

GridTune	Set to TRUE to run a grid tuning procedure. Set a number in MaxModelsInGrid to tell the procedure how many models you want to test.
grid_eval_metric	'mae', 'mape', 'rmse', 'r2'. Case sensitive
BaselineComparison	Set to either 'default' or 'best'. Default is to compare each successive model build to the baseline model using max trees (from function args). Best makes the comparison to the current best model.
MaxModelsInGrid	Number of models to test from grid options (243 total possible options)
MaxRunsWithoutNewWinner	Runs without new winner to end procedure
MaxRunMinutes	In minutes
PassInGrid	Default is NULL. Provide a data.table of grid options from a previous run.
input_model	= NULL, # continue training a model that is stored to fil # Core parameters <a href="https://lightgbm.readthedocs.io/en/latest/Parameters.html#core-parameter">https://lightgbm.readthedocs.io/en/latest/Parameters.html#core-parameter</a>
task	'train' or 'refit'
device_type	'cpu' or 'gpu'
NThreads	only list up to number of cores, not threads. parallel::detectCores() / 2
objective	'regression'
metric	'rmse', 'l1', 'l2', 'quantile', 'mape', 'huber', 'fair', 'poisson', 'gamma', 'gamma_deviance', 'tweedie', 'ndcg'
boosting	'gbdt', 'rf', 'dart', 'goss'
LinearTree	FALSE
Trees	50L
eta	NULL
num_leaves	31
deterministic	TRUE # Learning Parameters <a href="https://lightgbm.readthedocs.io/en/latest/Parameters.html#learning-control-parameter">https://lightgbm.readthedocs.io/en/latest/Parameters.html#learning-control-parameter</a>
force_col_wise	FALSE
force_row_wise	FALSE
max_depth	NULL
min_data_in_leaf	20
min_sum_hessian_in_leaf	0.001
bagging_freq	0
bagging_fraction	1.0
feature_fraction	1.0
feature_fraction_bynode	1.0

```

extra_trees      FALSE
early_stopping_round
10
first_metric_only
TRUE
max_delta_step  0.0
lambda_l1       0.0
lambda_l2       0.0
linear_lambda   0.0
min_gain_to_split
0
drop_rate_dart  0.10
max_drop_dart   50
skip_drop_dart  0.50
uniform_drop_dart
FALSE
top_rate_goss   FALSE
other_rate_goss
FALSE
monotone_constraints
NULL, 'gbdt_prediction.cpp'
monotone_constraints_method
'advanced'
monotone_penalty
0.0
forcedsplits_filename
NULL # use for AutoStack option; .json fil
refit_decay_rate
0.90
path_smooth     0.0
# IO Dataset Parameters https://lightgbm.readthedocs.io/en/latest/Parameters.html#io-parameters
max_bin         255
min_data_in_bin
3
data_random_seed
1
is_enable_sparse
TRUE
enable_bundle   TRUE
use_missing     TRUE
zero_as_missing
FALSE
two_round       FALSE
# Convert Parameters # https://lightgbm.readthedocs.io/en/latest/Parameters.html#convert-parameters

```



```

convert_model    'gbdt_prediction.cpp'
convert_model_language
                  'cpp'
                  # Objective Parameters https://lightgbm.readthedocs.io/en/latest/Parameters.html#objective-parameters
boost_from_average
                  TRUE
alpha            0.90
fair_c           1.0
poisson_max_delta_step
                  0.70
tweedie_variance_power
                  1.5
lambdarank_truncation_level
                  30
                  # Metric Parameters (metric is in Core)
is_provide_training_metric
                  TRUE
eval_at          c(1,2,3,4,5)
                  # Network Parameter
num_machines     1
                  # GPU Parameter
gpu_platform_id  -1
gpu_device_id    -1
gpu_use_dp       TRUE
num_gpu          1

```

**Value**

Saves to file and returned in list: VariableImportance.csv, Model, ValidationData.csv, Evaluation-Plot.png, EvaluationBoxPlot.png, EvaluationMetrics.csv, ParDepPlots.R a named list of features with partial dependence calibration plots, ParDepBoxPlots.R, GridCollect, and GridList

**Author(s)**

Adrian Antico

**See Also**

Other Automated Supervised Learning - Regression: [AutoCatBoostRegression\(\)](#), [AutoH2oDRFRegression\(\)](#), [AutoH2oGAMRegression\(\)](#), [AutoH2oGBMRegression\(\)](#), [AutoH2oGLMRegression\(\)](#), [AutoH2oMLRegression\(\)](#), [AutoNLS\(\)](#), [AutoXGBoostRegression\(\)](#)

**Examples**

```

## Not run:
# Create some dummy correlated data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 1000,
  ID = 2,
  ZIP = 0,
  AddDate = FALSE,
  Classification = FALSE,
  MultiClass = FALSE)

# Run function
TestModel <- RemixAutoML::AutoLightGBMRegression(

  # Metadata args
  OutputSelection = c('Importances','EvalPlots','EvalMetrics','Score_TrainData'),
  model_path = normalizePath('./'),
  metadata_path = NULL,
  ModelID = 'Test_Model_1',
  NumOfParDepPlots = 3L,
  EncodingMethod = 'credibility',
  ReturnFactorLevels = TRUE,
  ReturnModelObjects = TRUE,
  SaveModelObjects = FALSE,
  SaveInfoToPDF = FALSE,
  DebugMode = FALSE,

  # Data args
  data = data,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = 'Adrian',
  FeatureColNames = names(data)[!names(data) %in% c('IDcol_1', 'IDcol_2','Adrian')],
  PrimaryDateColumn = NULL,
  WeightsColumnName = NULL,
  IDcols = c('IDcol_1','IDcol_2'),
  TransformNumericColumns = NULL,
  Methods = c('Asinh','Asin','Log','LogPlus1','Sqrt','Logit'),

  # Grid parameters
  GridTune = FALSE,
  grid_eval_metric = 'r2',
  BaselineComparison = 'default',
  MaxModelsInGrid = 10L,
  MaxRunsWithoutNewWinner = 20L,
  MaxRunMinutes = 24L*60L,
  PassInGrid = NULL,

  # Core parameters
  # https://lightgbm.readthedocs.io/en/latest/Parameters.html#core-parameters
  input_model = NULL, # continue training a model that is stored to file
  task = 'train',
  device_type = 'CPU',
  NThreads = parallel::detectCores() / 2,

```

```
objective = 'regression',
metric = 'rmse',
boosting = 'gbdt',
LinearTree = FALSE,
Trees = 50L,
eta = NULL,
num_leaves = 31,
deterministic = TRUE,

# Learning Parameters
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#learning-control-parameters
force_col_wise = FALSE,
force_row_wise = FALSE,
max_depth = NULL,
min_data_in_leaf = 20,
min_sum_hessian_in_leaf = 0.001,
bagging_freq = 0,
bagging_fraction = 1.0,
feature_fraction = 1.0,
feature_fraction_bynode = 1.0,
extra_trees = FALSE,
early_stopping_round = 10,
first_metric_only = TRUE,
max_delta_step = 0.0,
lambda_l1 = 0.0,
lambda_l2 = 0.0,
linear_lambda = 0.0,
min_gain_to_split = 0,
drop_rate_dart = 0.10,
max_drop_dart = 50,
skip_drop_dart = 0.50,
uniform_drop_dart = FALSE,
top_rate_goss = FALSE,
other_rate_goss = FALSE,
monotone_constraints = NULL,
monotone_constraints_method = 'advanced',
monotone_penalty = 0.0,
forced_splits_filename = NULL, # use for AutoStack option; .json file
refit_decay_rate = 0.90,
path_smooth = 0.0,

# IO Dataset Parameters
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#io-parameters
max_bin = 255,
min_data_in_bin = 3,
data_random_seed = 1,
is_enable_sparse = TRUE,
enable_bundle = TRUE,
use_missing = TRUE,
zero_as_missing = FALSE,
two_round = FALSE,

# Convert Parameters
convert_model = NULL,
convert_model_language = 'cpp',

# Objective Parameters
```

```

# https://lightgbm.readthedocs.io/en/latest/Parameters.html#objective-parameters
boost_from_average = TRUE,
alpha = 0.90,
fair_c = 1.0,
poisson_max_delta_step = 0.70,
tweedie_variance_power = 1.5,
lamdarank_truncation_level = 30,

# Metric Parameters (metric is in Core)
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#metric-parameters
is_provide_training_metric = TRUE,
eval_at = c(1,2,3,4,5),

# Network Parameters
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#network-parameters
num_machines = 1,

# GPU Parameters
# https://lightgbm.readthedocs.io/en/latest/Parameters.html#gpu-parameters
gpu_platform_id = -1,
gpu_device_id = -1,
gpu_use_dp = TRUE,
num_gpu = 1)

## End(Not run)

```

---

AutoLightGBMScoring      *AutoLightGBMScoring*

---

## Description

AutoLightGBMScoring is an automated scoring function that compliments the AutoLightGBM model training functions. This function requires you to supply features for scoring. It will run ModelDataPrep() and the DummifyDT() function to prepare your features for xgboost data conversion and scoring.

## Usage

```

AutoLightGBMScoring(
  TargetType = NULL,
  ScoringData = NULL,
  ReturnShapValues = FALSE,
  FeatureColumnNames = NULL,
  IDcols = NULL,
  EncodingMethod = "credibility",
  FactorLevelsList = NULL,
  TargetLevels = NULL,
  OneHot = FALSE,
  ModelObject = NULL,
  ModelPath = NULL,
  ModelID = NULL,
  ReturnFeatures = TRUE,
  TransformNumeric = FALSE,

```

```

BackTransNumeric = FALSE,
TargetColumnName = NULL,
TransformationObject = NULL,
TransID = NULL,
TransPath = NULL,
MDP_Impute = TRUE,
MDP_CharToFactor = TRUE,
MDP_RemoveDates = TRUE,
MDP_MissFactor = "0",
MDP_MissNum = -1
)

```

### Arguments

TargetType	Set this value to 'regression', 'classification', or 'multiclass' to score models built using AutoLightGBMRegression(), AutoLightGBMClassifier() or AutoLightGBMMultiClass()
ScoringData	This is your data.table of features for scoring. Can be a single row or batch.
ReturnShapValues	Not functional yet. The shap values are returned in a way that is slow and incompatible with the existing tools. Working on a better solution.
FeatureColumnNames	Supply either column names or column numbers used in the AutoLightGBM__() function
IDcols	Supply ID column numbers for any metadata you want returned with your predicted values
EncodingMethod	Choose from 'binary', 'm_estimator', 'credibility', 'woe', 'target_encoding', 'poly_encode', 'backward_difference', 'helmert'
FactorLevelsList	Supply the factor variables' list from DummifyDT()
TargetLevels	Supply the target levels output from AutoLightGBMMultiClass() or the scoring function will go looking for it in the file path you supply.
ModelObject	Supply a model for scoring, otherwise it will have to search for it in the file path you specify
ModelPath	Supply your path file used in the AutoLightGBM__() function
ModelID	Supply the model ID used in the AutoLightGBM__() function
ReturnFeatures	Set to TRUE to return your features with the predicted values.
TransformNumeric	Set to TRUE if you have features that were transformed automatically from an Auto__Regression() model AND you haven't already transformed them.
BackTransNumeric	Set to TRUE to generate back-transformed predicted values. Also, if you return features, those will also be back-transformed.
TargetColumnName	Input your target column name used in training if you are utilizing the transformation service
TransformationObject	Set to NULL if you didn't use transformations or if you want the function to pull from the file output from the Auto__Regression() function. You can also supply the transformation data.table object with the transformation details versus having it pulled from file.

TransID	Set to the ID used for saving the transformation data.table object or set it to the ModelID if you are pulling from file from a build with Auto__Regression().
TransPath	Set the path file to the folder where your transformation data.table detail object is stored. If you used the Auto__Regression() to build, set it to the same path as ModelPath.
MDP_Impute	Set to TRUE if you did so for modeling and didn't do so before supplying ScoringData in this function
MDP_CharToFactor	Set to TRUE to turn your character columns to factors if you didn't do so to your ScoringData that you are supplying to this function
MDP_RemoveDates	Set to TRUE if you have date of timestamp columns in your ScoringData
MDP_MissFactor	If you set MDP_Impute to TRUE, supply the character values to replace missing values with
MDP_MissNum	If you set MDP_Impute to TRUE, supply a numeric value to replace missing values with

**Value**

A data.table of predicted values with the option to return model features as well.

**Author(s)**

Adrian Antico

**See Also**

Other Automated Model Scoring: [AutoCatBoostScoring\(\)](#), [AutoH2OMLScoring\(\)](#), [AutoXGBoostScoring\(\)](#)

**Examples**

```
## Not run:
Preds <- RemixAutoML::AutoLightGBMScoring(
  TargetType = 'regression',
  ScoringData = data,
  ReturnShapValues = FALSE,
  FeatureColumnNames = 2:12,
  IDcols = NULL,
  EncodingMethod = 'credibility',
  FactorLevelsList = NULL,
  TargetLevels = NULL,
  ModelObject = NULL,
  ModelPath = 'home',
  ModelID = 'ModelTest',
  ReturnFeatures = TRUE,
  TransformNumeric = FALSE,
  BackTransNumeric = FALSE,
  TargetColumnName = NULL,
  TransformationObject = NULL,
  TransID = NULL,
  TransPath = NULL,
  MDP_Impute = TRUE,
  MDP_CharToFactor = TRUE,
  MDP_RemoveDates = TRUE,
```

```
MDP_MissFactor = '0',
MDP_MissNum = -1)

## End(Not run)
```

---

AutoMarketBasketModel *AutoMarketBasketModel*


---

## Description

AutoMarketBasketModel function runs a market basket analysis automatically. It will convert your data, run the algorithm, and add on additional significance values not originally contained within.

## Usage

```
AutoMarketBasketModel(
  data,
  OrderIDColumnName,
  ItemIDColumnName,
  LHS_Delimiter = ",",
  Support = 0.001,
  Confidence = 0.1,
  MaxLength = 2,
  MinLength = 2,
  MaxTime = 5
)
```

## Arguments

data	This is your transactions data set
OrderIDColumnName	Supply your column name for the Order ID Values
ItemIDColumnName	Supply your column name for the Item ID Values
LHS_Delimiter	Default delimiter for separating multiple ItemID's is a comma.
Support	Threshold for inclusion using support
Confidence	Threshold for inclusion using confidence
MaxLength	Maximum combinations of Item ID (number of items in basket to consider)
MinLength	Minimum length of combinations of ItemID (number of items in basket to consider)
MaxTime	Max run time per iteration (default is 5 seconds)

## Author(s)

Adrian Antico and Douglas Pestana

## See Also

Chi-sq statistics and p-values based on this paper: <http://www.cs.bc.edu/~alvarez/ChiSquare/chi2tr.pdf>

Other Recommenders: [AutoRecommenderDataCreate\(\)](#), [AutoRecommenderScore\(\)](#), [AutoRecommenderTrain\(\)](#)

Examples

```
## Not run:
rules_data <- AutoMarketBasketModel(
  data,
  OrderIDColumnName = "OrderNumber",
  ItemIDColumnName = "ItemNumber",
  LHS_Delimiter = ", ",
  Support = 0.001,
  Confidence = 0.1,
  MaxLength = 2,
  MinLength = 2,
  MaxTime = 5)

## End(Not run)
```

---

AutoNLS	<i>AutoNLS</i>
---------	----------------

---

Description

This function will build models for 9 different nls models, along with a non-parametric monotonic regression and a polynomial regression. The models are evaluated, a winner is picked, and the predicted values are stored in your data table.

Usage

```
AutoNLS(data, y, x, monotonic = TRUE)
```

Arguments

data	Data is the data table you are building the modeling on
y	Y is the target variable name in quotes
x	X is the independent variable name in quotes
monotonic	This is a TRUE/FALSE indicator - choose TRUE if you want monotonic regression over polynomial regression

Value

A list containing "PredictionData" which is a data table with your original column replaced by the nls model predictions; "ModelName" the model name; "ModelObject" The winning model to later use; "EvaluationMetrics" Model metrics for models with ability to build.

Author(s)

Adrian Antico

See Also

Other Automated Supervised Learning - Regression: [AutoCatBoostRegression\(\)](#), [AutoH2oDRFRegression\(\)](#), [AutoH2oGAMRegression\(\)](#), [AutoH2oGBMRegression\(\)](#), [AutoH2oGLMRegression\(\)](#), [AutoH2oMLRegression\(\)](#), [AutoLightGBMRegression\(\)](#), [AutoXGBoostRegression\(\)](#)



**Examples**

```

## Not run:
# Create Growth Data
data <- data.table::data.table(Target = seq(1, 500, 1),
  Variable = rep(1, 500))
for (i in as.integer(1:500)) {
  if (i == 1) {
    var <- data[i, "Target"][[1]]
    data.table::set(data, i = i, j = 2L,
      value = var * (1 + runif(1) / 100))
  } else {
    var <- data[i - 1, "Variable"][[1]]
    data.table::set(data, i = i, j = 2L,
      value = var * (1 + runif(1) / 100))
  }
}

# Add jitter to Target
data[, Target := jitter(Target, factor = 0.25)]

# To keep original values
data1 <- data.table::copy(data)

# Merge and Model data
data11 <- AutoNLS(
  data = data,
  y = "Target",
  x = "Variable",
  monotonic = TRUE)

# Join predictions to source data
data2 <- merge(
  data1,
  data11$PredictionData,
  by = "Variable",
  all = FALSE)

# Plot output
ggplot2::ggplot(data2, ggplot2::aes(x = Variable)) +
  ggplot2::geom_line(ggplot2::aes(y = data2[["Target.x"]],
    color = "Target")) +
  ggplot2::geom_line(ggplot2::aes(y = data2[["Target.y"]],
    color = "Predicted")) +
  RemixAutoML::ChartTheme(Size = 12) +
  ggplot2::ggtitle(paste0("Growth Models AutoNLS: ",
    data11$ModelName)) +
  ggplot2::ylab("Target Variable") +
  ggplot2::xlab("Independent Variable") +
  ggplot2::scale_colour_manual("Values",
    breaks = c("Target", "Predicted"),
    values = c("red", "blue"))

summary(data11$ModelObject)
data11$EvaluationMetrics

## End(Not run)

```

---

AutoRecommenderDataCreate

*AutoRecommenderDataCreate*


---

## Description

AutoRecommenderDataCreate to create data that is prepared for modeling

## Usage

```
AutoRecommenderDataCreate(
  data,
  EntityColName = "CustomerID",
  ProductColName = "StockCode",
  MetricColName = "TotalSales",
  ReturnMatrix = FALSE
)
```

## Arguments

data	This is your transactional data.table. Must include an Entity (typically customer), ProductCode (such as SKU), and a sales metric (such as total sales).
EntityColName	This is the column name in quotes that represents the column name for the Entity, such as customer
ProductColName	This is the column name in quotes that represents the column name for the product, such as SKU
MetricColName	This is the column name in quotes that represents the column name for the metric, such as total sales
ReturnMatrix	Set to FALSE to coerce the object (desired route) or TRUE to return a matrix

## Value

A BinaryRatingsMatrix

## Author(s)

Adrian Antico and Douglas Pestana

## See Also

Other Recommenders: [AutoMarketBasketModel\(\)](#), [AutoRecommenderScore\(\)](#), [AutoRecommenderTrain\(\)](#)

## Examples

```
## Not run:
RatingsMatrix <- RemixAutoML::AutoRecommenderDataCreate(
  data,
  EntityColName = "CustomerID",
  ProductColName = "StockCode",
  MetricColName = "TotalSales",
  ReturnMatrix = TRUE)

## End(Not run)
```

---

AutoRecommenderScore    *AutoRecommenderScore*


---

## Description

This function will take your ratings matrix and model and score your data in parallel.

## Usage

```
AutoRecommenderScore(
  data,
  WinningModel,
  EntityColName = "CustomerID",
  ProductColName = "StockCode",
  NumItemsReturn = 1
)
```

## Arguments

data	The binary ratings matrix from <code>RecomDataCreate()</code>
WinningModel	The winning model returned from <code>AutoRecommender()</code>
EntityColName	Typically your customer ID
ProductColName	Something like "StockCode"
NumItemsReturn	Number of items to return on scoring

## Value

Returns the prediction data

## Author(s)

Adrian Antico and Douglas Pestana

## See Also

Other Recommenders: [AutoMarketBasketModel\(\)](#), [AutoRecommenderDataCreate\(\)](#), [AutoRecommenderTrain\(\)](#)

## Examples

```
## Not run:
Results <- RemixAutoML::AutoRecommenderScore(
  data = AutoRecomDataCreate(
    data,
    EntityColName = "CustomerID",
    ProductColName = "StockCode",
    MetricColName = "TotalSales"),
  WinningModel = AutoRecommender(
    AutoRecomDataCreate(
      data,
      EntityColName = "CustomerID",
      ProductColName = "StockCode",
      MetricColName = "TotalSales"),
```

```

    Partition = "Split",
    KFold = 2,
    Ratio = 0.75,
    RatingType = "TopN",
    RatingsKeep = 20,
    SkipModels = "AssociationRules",
    ModelMetric = "TPR"),
  EntityColName = "CustomerID",
  ProductColName = "StockCode")

## End(Not run)

```

---

AutoRecommenderTrain    *AutoRecommenderTrain*

---

## Description

This function returns the winning model that you pass onto AutoRecommenderScoring

## Usage

```

AutoRecommenderTrain(
  data,
  Partition = "Split",
  KFold = 1,
  Ratio = 0.75,
  Given = 1,
  RatingType = "TopN",
  RatingsKeep = 20,
  SkipModels = "AssociationRules",
  ModelMetric = "TPR"
)

```

## Arguments

data	This is your BinaryRatingsMatrix. See function RecomDataCreate
Partition	Choose from "split", "cross-validation", "bootstrap". See evaluationScheme in recommenderlab for details.
KFold	Choose 1 for traditional train and test. Choose greater than 1 for the number of cross validations
Ratio	The ratio for train and test. E.g. 0.75 for 75 percent data allocated to training
Given	The number of products you would like to evaluate. Negative values implement all-but schemes.
RatingType	Choose from "TopN", "ratings", "ratingMatrix"
RatingsKeep	The total ratings you wish to return. Default is 20.
SkipModels	AssociationRules runs the slowest and may crash your system. Choose from: "AssociationRules", "ItemBasedCF", "UserBasedCF", "PopularItems", "RandomItems"
ModelMetric	Choose from "Precision", "Recall", "TPR", or "FPR"

**Value**

The winning model used for scoring in the `AutoRecommenderScoring` function

**Author(s)**

Adrian Antico and Douglas Pestana

**See Also**

Other Recommenders: [AutoMarketBasketModel\(\)](#), [AutoRecommenderDataCreate\(\)](#), [AutoRecommenderScore\(\)](#)

**Examples**

```
## Not run:
WinningModel <- AutoRecommender(
  RatingsMatrix,
  Partition = "Split",
  KFold = 1,
  Ratio = 0.75,
  Given = 1,
  RatingType = "TopN",
  RatingsKeep = 20,
  SkipModels = "AssociationRules",
  ModelMetric = "TPR")

## End(Not run)
```

---

AutoShapeShap

*AutoShapeShap*


---

**Description**

AutoShapeShap will convert your scored shap values from CatBoost

**Usage**

```
AutoShapeShap(
  ScoringData = NULL,
  Threads = max(1L, parallel::detectCores() - 2L),
  DateColumnName = "Date",
  ByVariableName = "GroupVariable"
)
```

**Arguments**

ScoringData	Scoring data from AutoCatBoostScoring with classification or regression
Threads	Number of threads to use for the parallel routine
DateColumnName	Name of the date column in scoring data
ByVariableName	Name of your base entity column name

**Author(s)**

Adrian Antico

**See Also**

Other Model Evaluation and Interpretation: [CumGainsChart\(\)](#), [EvalPlot\(\)](#), [ParDepCalPlots\(\)](#), [ROCPlot\(\)](#), [RedYellowGreen\(\)](#), [ResidualPlots\(\)](#), [SingleRowShapeShap\(\)](#), [threshOptim\(\)](#)

AutoTBATS

*AutoTBATS***Description**

AutoTBATS is a multi-armed bandit model testing framework for AR and SAR NNets. Randomized probability matching is the underlying bandit algorithm. Model evaluation is done by blending the training error and the validation error from testing the model on out of sample data. The bandit algorithm compares the performance of the current build against the previous builds which starts with the classic nnetar model from the forecast package. Depending on how many lags, seasonal lags, and fourier pairs you test the number of combinations of features to test begins to approach 10,000 different combinations of settings. The function tests out transformations, differencing, and variations of the lags, seasonal lags, and fourier pairs. The parameter space is broken up into various buckets that are increasing in sophistication. The bandit algorithm samples from those buckets and based on many rounds of testing it determines which buckets to generate samples from more frequently based on the models performance coming from that bucket. All of the models have performance data collected on them and a final rebuild is initiated when a winner is found. The rebuild process begins by retraining the model with the settings that produced the best performance. If the model fails to build, for whatever reason, the next best buildable model is rebuilt.

**Usage**

```
AutoTBATS(
  data,
  FilePath = NULL,
  TargetVariableName,
  DateColumnName,
  TimeAggLevel = "week",
  EvaluationMetric = "MAE",
  NumHoldOutPeriods = 5L,
  NumFCPeriods = 5L,
  MaxLags = 5L,
  MaxMovingAverages = 5L,
  MaxSeasonalPeriods = 1L,
  TrainWeighting = 0.5,
  MaxConsecutiveFails = 12L,
  MaxNumberModels = 100L,
  MaxRunTimeMinutes = 10L,
  NumberCores = max(1L, min(4L, parallel::detectCores() - 2L))
)
```

**Arguments**

<code>data</code>	Source data.table
<code>FilePath</code>	NULL to return nothing. Provide a file path to save the model and xregs if available
<code>TargetVariableName</code>	Name of your time series target variable
<code>DateColumnName</code>	Name of your date column
<code>TimeAggLevel</code>	Choose from "year", "quarter", "month", "week", "day", "hour"
<code>EvaluationMetric</code>	Choose from MAE, MSE, and MAPE
<code>NumHoldOutPeriods</code>	Number of time periods to use in the out of sample testing
<code>NumFCPeriods</code>	Number of periods to forecast
<code>MaxLags</code>	A single value of the max number of lags to use in the internal auto.arima of tbats
<code>MaxMovingAverages</code>	A single value of the max number of moving averages to use in the internal auto.arima of tbats
<code>MaxSeasonalPeriods</code>	A single value for the max allowable seasonal periods to be tested in the tbats framework
<code>TrainWeighting</code>	Model ranking is based on a weighted average of training metrics and out of sample metrics. Supply the weight of the training metrics, such as 0.50 for 50 percent.
<code>MaxConsecutiveFails</code>	When a new best model is found MaxConsecutiveFails resets to zero. Indicated the number of model attempts without a new winner before terminating the procedure.
<code>MaxNumberModels</code>	Indicate the maximum number of models to test.
<code>MaxRunTimeMinutes</code>	Indicate the maximum number of minutes to wait for a result.
<code>NumberCores</code>	Default max(1L, min(4L, parallel::detectCores()-2L))

**Author(s)**

Adrian Antico

**See Also**

Other Automated Time Series: [AutoArfima\(\)](#), [AutoBanditNNet\(\)](#), [AutoBanditSarima\(\)](#), [AutoETS\(\)](#), [AutoTS\(\)](#)

**Examples**

```
## Not run:
# Create fake data
data <- RemixAutoML::FakeDataGenerator(TimeSeries = TRUE, TimeSeriesTimeAgg = "days")

# Build model
```

```

Output <- RemixAutoML::AutoTBATS(
  data,
  FilePath = NULL,
  TargetVariableName = "Weekly_Sales",
  DateColumnName = "Date",
  TimeAggLevel = "weeks",
  EvaluationMetric = "MAE",
  NumHoldOutPeriods = 5L,
  NumFCPeriods = 5L,
  MaxLags = 5L,
  MaxMovingAverages = 5L,
  MaxSeasonalPeriods = 1L,
  TrainWeighting = 0.50,
  MaxConsecutiveFails = 12L,
  MaxNumberModels = 100L,
  MaxRunTimeMinutes = 10L,
  NumberCores = max(1L, min(4L, parallel::detectCores()-2L)))

# Output
Output$ForecastPlot
Output$Forecast
Output$PerformanceGrid

## End(Not run)

```

---

AutoTransformationCreate

*AutoTransformationCreate*


---

## Description

AutoTransformationCreate is a function for automatically identifying the optimal transformations for numeric features and transforming them once identified. This function will loop through your selected transformation options (YeoJohnson, BoxCox, Asinh, Asin, and Logit) and find the one that produces data that is the closest to normally distributed data. It then makes the transformation and collects the metadata information for use in the AutoTransformationScore() function, either by returning the objects (always) or saving them to file (optional).

## Usage

```

AutoTransformationCreate(
  data,
  ColumnNames = NULL,
  Methods = c("BoxCox", "YeoJohnson", "Asinh", "Log", "LogPlus1", "Sqrt", "Asin",
    "Logit", "Identity"),
  Path = NULL,
  TransID = "ModelID",
  SaveOutput = FALSE
)

```



**Arguments**

data	This is your source data
ColumnNames	List your columns names in a vector, for example, c("Target", "IV1")
Methods	Choose from "YeoJohnson", "BoxCox", "Asinh", "Log", "LogPlus1", "Asin", "Logit", and "Identity".
Path	Set to the directly where you want to save all of your modeling files
TransID	Set to a character value that corresponds with your modeling project
SaveOutput	Set to TRUE to save necessary file to run AutoTransformationScore()

**Value**

data with transformed columns and the transformation object for back-transforming later

**Author(s)**

Adrian Antico

**See Also**

Other Feature Engineering: [AutoDataPartition\(\)](#), [AutoDiffLagN\(\)](#), [AutoHierarchicalFourier\(\)](#), [AutoInteraction\(\)](#), [AutoLagRollMode\(\)](#), [AutoLagRollStatsScoring\(\)](#), [AutoLagRollStats\(\)](#), [AutoTransformationScore\(\)](#), [AutoWord2VecModeler\(\)](#), [AutoWord2VecScoring\(\)](#), [CategoricalEncoding\(\)](#), [CreateCalendarVariables\(\)](#), [CreateHolidayVariables\(\)](#), [DummifyDT\(\)](#), [H2OAutoencoderScoring\(\)](#), [H2OAutoencoder\(\)](#), [ModelDataPrep\(\)](#), [TimeSeriesFill\(\)](#)

**Examples**

```
## Not run:
# Create Fake Data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 25000,
  ID = 2L,
  ZIP = 0,
  FactorCount = 2L,
  AddDate = FALSE,
  Classification = FALSE,
  MultiClass = FALSE)

# Columns to transform
Cols <- names(data)[1L:11L]
print(Cols)

# Run function
data <- RemixAutoML::AutoTransformationCreate(
  data,
  ColumnNames = Cols,
  Methods = c("YeoJohnson", "BoxCox", "Asinh", "Log", "LogPlus1", "Sqrt", "Asin", "Logit", "Identity"),
  Path = getwd(),
  TransID = "Trans",
  SaveOutput = TRUE)

## End(Not run)
```

---

AutoTransformationScore

*AutoTransformationScore() is a the complimentary function to AutoTransformationCreate()*

---

## Description

AutoTransformationScore() is a the compliment function to AutoTransformationCreate(). Automatically apply or inverse the transformations you identified in AutoTransformationCreate() to other data sets. This is useful for applying transformations to your validation and test data sets for modeling. It's also useful for back-transforming your target and prediction columns after you have build and score your models so you can obtain statistics on the original features.

## Usage

```
AutoTransformationScore(
    ScoringData,
    FinalResults,
    Type = "Inverse",
    TransID = "TestModel",
    Path = NULL
)
```

## Arguments

ScoringData	This is your source data
FinalResults	This is the FinalResults output object from AutoTransformationCreate().
Type	Set to "Inverse" to back-transfrom or "Apply" for applying the transformation.
TransID	Set to a character value that corresponds with your modeling project
Path	Set to the directly where you want to save all of your modeling files

## Value

data with transformed columns

## Author(s)

Adrian Antico

## See Also

Other Feature Engineering: [AutoDataPartition\(\)](#), [AutoDiffLagN\(\)](#), [AutoHierarchicalFourier\(\)](#), [AutoInteraction\(\)](#), [AutoLagRollMode\(\)](#), [AutoLagRollStatsScoring\(\)](#), [AutoLagRollStats\(\)](#), [AutoTransformationCreate\(\)](#), [AutoWord2VecModeler\(\)](#), [AutoWord2VecScoring\(\)](#), [CategoricalEncoding\(\)](#), [CreateCalendarVariables\(\)](#), [CreateHolidayVariables\(\)](#), [DummifyDT\(\)](#), [H2OAutoencoderScoring\(\)](#), [H2OAutoencoder\(\)](#), [ModelDataPrep\(\)](#), [TimeSeriesFill\(\)](#)

## Examples

```
## Not run:
# Create Fake Data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 25000,
  ID = 2L,
  ZIP = 0,
  FactorCount = 2L,
  AddDate = FALSE,
  Classification = FALSE,
  MultiClass = FALSE)

# Columns to transform
Cols <- names(data)[1L:11L]
print(Cols)

data <- data[1]

# Run function
Output <- RemixAutoML::AutoTransformationCreate(
  data,
  ColumnNames = Cols,
  Methods = c("YeoJohnson", "BoxCox", "Asinh", "Log", "LogPlus1", "Sqrt", "Asin", "Logit", "Identity"),
  Path = getwd(),
  TransID = "Model_1",
  SaveOutput = TRUE)

# Output
data <- Output$Data
TransInfo <- Output$FinalResults

# Back Transform
data <- RemixAutoML::AutoTransformationScore(
  data,
  FinalResults = TransInfo,
  Path = NULL,
  TransID = "Model_1")

## End(Not run)
```

---

AutoTS

*AutoTS*


---

## Description

Step 1 is to build all the models and evaluate them on the number of HoldOutPeriods periods you specify. Step 2 is to pick the winner and rebuild the winning model on the full data set. Step 3 is to generate forecasts with the final model for FCPeriods that you specify. AutoTS builds the best time series models for each type, using optimized box-cox transformations and using a user-supplied frequency for the ts data conversion along with a model-based frequency for the ts data conversion, compares all types, selects the winner, and generates a forecast. Models include:

DSHW: Double Seasonal Holt Winters

ARFIMA: Auto Regressive Fractional Integrated Moving Average

ARIMIA: Stepwise Auto Regressive Integrated Moving Average with specified max lags, seasonal lags, moving averages, and seasonal moving averages

ETS: Additive and Multiplicative Exponential Smoothing and Holt Winters

NNetar: Auto Regressive Neural Network models automatically compares models with 1 lag or 1 seasonal lag compared to models with up to N lags and N seasonal lags

TBATS: Exponential smoothing state space model with Box-Cox transformation, ARMA errors, Trend and Seasonal components

TSLM: Time Series Linear Model - builds a linear model with trend and season components extracted from the data

## Usage

```
AutoTS(
  data,
  TargetName = "Target",
  DateName = "DateTime",
  FCPeriods = 30,
  HoldOutPeriods = 30,
  EvaluationMetric = "MAPE",
  InnerEval = "AICc",
  TimeUnit = "day",
  Lags = 25,
  SLags = 2,
  MaxFourierPairs = 0,
  NumCores = 4,
  SkipModels = NULL,
  StepWise = TRUE,
  TSClean = TRUE,
  ModelFreq = TRUE,
  PrintUpdates = FALSE,
  PlotPredictionIntervals = TRUE
)
```

## Arguments

data	is the source time series data as a data.table - or a data structure that can be converted to a data.table
TargetName	is the name of the target variable in your data.table
DateName	is the name of the date column in your data.table
FCPeriods	is the number of periods into the future you wish to forecast
HoldOutPeriods	is the number of periods to use for validation testing
EvaluationMetric	Set this to either "MAPE", "MSE", or "MAE". Default is "MAPE"
InnerEval	Choose from AICC, AIC, and BIC. These are what the time series models use internally to optimize
TimeUnit	is the level of aggregation your dataset comes in. Choices include: hour, day, week, month, quarter, year, 1Min, 5Min, 10Min, 15Min, and 30Min

Lags	is the number of lags you wish to test in various models (same as moving averages)
SLags	is the number of seasonal lags you wish to test in various models (same as moving averages)
MaxFourierPairs	Set the max number of Fourier terms to test out. They will be utilized in the ARIMA and NN models.
NumCores	is the number of cores available on your computer
SkipModels	Don't run specified models - e.g. exclude all models "DSHW" "ARFIMA" "ARIMA" "ETS" "NNET" "TBATS" "TSLM"
StepWise	Set to TRUE to have ARIMA and ARFIMA run a stepwise selection process. Otherwise, all models will be generated in parallel execution, but still run much slower.
TSClean	Set to TRUE to have missing values interpolated and outliers replaced with interpolated values: creates separate models for a larger comparison set
ModelFreq	Set to TRUE to run a separate version of all models where the time series frequency is chosen algorithmically
PrintUpdates	Set to TRUE for a print to console of function progress
PlotPredictionIntervals	Set to FALSE to not print prediction intervals on your plot output

**Value**

Returns a list containing 1: A data.table object with a date column and the forecasted values; 2: The model evaluation results; 3: The champion model for later use if desired; 4: The name of the champion model; 5: A time series ggplot with historical values and forecasted values with 80

**Author(s)**

Adrian Antico and Douglas Pestana

**See Also**

Other Automated Time Series: [AutoArfima\(\)](#), [AutoBanditNNet\(\)](#), [AutoBanditSarima\(\)](#), [AutoETS\(\)](#), [AutoTBATS\(\)](#)

**Examples**

```
## Not run:
data <- data.table::data.table(DateTime = as.Date(Sys.time()),
  Target = stats::filter(rnorm(100,
    mean = 50,
    sd = 20),
    filter=rep(1,10),
    circular=TRUE))
data[, temp := seq(1:100)][, DateTime := DateTime - temp][
  , temp := NULL]
data <- data[order(DateTime)]
output <- AutoTS(
  data,
  TargetName      = "Target",
  DateName        = "DateTime",
```

```

FCPeriods           = 1,
HoldOutPeriods      = 1,
EvaluationMetric     = "MAPE",
InnerEval           = "AICc",
TimeUnit            = "day",
Lags                 = 1,
SLags                = 1,
MaxFourierPairs     = 0,
NumCores             = 4,
SkipModels          = c("NNET", "TBATS", "ETS",
  "TSLM", "ARFIMA", "DSHW"),
StepWise             = TRUE,
TSClean             = FALSE,
ModelFreq           = TRUE,
PlotPredictionIntervals = TRUE,
PrintUpdates        = FALSE)
ForecastData <- output$Forecast
ModelEval          <- output$EvaluationMetrics
WinningModel <- output$TimeSeriesModel

## End(Not run)

```

---

AutoWord2VecModeler      *AutoWord2VecModeler*

---

## Description

This function allows you to automatically build a word2vec model and merge the data onto your supplied dataset

## Usage

```

AutoWord2VecModeler(
  data,
  BuildType = "Combined",
  stringCol = c("Text_Col1", "Text_Col2"),
  KeepStringCol = FALSE,
  model_path = NULL,
  vects = 100,
  MinWords = 1,
  WindowSize = 12,
  Epochs = 25,
  SaveModel = "standard",
  Threads = max(1L, parallel::detectCores() - 2L),
  MaxMemory = "28G",
  ModelID = "Model_1"
)

```

## Arguments

<code>data</code>	Source data table to merge vects onto
<code>BuildType</code>	Choose from "individual" or "combined". Individual will build a model for every text column. Combined will build a single model for all columns.

stringCol	A string name for the column to convert via word2vec
KeepStringCol	Set to TRUE if you want to keep the original string column that you convert via word2vec
model_path	A string path to the location where you want the model and metadata stored
vects	The number of vectors to retain from the word2vec model
MinWords	For H2O word2vec model
WindowSize	For H2O word2vec model
Epochs	For H2O word2vec model
SaveModel	Set to "standard" to save normally; set to "mojo" to save as mojo. NOTE: while you can save a mojo, I haven't figured out how to score it in the AutoH2OScoring function.
Threads	Number of available threads you want to dedicate to model building
MaxMemory	Amount of memory you want to dedicate to model building
ModelID	Name for saving to file

**Author(s)**

Adrian Antico

**See Also**

Other Feature Engineering: [AutoDataPartition\(\)](#), [AutoDiffLagN\(\)](#), [AutoHierarchicalFourier\(\)](#), [AutoInteraction\(\)](#), [AutoLagRollMode\(\)](#), [AutoLagRollStatsScoring\(\)](#), [AutoLagRollStats\(\)](#), [AutoTransformationCreate\(\)](#), [AutoTransformationScore\(\)](#), [AutoWord2VecScoring\(\)](#), [CategoricalEncoding\(\)](#), [CreateCalendarVariables\(\)](#), [CreateHolidayVariables\(\)](#), [DummifyDT\(\)](#), [H2OAutoencoderScoring\(\)](#), [H2OAutoencoder\(\)](#), [ModelDataPrep\(\)](#), [TimeSeriesFill\(\)](#)

**Examples**

```
## Not run:

# Create fake data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.70,
  N = 1000L,
  ID = 2L,
  FactorCount = 2L,
  AddDate = TRUE,
  AddComment = TRUE,
  ZIP = 2L,
  TimeSeries = FALSE,
  ChainLadderData = FALSE,
  Classification = FALSE,
  MultiClass = FALSE)

# Create Model and Vectors
data <- RemixAutoML::AutoWord2VecModeler(
  data,
  BuildType = "individual",
  stringCol = c("Comment"),
  KeepStringCol = FALSE,
  ModelID = "Model_1",
```

```

model_path = getwd(),
vects = 10,
MinWords = 1,
WindowSize = 1,
Epochs = 25,
SaveModel = "standard",
Threads = max(1,parallel::detectCores()-2),
MaxMemory = "28G")

# Remove data
rm(data)

# Create fake data for mock scoring
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.70,
  N = 1000L,
  ID = 2L,
  FactorCount = 2L,
  AddDate = TRUE,
  AddComment = TRUE,
  ZIP = 2L,
  TimeSeries = FALSE,
  ChainLadderData = FALSE,
  Classification = FALSE,
  MultiClass = FALSE)

# Give h2o a few seconds
Sys.sleep(5L)

# Create vectors for scoring
data <- RemixAutoML::AutoWord2VecScoring(
  data,
  BuildType = 'individual',
  ModelObject = NULL,
  ModelID = "Model_1",
  model_path = getwd(),
  stringCol = "Comment",
  KeepStringCol = FALSE,
  H2OStartUp = TRUE,
  H2OShutdown = TRUE,
  Threads = max(1L, parallel::detectCores() - 2L),
  MaxMemory = "28G")

## End(Not run)

```

---

AutoWord2VecScoring      *AutoWord2VecScoring*

---

## Description

AutoWord2VecScoring is for scoring models generated by AutoWord2VecModeler()

## Usage

```
AutoWord2VecScoring(
```



```

    data,
    BuildType = "individual",
    ModelObject = NULL,
    ModelID = "Model_1",
    model_path = NULL,
    stringCol = NULL,
    KeepStringCol = FALSE,
    H2OStartUp = TRUE,
    H2OShutdown = TRUE,
    Threads = max(1L, parallel::detectCores() - 2L),
    MaxMemory = "28G"
  )

```

### Arguments

data	data.table
BuildType	"individual" or "combined". Used to locate model in file
ModelObject	NULL if you want it loaded in the function
ModelID	Same as in training
model_path	Location of model
stringCol	Columns to transform
KeepStringCol	FALSE to remove string col after creating vectors
H2OStartUp	= TRUE,
Threads	max(1L, parallel::detectCores() - 2L)
MaxMemory	"28G"

### Author(s)

Adrian Antico

### See Also

Other Feature Engineering: [AutoDataPartition\(\)](#), [AutoDiffLagN\(\)](#), [AutoHierarchicalFourier\(\)](#), [AutoInteraction\(\)](#), [AutoLagRollMode\(\)](#), [AutoLagRollStatsScoring\(\)](#), [AutoLagRollStats\(\)](#), [AutoTransformationCreate\(\)](#), [AutoTransformationScore\(\)](#), [AutoWord2VecModeler\(\)](#), [CategoricalEncoding\(\)](#), [CreateCalendarVariables\(\)](#), [CreateHolidayVariables\(\)](#), [DummifyDT\(\)](#), [H2OAutoencoderScoring\(\)](#), [H2OAutoencoder\(\)](#), [ModelDataPrep\(\)](#), [TimeSeriesFill\(\)](#)

### Examples

```

## Not run:
# Create fake data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.70,
  N = 1000L,
  ID = 2L,
  FactorCount = 2L,
  AddDate = TRUE,
  AddComment = TRUE,
  ZIP = 2L,
  TimeSeries = FALSE,
  ChainLadderData = FALSE,

```

```

    Classification = FALSE,
    MultiClass = FALSE)

# Create Model and Vectors
data <- RemixAutoML::AutoWord2VecModeler(
  data,
  BuildType = "individual",
  stringCol = c("Comment"),
  KeepStringCol = FALSE,
  ModelID = "Model_1",
  model_path = getwd(),
  vects = 10,
  MinWords = 1,
  WindowSize = 1,
  Epochs = 25,
  SaveModel = "standard",
  Threads = max(1,parallel::detectCores()-2),
  MaxMemory = "28G")

# Remove data
rm(data)

# Create fake data for mock scoring
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.70,
  N = 1000L,
  ID = 2L,
  FactorCount = 2L,
  AddDate = TRUE,
  AddComment = TRUE,
  ZIP = 2L,
  TimeSeries = FALSE,
  ChainLadderData = FALSE,
  Classification = FALSE,
  MultiClass = FALSE)

# Create vectors for scoring
data <- RemixAutoML::AutoWord2VecScoring(
  data,
  BuildType = "individual",
  ModelObject = NULL,
  ModelID = "Model_1",
  model_path = getwd(),
  stringCol = "Comment",
  KeepStringCol = FALSE,
  H2OStartUp = TRUE,
  H2OShutdown = TRUE,
  Threads = max(1L, parallel::detectCores() - 2L),
  MaxMemory = "28G")

## End(Not run)

```

## Description

This function builds a word frequency table and a word cloud. It prepares data, cleans text, and generates output.

## Usage

```
AutoWordFreq(
  data,
  TextColName = "DESCR",
  GroupColName = "ClusterAllNoTarget",
  GroupLevel = 0,
  RemoveEnglishStopwords = TRUE,
  Stemming = TRUE,
  StopWords = c("bla", "bla2")
)
```

## Arguments

<code>data</code>	Source data table
<code>TextColName</code>	A string name for the column
<code>GroupColName</code>	Set to NULL to ignore, otherwise set to Cluster column name (or factor column name)
<code>GroupLevel</code>	Must be set if <code>GroupColName</code> is defined. Set to cluster ID (or factor level)
<code>RemoveEnglishStopwords</code>	Set to TRUE to remove English stop words, FALSE to ignore
<code>Stemming</code>	Set to TRUE to run stemming on your text data
<code>StopWords</code>	Add your own stopwords, in vector format

## Author(s)

Adrian Antico

## See Also

Other EDA: [EDA\\_Histograms\(\)](#), [Mode\(\)](#), [PlotGUI\(\)](#), [ScatterCopula\(\)](#), [UserBaseEvolution\(\)](#)

## Examples

```
## Not run:
data <- data.table::data.table(
  DESCR = c(
    "Gru", "Gru", "Gru", "Gru", "Gru", "Gru", "Gru",
    "Gru", "Gru", "Gru", "Gru", "Gru", "Gru", "Urkle",
    "Urkle", "Urkle", "Urkle", "Urkle", "Urkle", "Urkle",
    "Gru", "Gru", "Gru", "bears", "bears", "bears",
    "bears", "bears", "bears", "smug", "smug", "smug", "smug",
    "smug", "smug", "smug", "smug", "smug", "smug", "smug",
    "smug", "smug", "smug", "smug", "smug", "eats", "eats",
    "eats", "eats", "eats", "eats", "beats", "beats", "beats", "beats",
    "beats", "beats", "beats", "beats", "beats", "beats",
    "beats", "science", "science", "Dwigt", "Dwigt", "Dwigt", "Dwigt",
    "Dwigt", "Dwigt", "Dwigt", "Dwigt", "Dwigt", "Dwigt",
  )
)
```

```

"Schrute", "Schrute", "Schrute", "Schrute", "Schrute",
"Schrute", "Schrute", "James", "James", "James", "James",
"James", "James", "James", "James", "James", "James",
"Halpert", "Halpert", "Halpert", "Halpert",
"Halpert", "Halpert", "Halpert", "Halpert"))
data <- AutoWordFreq(
  data,
  TextColName = "DESCR",
  GroupColName = NULL,
  GroupLevel = NULL,
  RemoveEnglishStopwords = FALSE,
  Stemming = FALSE,
  StopWords = c("Bla"))

## End(Not run)

```

---

AutoXGBoostCARMA

*AutoXGBoostCARMA*


---

## Description

AutoXGBoostCARMA Multivariate Forecasting with calendar variables, Holiday counts, holiday lags, holiday moving averages, differencing, transformations, interaction-based categorical encoding using target variable and features to generate various time-based aggregated lags, moving averages, moving standard deviations, moving skewness, moving kurtosis, moving quantiles, parallelized interaction-based fourier pairs by grouping variables, and Trend Variables.

## Usage

```

AutoXGBoostCARMA(
  data = NULL,
  XREGS = NULL,
  NonNegativePred = FALSE,
  RoundPreds = FALSE,
  TrainOnFull = FALSE,
  TargetColumnName = NULL,
  DateColumnName = NULL,
  HierarchGroups = NULL,
  GroupVariables = NULL,
  FC_Periods = 5,
  SaveDataPath = NULL,
  PDFOutputPath = NULL,
  TimeUnit = "week",
  TimeGroups = c("weeks", "months"),
  TargetTransformation = FALSE,
  Methods = c("Asinh", "Log", "LogPlus1", "Sqrt"),
  EncodingMethod = "binary",
  AnomalyDetection = NULL,
  Lags = c(1:5),
  MA_Periods = c(1:5),
  SD_Periods = NULL,
  Skew_Periods = NULL,

```

```

Kurt_Periods = NULL,
Quantile_Periods = NULL,
Quantiles_Selected = NULL,
Difference = TRUE,
FourierTerms = 0,
CalendarVariables = c("second", "minute", "hour", "wday", "mday", "yday", "week",
  "wom", "isoweek", "month", "quarter", "year"),
HolidayVariable = c("USPublicHolidays", "EasterGroup", "ChristmasGroup",
  "OtherEcclesticalFeasts"),
HolidayLookback = NULL,
HolidayLags = 1L,
HolidayMovingAverages = 3L,
TimeTrendVariable = FALSE,
DataTruncate = FALSE,
ZeroPadSeries = NULL,
SplitRatios = c(1 - 10/100, 10/100),
TreeMethod = "hist",
NThreads = max(1, parallel::detectCores() - 2L),
PartitionType = "random",
Timer = TRUE,
DebugMode = FALSE,
EvalMetric = "MAE",
LossFunction = "reg:squarederror",
GridTune = FALSE,
GridEvalMetric = "mae",
ModelCount = 30L,
MaxRunsWithoutNewWinner = 20L,
MaxRunMinutes = 24L * 60L,
NTrees = 1000L,
LearningRate = 0.3,
MaxDepth = 9L,
MinChildWeight = 1,
SubSample = 1,
ColSampleByTree = 1
)

```

### Arguments

data	Supply your full series data set here
XREGS	Additional data to use for model development and forecasting. Data needs to be a complete series which means both the historical and forward looking values over the specified forecast window needs to be supplied.
NonNegativePred	TRUE or FALSE
RoundPreds	Rounding predictions to an integer value. TRUE or FALSE. Defaults to FALSE
TrainOnFull	Set to TRUE to train on full data
TargetColumnName	List the column name of your target variables column. E.g. 'Target'
DateColumnName	List the column name of your date column. E.g. 'DateTime'
HierarchGroups	= NULL Character vector or NULL with names of the columns that form the interaction hierarchy

GroupVariables	Defaults to NULL. Use NULL when you have a single series. Add in GroupVariables when you have a series for every level of a group or multiple groups.
FC_Periods	Set the number of periods you want to have forecasts for. E.g. 52 for weekly data to forecast a year ahead
SaveDataPath	Path to save modeling data
PDFOutputPath	Supply a path to save model insights to PDF
TimeUnit	List the time unit your data is aggregated by. E.g. '1min', '5min', '10min', '15min', '30min', 'hour', 'day', 'week', 'month', 'quarter', 'year'
TimeGroups	Select time aggregations for adding various time aggregated GDL features.
TargetTransformation	Run AutoTransformationCreate() to find best transformation for the target variable. Tests YeoJohnson, BoxCox, and Asigh (also Asin and Logit for proportion target variables).
Methods	Choose from 'YeoJohnson', 'BoxCox', 'Asinh', 'Log', 'LogPlus1', 'Sqrt', 'Asin', or 'Logit'. If more than one is selected, the one with the best normalization pearson statistic will be used. Identity is automatically selected and compared.
EncodingMethod	Choose from 'binary', 'm_estimator', 'credibility', 'woe', 'target_encoding', 'poly_encode', 'backward_difference', 'helmert'
AnomalyDetection	NULL for not using the service. Other, provide a list, e.g. AnomalyDetection = list('tstat_high' = 4, tstat_low = -4)
Lags	Select the periods for all lag variables you want to create. E.g. c(1:5,52) or list('day' = c(1:10), 'weeks' = c(1:4))
MA_Periods	Select the periods for all moving average variables you want to create. E.g. c(1:5,52) or list('day' = c(2:10), 'weeks' = c(2:4))
SD_Periods	Select the periods for all moving standard deviation variables you want to create. E.g. c(1:5,52) or list('day' = c(2:10), 'weeks' = c(2:4))
Skew_Periods	Select the periods for all moving skewness variables you want to create. E.g. c(1:5,52) or list('day' = c(2:10), 'weeks' = c(2:4))
Kurt_Periods	Select the periods for all moving kurtosis variables you want to create. E.g. c(1:5,52) or list('day' = c(2:10), 'weeks' = c(2:4))
Quantile_Periods	Select the periods for all moving quantiles variables you want to create. E.g. c(1:5,52) or list('day' = c(2:10), 'weeks' = c(2:4))
Quantiles_Selected	Select from the following c('q5','q10','q15','q20','q25','q30','q35','q40','q45','q50','q55','q60','q65')
Difference	Set to TRUE to put the I in ARIMA
FourierTerms	Set to the max number of pairs
CalendarVariables	NULL, or select from 'second', 'minute', 'hour', 'wday', 'mday', 'yday', 'week', 'wom', 'isoweek', 'month', 'quarter', 'year'
HolidayVariable	NULL, or select from 'USPublicHolidays', 'EasterGroup', 'ChristmasGroup', 'OtherEcclesticalFeasts'
HolidayLookback	Number of days in range to compute number of holidays from a given date in the data. If NULL, the number of days are computed for you.

HolidayLags	Number of lags for the holiday counts
HolidayMovingAverages	Number of moving averages for holiday counts
TimeTrendVariable	Set to TRUE to have a time trend variable added to the model. Time trend is numeric variable indicating the numeric value of each record in the time series (by group). Time trend starts at 1 for the earliest point in time and increments by one for each success time point.
DataTruncate	Set to TRUE to remove records with missing values from the lags and moving average features created
ZeroPadSeries	NULL to do nothing. Otherwise, set to 'maxmax', 'minmax', 'maxmin', 'minmin'. See <a href="#">TimeSeriesFill</a> for explanations of each type
SplitRatios	E.g c(0.7,0.2,0.1) for train, validation, and test sets
TreeMethod	Choose from 'hist', 'gpu_hist'
NThreads	Set the maximum number of threads you'd like to dedicate to the model run. E.g. 8
PartitionType	Select 'random' for random data partitioning 'time' for partitioning by time frames
Timer	Setting to TRUE prints out the forecast number while it is building
DebugMode	Setting to TRUE generates printout of all header code comments during run time of function
EvalMetric	Select from 'r2', 'RMSE', 'MSE', 'MAE'
LossFunction	Default is 'reg:squarederror'. Other options include 'reg:squaredlogerror', 'reg:pseudohubererror', 'count:poisson', 'survival:cox', 'survival:aft', 'aft_loss_distribution', 'reg:gamma', 'reg:tweedie'
GridTune	Set to TRUE to run a grid tune
GridEvalMetric	This is the metric used to find the threshold 'poisson', 'mae', 'mape', 'mse', 'msle', 'kl', 'cs', 'r2'
ModelCount	Set the number of models to try in the grid tune
MaxRunsWithoutNewWinner	Number of consecutive runs without a new winner in order to terminate procedure
MaxRunMinutes	Default 24L*60L
NTrees	Select the number of trees you want to have built to train the model
LearningRate	Learning Rate
MaxDepth	Depth
MinChildWeight	Records in leaf
SubSample	Random forecast setting
ColSampleByTree	Self explanatory

**Value**

See examples

**Author(s)**

Adrian Antico

**See Also**

Other Automated Panel Data Forecasting: [AutoCatBoostCARMA\(\)](#), [AutoCatBoostHurdleCARMA\(\)](#), [AutoCatBoostVectorCARMA\(\)](#), [AutoH2OCARMA\(\)](#), [AutoLightGBMCARMA\(\)](#), [AutoLightGBMHurdleCARMA\(\)](#), [AutoXGBoostHurdleCARMA\(\)](#)

**Examples**

```
## Not run:
```

```
# Load data
```

```
data <- data.table::fread('https://www.dropbox.com/s/2str3ek4f4cheqi/walmart_train.csv?dl=1')
```

```
# Ensure series have no missing dates (also remove series with more than 25% missing values)
```

```
data <- RemixAutoML::TimeSeriesFill(
  data,
  DateColumnName = 'Date',
  GroupVariables = c('Store', 'Dept'),
  TimeUnit = 'weeks',
  FillType = 'maxmax',
  MaxMissingPercent = 0.25,
  SimpleImpute = TRUE)
```

```
# Set negative numbers to 0
```

```
data <- data[, Weekly_Sales := data.table::fifelse(Weekly_Sales < 0, 0, Weekly_Sales)]
```

```
# Remove IsHoliday column
```

```
data[, IsHoliday := NULL]
```

```
# Create xregs (this is the include the categorical variables instead of utilizing only the interaction of them)
```

```
xregs <- data[, .SD, .SDcols = c('Date', 'Store', 'Dept')]
```

```
# Change data types
```

```
data[, ':= ' (Store = as.character(Store), Dept = as.character(Dept))]
xregs[, ':= ' (Store = as.character(Store), Dept = as.character(Dept))]
```

```
# Build forecast
```

```
XGBoostResults <- AutoXGBoostCARMA(
```

```
  # Data Artifacts
```

```
  data = data,
  NonNegativePred = FALSE,
  RoundPreds = FALSE,
  TargetColumnName = 'Weekly_Sales',
  DateColumnName = 'Date',
  HierarchGroups = NULL,
  GroupVariables = c('Store', 'Dept'),
  TimeUnit = 'weeks',
  TimeGroups = c('weeks', 'months'),
```

```
  # Data Wrangling Features
```

```
  EncodingMethod = 'binary',
  ZeroPadSeries = NULL,
```



```

DataTruncate = FALSE,
SplitRatios = c(1 - 10 / 138, 10 / 138),
PartitionType = 'timeseries',
AnomalyDetection = NULL,

# Productionize
FC_Periods = 0,
TrainOnFull = FALSE,
NThreads = 8,
Timer = TRUE,
DebugMode = FALSE,
SaveDataPath = NULL,
PDFOutputPath = NULL,

# Target Transformations
TargetTransformation = TRUE,
Methods = c('BoxCox', 'Asinh', 'Asin', 'Log',
            'LogPlus1', 'Sqrt', 'Logit', 'YeoJohnson'),
Difference = FALSE,

# Features
Lags = list('weeks' = seq(1L, 10L, 1L),
            'months' = seq(1L, 5L, 1L)),
MA_Periods = list('weeks' = seq(5L, 20L, 5L),
                  'months' = seq(2L, 10L, 2L)),
SD_Periods = NULL,
Skew_Periods = NULL,
Kurt_Periods = NULL,
Quantile_Periods = NULL,
Quantiles_Selected = c('q5', 'q95'),
XREGS = xregs,
FourierTerms = 4,
CalendarVariables = c('week', 'wom', 'month', 'quarter'),
HolidayVariable = c('USPublicHolidays', 'EasterGroup',
                    'ChristmasGroup', 'OtherEcclesticalFeasts'),
HolidayLookback = NULL,
HolidayLags = 1,
HolidayMovingAverages = 1:2,
TimeTrendVariable = TRUE,

# ML eval args
TreeMethod = 'hist',
EvalMetric = 'RMSE',
LossFunction = 'reg:squarederror',

# ML grid tuning
GridTune = FALSE,
ModelCount = 5,
MaxRunsWithoutNewWinner = 20L,
MaxRunMinutes = 24L*60L,

# ML args
NTrees = 300,
LearningRate = 0.3,
MaxDepth = 9L,
MinChildWeight = 1.0,
SubSample = 1.0,

```

```

ColSampleByTree = 1.0)

UpdateMetrics <- print(
  XGBoostResults$ModelInformation$EvaluationMetrics[
    Metric == 'MSE', MetricValue := sqrt(MetricValue)])
print(UpdateMetrics)
XGBoostResults$ModelInformation$EvaluationMetricsByGroup[order(-R2_Metric)]
XGBoostResults$ModelInformation$EvaluationMetricsByGroup[order(MAE_Metric)]
XGBoostResults$ModelInformation$EvaluationMetricsByGroup[order(MSE_Metric)]
XGBoostResults$ModelInformation$EvaluationMetricsByGroup[order(MAPE_Metric)]

## End(Not run)

```

---

AutoXGBoostClassifier *AutoXGBoostClassifier*

---

## Description

AutoXGBoostClassifier is an automated XGBoost modeling framework with grid-tuning and model evaluation that runs a variety of steps. First, a stratified sampling (by the target variable) is done to create train and validation sets. Then, the function will run a random grid tune over N number of models and find which model is the best (a default model is always included in that set). Once the model is identified and built, several other outputs are generated: validation data with predictions, evaluation plot, evaluation boxplot, evaluation metrics, variable importance, partial dependence calibration plots, partial dependence calibration box plots, and column names used in model fitting.

## Usage

```

AutoXGBoostClassifier(
  OutputSelection = c("Importances", "EvalPlots", "EvalMetrics", "Score_TrainData"),
  data = NULL,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = NULL,
  FeatureColNames = NULL,
  WeightsColumnName = NULL,
  IDcols = NULL,
  model_path = NULL,
  metadata_path = NULL,
  SaveInfoToPDF = FALSE,
  ModelID = "FirstModel",
  EncodingMethod = "credibility",
  ReturnFactorLevels = TRUE,
  ReturnModelObjects = TRUE,
  SaveModelObjects = FALSE,
  Verbose = 0L,
  NumOfParDepPlots = 3L,
  NThreads = max(1L, parallel::detectCores() - 2L),
  LossFunction = "reg:logistic",
  CostMatrixWeights = c(1, 0, 0, 1),
  grid_eval_metric = "MCC",

```

```

eval_metric = "auc",
TreeMethod = "hist",
GridTune = FALSE,
BaselineComparison = "default",
MaxModelsInGrid = 10L,
MaxRunsWithoutNewWinner = 20L,
MaxRunMinutes = 24L * 60L,
PassInGrid = NULL,
Trees = 1000L,
eta = 0.3,
max_depth = 9,
min_child_weight = 1,
subsample = 1,
colsample_bytree = 1,
DebugMode = FALSE
)

```

## Arguments

OutputSelection	You can select what type of output you want returned. Choose from c("Importances", "EvalPlots", "EvalMetrics", "PDFs", "Score_TrainData")
data	This is your data set for training and testing your model
TrainOnFull	Set to TRUE to train on full data
ValidationData	This is your holdout data set used in modeling either refine your hyperparameters.
TestData	This is your holdout data set. Catboost using both training and validation data in the training process so you should evaluate out of sample performance with this data set.
TargetColumnName	Either supply the target column name OR the column number where the target is located (but not mixed types). Note that the target column needs to be a 0   1 numeric variable.
FeatureColNames	Either supply the feature column names OR the column number where the target is located (but not mixed types)
WeightsColumnName	Supply a column name for your weights column. Leave NULL otherwise
IDcols	A vector of column names or column numbers to keep in your data but not include in the modeling.
model_path	A character string of your path file to where you want your output saved
metadata_path	A character string of your path file to where you want your model evaluation output saved. If left NULL, all output will be saved to model_path.
SaveInfoToPDF	Set to TRUE to save modeling information to PDF. If model_path or metadata_path aren't defined then output will be saved to the working directory
ModelID	A character string to name your model and output
EncodingMethod	Choose from 'binary', 'm_estimator', 'credibility', 'woe', 'target_encoding', 'poly_encode', 'backward_difference', 'helmert'
ReturnFactorLevels	TRUE or FALSE. Set to FALSE to not return factor levels.

ReturnModelObjects	Set to TRUE to output all modeling objects (E.g. plots and evaluation metrics)
SaveModelObjects	Set to TRUE to return all modeling objects to your environment
Verbose	Set to 0 if you want to suppress model evaluation updates in training
NumOfParDepPlots	Tell the function the number of partial dependence calibration plots you want to create.
NThreads	Set the maximum number of threads you'd like to dedicate to the model run. E.g. 8
LossFunction	Select from 'reg:logistic', "binary:logistic"
CostMatrixWeights	A vector with 4 elements c(True Positive Cost, False Negative Cost, False Positive Cost, True Negative Cost). Default c(1,0,0,1),
grid_eval_metric	Case sensitive. I typically choose 'Utility' or 'MCC'. Choose from 'Utility', 'MCC', 'Acc', 'F1_Score', 'F2_Score', 'F0.5_Score', 'TPR', 'TNR', 'FNR', 'FPR', 'FDR', 'FOR', 'NPV', 'PPV', 'ThreatScore'
eval_metric	This is the metric used to identify best grid tuned model. Choose from "logloss", "error", "aucpr", "auc"
TreeMethod	Choose from "hist", "gpu_hist"
GridTune	Set to TRUE to run a grid tuning procedure
BaselineComparison	Set to either "default" or "best". Default is to compare each successive model build to the baseline model using max trees (from function args). Best makes the comparison to the current best model.
MaxModelsInGrid	Number of models to test from grid options.
MaxRunsWithoutNewWinner	A number
MaxRunMinutes	In minutes
PassInGrid	Default is NULL. Provide a data.table of grid options from a previous run.
Trees	Bandit grid partitioned. Supply a single value for non-grid tuning cases. Otherwise, supply a vector for the trees numbers you want to test. For running grid tuning, a NULL value supplied will mean these values are tested seq(1000L, 10000L, 1000L)
eta	Bandit grid partitioned. Supply a single value for non-grid tuning cases. Otherwise, supply a vector for the LearningRate values to test. For running grid tuning, a NULL value supplied will mean these values are tested c(0.01,0.02,0.03,0.04)
max_depth	Bandit grid partitioned. Number, or vector for depth to test. For running grid tuning, a NULL value supplied will mean these values are tested seq(4L, 16L, 2L)
min_child_weight	Number, or vector for min_child_weight to test. For running grid tuning, a NULL value supplied will mean these values are tested seq(1.0, 10.0, 1.0)
subsample	Number, or vector for subsample to test. For running grid tuning, a NULL value supplied will mean these values are tested seq(0.55, 1.0, 0.05)
colsample_bytree	Number, or vector for colsample_bytree to test. For running grid tuning, a NULL value supplied will mean these values are tested seq(0.55, 1.0, 0.05)
DebugMode	TRUE to print to console the steps taken

**Value**

Saves to file and returned in list: VariableImportance.csv, Model, ValidationData.csv, Evaluation-Plot.png, EvaluationMetrics.csv, ParDepPlots.R a named list of features with partial dependence calibration plots, GridCollect, and GridList

**Author(s)**

Adrian Antico

**See Also**

Other Automated Supervised Learning - Binary Classification: [AutoCatBoostClassifier\(\)](#), [AutoH2oDRFClassifier\(\)](#), [AutoH2oGAMClassifier\(\)](#), [AutoH2oGBMClassifier\(\)](#), [AutoH2oGLMClassifier\(\)](#), [AutoH2oMLClassifier\(\)](#), [AutoLightGBMClassifier\(\)](#)

**Examples**

```
## Not run:
# Create some dummy correlated data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 1000L,
  ID = 2L,
  ZIP = 0L,
  AddDate = FALSE,
  Classification = TRUE,
  MultiClass = FALSE)

# Run function
TestModel <- RemixAutoML::AutoXGBoostClassifier(

  # GPU or CPU
  TreeMethod = "hist",
  NThreads = parallel::detectCores(),

  # Metadata args
  OutputSelection = c('Importances', 'EvalPlots', 'EvalMetrics', 'Score_TrainData'),
  model_path = normalizePath("./"),
  metadata_path = NULL,
  ModelID = "Test_Model_1",
  EncodingMethod = "binary",
  ReturnFactorLevels = TRUE,
  ReturnModelObjects = TRUE,
  SaveModelObjects = FALSE,
  SaveInfoToPDF = FALSE,

  # Data args
  data = data,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = "Adrian",
  FeatureColNames = names(data)[!names(data) %in%
    c("IDcol_1", "IDcol_2", "Adrian")],
  WeightsColumnName = NULL,
  IDcols = c("IDcol_1", "IDcol_2"),
```

```

# Model evaluation
LossFunction = 'reg:logistic',
CostMatrixWeights = c(1,0,0,1),
eval_metric = "auc",
grid_eval_metric = "MCC",
NumOfParDepPlots = 3L,

# Grid tuning args
PassInGrid = NULL,
GridTune = FALSE,
BaselineComparison = "default",
MaxModelsInGrid = 10L,
MaxRunsWithoutNewWinner = 20L,
MaxRunMinutes = 24L*60L,
Verbose = 1L,

# ML args
Trees = 500L,
eta = 0.30,
max_depth = 9L,
min_child_weight = 1.0,
subsample = 1,
colsample_bytree = 1,
DebugMode = FALSE)

## End(Not run)

```

---

AutoXGBoostFunnelCARMA

*AutoXGBoostFunnelCARMA*


---

## Description

AutoXGBoostFunnelCARMA is a forecasting model for cohort funnel forecasting for grouped data or non-grouped data

## Usage

```

AutoXGBoostFunnelCARMA(
  data,
  GroupVariables = NULL,
  BaseFunnelMeasure = NULL,
  ConversionMeasure = NULL,
  ConversionRateMeasure = NULL,
  CohortPeriodsVariable = NULL,
  CalendarDate = NULL,
  CohortDate = NULL,
  EncodingMethod = "credibility",
  OutputSelection = c("Importances", "EvalPlots", "EvalMetrics", "Score_TrainData"),
  WeightsColumnName = NULL,
  TruncateDate = NULL,
  PartitionRatios = c(0.7, 0.2, 0.1),

```

```

TimeUnit = c("day"),
CalendarTimeGroups = c("day", "week", "month"),
CohortTimeGroups = c("day", "week", "month"),
TransformTargetVariable = TRUE,
TransformMethods = c("Identity", "YeoJohnson"),
AnomalyDetection = list(tstat_high = 3, tstat_low = -2),
Jobs = c("Evaluate", "Train"),
SaveModelObjects = TRUE,
ModelID = "Segment_ID",
ModelPath = NULL,
MetaDataPath = NULL,
DebugMode = FALSE,
CalendarVariables = c("wday", "mday", "yday", "week", "isoweek", "month", "quarter",
  "year"),
HolidayGroups = c("USPublicHolidays", "EasterGroup", "ChristmasGroup",
  "OtherEcclesticalFeasts"),
HolidayLookback = NULL,
CohortHolidayLags = c(1L, 2L, 7L),
CohortHolidayMovingAverages = c(3L, 7L),
CalendarHolidayLags = c(1L, 2L, 7L),
CalendarHolidayMovingAverages = c(3L, 7L),
ImputeRollStats = -0.001,
CalendarLags = list(day = c(1L, 7L, 21L), week = c(1L, 4L, 52L), month = c(1L, 6L,
  12L)),
CalendarMovingAverages = list(day = c(1L, 7L, 21L), week = c(1L, 4L, 52L), month =
  c(1L, 6L, 12L)),
CalendarStandardDeviations = NULL,
CalendarSkews = NULL,
CalendarKurts = NULL,
CalendarQuantiles = NULL,
CalendarQuantilesSelected = "q50",
CohortLags = list(day = c(1L, 7L, 21L), week = c(1L, 4L, 52L), month = c(1L, 6L,
  12L)),
CohortMovingAverages = list(day = c(1L, 7L, 21L), week = c(1L, 4L, 52L), month =
  c(1L, 6L, 12L)),
CohortStandardDeviations = NULL,
CohortSkews = NULL,
CohortKurts = NULL,
CohortQuantiles = NULL,
CohortQuantilesSelected = "q50",
PassInGrid = NULL,
GridTune = FALSE,
BaselineComparison = "default",
MaxModelsInGrid = 25L,
MaxRunMinutes = 180L,
MaxRunsWithoutNewWinner = 10L,
GridEvalMetric = "mae",
NumOfParDepPlots = 1L,
NThreads = parallel::detectCores(),
TreeMethod = "hist",
EvalMetric = "MAE",
LossFunction = "reg:squarederror",

```

```

Trees = 1000L,
LearningRate = 0.3,
MaxDepth = 9L,
MinChildWeight = 1,
SubSample = 1,
ColSampleByTree = 1
)

```

## Arguments

<code>data</code>	data object
<code>BaseFunnelMeasure</code>	E.g. "Leads". This value should be a forward looking variable. Say you want to forecast ConversionMeasure 2 months into the future. You should have two months into the future of values of BaseFunnelMeasure
<code>ConversionMeasure</code>	E.g. "Conversions". Rate is derived as conversions over leads by cohort periods out
<code>ConversionRateMeasure</code>	Conversions over Leads for every cohort
<code>CohortPeriodsVariable</code>	Numeric. Numerical value of the the number of periods since cohort base date.
<code>CalendarDate</code>	The name of your date column that represents the calendar date
<code>CohortDate</code>	The name of your date column that represents the cohort date
<code>OutputSelection</code>	<code>= c('Importances', 'EvalPlots', 'EvalMetrics', 'Score_TrainData')</code>
<code>WeightsColumnName</code>	<code>= NULL</code>
<code>TruncateDate</code>	NULL. Supply a date to represent the earliest point in time you want in your data. Filtering takes place before partitioning data so feature engineering can include as many non null values as possible.
<code>PartitionRatios</code>	Requires three values for train, validation, and test data sets
<code>TimeUnit</code>	Base time unit of data. "days", "weeks", "months", "quarters", "years"
<code>CalendarTimeGroups</code>	TimeUnit value must be included. If you want to generate lags and moving averages in several time based aggregations, choose from "days", "weeks", "months", "quarters", "years".
<code>CohortTimeGroups</code>	TimeUnit value must be included. If you want to generate lags and moving averages in several time based aggregations, choose from "days", "weeks", "months", "quarters", "years".
<code>TransformTargetVariable</code>	TRUE or FALSE
<code>TransformMethods</code>	Choose from "Identity", "BoxCox", "Asinh", "Asin", "Log", "LogPlus1", "Logit", "YeoJohnson"
<code>AnomalyDetection</code>	Provide a named list. See examples
<code>Jobs</code>	Default is "eval" and "train"



SaveModelObjects	Set to TRUE to return all modeling objects to your environment
ModelID	A character string to name your model and output
ModelPath	Path to where you want your models saved
MetaDataPath	Path to where you want your metadata saved. If NULL, function will try ModelPath if it is not NULL.
DebugMode	Internal use
CalendarVariables	"wday", "mday", "yday", "week", "isoweek", "month", "quarter", "year"
HolidayGroups	c("USPublicHolidays", "EasterGroup", "ChristmasGroup", "OtherEcclesticalFeasts")
HolidayLookback	Number of days in range to compute number of holidays from a given date in the data. If NULL, the number of days are computed for you.
CohortHolidayLags	c(1L, 2L, 7L),
CohortHolidayMovingAverages	c(3L, 7L),
CalendarHolidayLags	c(1L, 2L, 7L),
CalendarHolidayMovingAverages	= c(3L, 7L),
ImputeRollStats	Constant value to fill NA after running AutoLagRollStats()
CalendarLags	List of the form list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))
CalendarMovingAverages	List of the form list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))
CalendarStandardDeviations	List of the form list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))
CalendarSkews	List of the form list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))
CalendarKurts	List of the form list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))
CalendarQuantiles	List of the form list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))
CalendarQuantilesSelected	Supply a vector of "q5", "q10", "q15", "q20", "q25", "q30", "q35", "q40", "q45", "q50", "q55", "q60", "q65", "q70", "q75", "q80", "q85", "q90", "q95"
CohortLags	List of the form list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))
CohortMovingAverages	List of the form list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))
CohortStandardDeviations	List of the form list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))

CohortSkews	List of the form <code>list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))</code>
CohortKurts	List of the form <code>list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))</code>
CohortQuantiles	List of the form <code>list("day" = c(1L, 7L, 21L), "week" = c(1L, 4L, 52L), "month" = c(1L, 6L, 12L))</code>
CohortQuantilesSelected	Supply a vector of "q5", "q10", "q15", "q20", "q25", "q30", "q35", "q40", "q45", "q50", "q55", "q60", "q65", "q70", "q75", "q80", "q85", "q90", "q95" # Grid tuning
PassInGrid	Defaults to NULL. Pass in a single row of grid from a previous output as a <code>data.table</code> (they are collected as <code>data.tables</code> )
GridTune	Set to TRUE to run a grid tuning procedure. Set a number in <code>MaxModelsInGrid</code> to tell the procedure how many models you want to test.
BaselineComparison	Set to either "default" or "best". Default is to compare each successive model build to the baseline model using max trees (from function args). Best makes the comparison to the current best model.
MaxModelsInGrid	Number of models to test from grid options
MaxRunMinutes	Maximum number of minutes to let this run
MaxRunsWithoutNewWinner	Number of models built before calling it quits # ML Args begin
NumOfParDepPlots	Tell the function the number of partial dependence calibration plots you want to create. Calibration boxplots will only be created for numerical features (not dummy variables)
NThreads	<code>= parallel::detectCores()</code>
TreeMethod	Choose from 'hist', 'gpu_hist'
EvalMetric	Select from 'r2', 'RMSE', 'MSE', 'MAE'
LossFunction	Default is 'reg:squarederror'. Other options include 'reg:squaredlogerror', 'reg:pseudohubererror', 'count:poisson', 'survival:cox', 'survival:aft', 'aft_loss_distribution', 'reg:gamma', 'reg:tweedie'
Trees	Select the number of trees you want to have built to train the model
LearningRate	Learning Rate
MaxDepth	Depth
MinChildWeight	Records in leaf
SubSample	Random forecast setting
ColSampleByTree	Self explanatory

**Author(s)**

Adrian Antico

## See Also

Other Automated Funnel Data Forecasting: [AutoCatBoostFunnelCARMAScoring\(\)](#), [AutoCatBoostFunnelCARMA\(\)](#), [AutoLightGBMFunnelCARMAScoring\(\)](#), [AutoLightGBMFunnelCARMA\(\)](#), [AutoXGBoostFunnelCARMAScoring\(\)](#)

## Examples

```
## Not run:
# Create fake data
data <- RemixAutoML::FakeDataGenerator(ChainLadderData = TRUE)

# Subset data for training
ModelDataBase <- data[CalendarDateColumn < '2020-01-01' & CohortDateColumn < '2020-01-01']
ModelData <- data.table::copy(ModelDataBase)

# Train Funne Model
TestModel <- RemixAutoML::AutoXGBoostFunnelCARMA(

  # Data Arguments
  data = ModelData,
  GroupVariables = NULL,
  BaseFunnelMeasure = "Leads", # if you have XREGS, supply vector such as c("Leads", "XREGS1", "XREGS2")
  ConversionMeasure = "Appointments",
  ConversionRateMeasure = NULL,
  CohortPeriodsVariable = "CohortDays",
  WeightsColumnName = NULL,
  CalendarDate = "CalendarDateColumn",
  CohortDate = "CohortDateColumn",
  PartitionRatios = c(0.70, 0.20, 0.10),
  TruncateDate = NULL,
  TimeUnit = "days",
  TransformTargetVariable = TRUE,
  TransformMethods = c("Asinh", "Asin", "Log", "LogPlus1", "Sqrt", "Logit"),
  AnomalyDetection = list(tstat_high = 3, tstat_low = -2),

  # MetaData Arguments
  Jobs = c("eval", "train"),
  SaveModelObjects = FALSE,
  ModelID = "ModelTest",
  ModelPath = getwd(),
  MetaDataPath = NULL,
  DebugMode = TRUE,
  NumOfParDepPlots = 1L,
  EncodingMethod = "credibility",
  NThreads = parallel::detectCores(),

  # Feature Engineering Arguments
  CalendarTimeGroups = c("days", "weeks", "months"),
  CohortTimeGroups = c("days", "weeks"),
  CalendarVariables = c("wday", "mday", "yday", "week", "month", "quarter", "year"),
  HolidayGroups = c("USPublicHolidays", "EasterGroup", "ChristmasGroup", "OtherEcclesticalFeasts"),
  HolidayLookback = NULL,
  CohortHolidayLags = c(1L, 2L, 7L),
  CohortHolidayMovingAverages = c(3L, 7L),
  CalendarHolidayLags = c(1L, 2L, 7L),
  CalendarHolidayMovingAverages = c(3L, 7L),
```

```

# Time Series Features
ImputeRollStats = -0.001,
CalendarLags = list("day" = c(1L,2L,7L,35L,42L), "week" = c(5L,6L,10L,12L,25L,26L)),
CalendarMovingAverages = list("day" = c(7L,14L,35L,42L), "week" = c(5L,6L,10L,12L,20L,24L), "month" = c(6L,12L,25L,35L,42L)),
CalendarStandardDeviations = NULL,
CalendarSkews = NULL,
CalendarKurts = NULL,
CalendarQuantiles = NULL,
CalendarQuantilesSelected = "q50",
CohortLags = list("day" = c(1L,2L,7L,35L,42L), "week" = c(5L,6L)),
CohortMovingAverages = list("day" = c(7L,14L,35L,42L), "week" = c(5L,6L), "month" = c(1L,2L)),
CohortStandardDeviations = NULL,
CohortSkews = NULL,
CohortKurts = NULL,
CohortQuantiles = NULL,
CohortQuantilesSelected = "q50",

# ML Grid Tuning
PassInGrid = NULL,
GridTune = FALSE,
BaselineComparison = "default",
MaxModelsInGrid = 25L,
MaxRunMinutes = 180L,
MaxRunsWithoutNewWinner = 10L,

# ML Setup Parameters
GridEvalMetric = 'mae',

# XGBoost arguments
TreeMethod = 'hist',
EvalMetric = 'MAE',
LossFunction = 'reg:squarederror',
Trees = 50L,
LearningRate = 0.3,
MaxDepth = 9L,
MinChildWeight = 1.0,
SubSample = 1.0,
ColSampleByTree = 1.0)

# Separate out the Base Funnel Measures Data
LeadsData <- data[, lapply(.SD, data.table::first), .SDcols = c("Leads"), by = c("CalendarDateColumn")]
ModelData <- ModelDataBase[, Leads := NULL]

# Forecast Funnel Model
Test <- RemixAutoML::AutoXGBoostFunnelCARMA(
  TrainData = ModelData,
  ForwardLookingData = LeadsData,
  TrainEndDate = ModelData[, max(CalendarDateColumn)],
  ForecastEndDate = LeadsData[, max(CalendarDateColumn)],
  TrainOutput = TestModel$ModelOutput,
  ArgsList = TestModel$ArgsList,
  ModelPath = NULL,
  MaxCohortPeriod = 15,
  DebugMode = TRUE)

## End(Not run)

```

---

AutoXGBoostFunnelCARMAScoring

*AutoLightGBMFunnelCARMAScoring*


---

## Description

AutoLightGBMFunnelCARMAScoring for generating forecasts

## Usage

```
AutoXGBoostFunnelCARMAScoring(
  TrainData,
  ForwardLookingData = NULL,
  TrainEndDate = NULL,
  ForecastEndDate = NULL,
  ArgsList = NULL,
  TrainOutput = NULL,
  ModelPath = NULL,
  MaxCohortPeriod = NULL,
  DebugMode = FALSE
)
```

## Arguments

TrainData	Data utilized in training. Do not put the BaseFunnelMeasure in this data set. Put it in the ForwardLookingData object
ForwardLookingData	Base funnel measure data. Needs to cover the span of the forecast horizon
TrainEndDate	Max date from the training data
ForecastEndDate	Max date to forecast out to
ArgsList	Output list from AutoCatBoostFunnelCARMA
TrainOutput	Pass in the model object to speed up forecasting
ModelPath	Path to model location
MaxCohortPeriod	Max cohort periods to utilize when forecasting
DebugMode	For debugging issues

## Author(s)

Adrian Antico

## See Also

Other Automated Funnel Data Forecasting: [AutoCatBoostFunnelCARMAScoring\(\)](#), [AutoCatBoostFunnelCARMA\(\)](#), [AutoLightGBMFunnelCARMAScoring\(\)](#), [AutoLightGBMFunnelCARMA\(\)](#), [AutoXGBoostFunnelCARMA\(\)](#)

**Examples**

```

## Not run:
# Create fake data
data <- RemixAutoML::FakeDataGenerator(ChainLadderData = TRUE)

# Subset data for training
ModelDataBase <- data[CalendarDateColumn < '2020-01-01' & CohortDateColumn < '2020-01-01']
ModelData <- data.table::copy(ModelDataBase)

# Train Funnel Model
TestModel <- RemixAutoML::AutoXGBoostFunnelCARMA(

  # Data Arguments
  data = ModelData,
  GroupVariables = NULL,
  BaseFunnelMeasure = "Leads", # if you have XREGS, supply vector such as c("Leads", "XREGS1", "XREGS2")
  ConversionMeasure = "Appointments",
  ConversionRateMeasure = NULL,
  CohortPeriodsVariable = "CohortDays",
  WeightsColumnName = NULL,
  CalendarDate = "CalendarDateColumn",
  CohortDate = "CohortDateColumn",
  PartitionRatios = c(0.70, 0.20, 0.10),
  TruncateDate = NULL,
  TimeUnit = "days",
  TransformTargetVariable = TRUE,
  TransformMethods = c("Asinh", "Asin", "Log", "LogPlus1", "Sqrt", "Logit"),
  AnomalyDetection = list(tstat_high = 3, tstat_low = -2),

  # MetaData Arguments
  Jobs = c("eval", "train"),
  SaveModelObjects = FALSE,
  ModelID = "ModelTest",
  ModelPath = getwd(),
  MetaDataPath = NULL,
  DebugMode = TRUE,
  NumOfParDepPlots = 1L,
  EncodingMethod = "credibility",
  NThreads = parallel::detectCores(),

  # Feature Engineering Arguments
  CalendarTimeGroups = c("days", "weeks", "months"),
  CohortTimeGroups = c("days", "weeks"),
  CalendarVariables = c("wday", "mday", "yday", "week", "month", "quarter", "year"),
  HolidayGroups = c("USPublicHolidays", "EasterGroup", "ChristmasGroup", "OtherEcclesticalFeasts"),
  HolidayLookback = NULL,
  CohortHolidayLags = c(1L, 2L, 7L),
  CohortHolidayMovingAverages = c(3L, 7L),
  CalendarHolidayLags = c(1L, 2L, 7L),
  CalendarHolidayMovingAverages = c(3L, 7L),

  # Time Series Features
  ImputeRollStats = -0.001,
  CalendarLags = list("day" = c(1L, 2L, 7L, 35L, 42L), "week" = c(5L, 6L, 10L, 12L, 25L, 26L)),
  CalendarMovingAverages = list("day" = c(7L, 14L, 35L, 42L), "week" = c(5L, 6L, 10L, 12L, 20L, 24L), "month" = c(6L, 12L, 24L, 36L, 48L)),
  CalendarStandardDeviations = NULL,

```

```

CalendarSkews = NULL,
CalendarKurts = NULL,
CalendarQuantiles = NULL,
CalendarQuantilesSelected = "q50",
CohortLags = list("day" = c(1L,2L,7L,35L,42L), "week" = c(5L,6L)),
CohortMovingAverages = list("day" = c(7L,14L,35L,42L), "week" = c(5L,6L), "month" = c(1L,2L)),
CohortStandardDeviations = NULL,
CohortSkews = NULL,
CohortKurts = NULL,
CohortQuantiles = NULL,
CohortQuantilesSelected = "q50",

# ML Grid Tuning
PassInGrid = NULL,
GridTune = FALSE,
BaselineComparison = "default",
MaxModelsInGrid = 25L,
MaxRunMinutes = 180L,
MaxRunsWithoutNewWinner = 10L,

# ML Setup Parameters
GridEvalMetric = 'mae',

# XGBoost arguments
TreeMethod = 'hist',
EvalMetric = 'MAE',
LossFunction = 'reg:squarederror',
Trees = 50L,
LearningRate = 0.3,
MaxDepth = 9L,
MinChildWeight = 1.0,
SubSample = 1.0,
ColSampleByTree = 1.0)

# Separate out the Base Funnel Measures Data
LeadsData <- data[, lapply(.SD, data.table::first), .SDcols = c("Leads"), by = c("CalendarDateColumn")]
ModelData <- ModelDataBase[, Leads := NULL]

# Forecast Funnel Model
Test <- RemixAutoML::AutoXGBoostFunnelCARMAScoring(
  TrainData = ModelData,
  ForwardLookingData = LeadsData,
  TrainEndDate = ModelData[, max(CalendarDateColumn)],
  ForecastEndDate = LeadsData[, max(CalendarDateColumn)],
  TrainOutput = TestModel$ModelOutput,
  ArgsList = TestModel$ArgsList,
  ModelPath = NULL,
  MaxCohortPeriod = 15,
  DebugMode = TRUE)

## End(Not run)

```

## Description

AutoXGBoostHurdleCARMA is an intermittent demand, Multivariate Forecasting algorithms with calendar variables, Holiday counts, holiday lags, holiday moving averages, differencing, transformations, interaction-based categorical encoding using target variable and features to generate various time-based aggregated lags, moving averages, moving standard deviations, moving skewness, moving kurtosis, moving quantiles, parallelized interaction-based fourier pairs by grouping variables, and Trend Variables.

## Usage

```
AutoXGBoostHurdleCARMA(
  data,
  NonNegativePred = FALSE,
  Threshold = NULL,
  RoundPreds = FALSE,
  TrainOnFull = FALSE,
  TargetColumnName = "Target",
  DateColumnName = "DateTime",
  HierarchGroups = NULL,
  GroupVariables = NULL,
  EncodingMethod = "credibility",
  TimeWeights = 1,
  FC_Periods = 30,
  TimeUnit = "week",
  TimeGroups = c("weeks", "months"),
  NumOfParDepPlots = 10L,
  TargetTransformation = FALSE,
  Methods = c("BoxCox", "Asinh", "Log", "LogPlus1", "Sqrt", "Asin", "Logit"),
  AnomalyDetection = NULL,
  XREGS = NULL,
  Lags = c(1L:5L),
  MA_Periods = c(2L:5L),
  SD_Periods = NULL,
  Skew_Periods = NULL,
  Kurt_Periods = NULL,
  Quantile_Periods = NULL,
  Quantiles_Selected = c("q5", "q95"),
  Difference = TRUE,
  FourierTerms = 6L,
  CalendarVariables = c("second", "minute", "hour", "wday", "mday", "yday", "week",
    "wom", "isoweek", "month", "quarter", "year"),
  HolidayVariable = c("USPublicHolidays", "EasterGroup", "ChristmasGroup",
    "OtherEcclesticalFeasts"),
  HolidayLookback = NULL,
  HolidayLags = 1L,
  HolidayMovingAverages = 1L:2L,
  TimeTrendVariable = FALSE,
  ZeroPadSeries = NULL,
  DataTruncate = FALSE,
  SplitRatios = c(0.7, 0.2, 0.1),
  PartitionType = "timeseries",
  Timer = TRUE,
```



```

DebugMode = FALSE,
EvalMetric = "RMSE",
GridTune = FALSE,
PassInGrid = NULL,
ModelCount = 100,
MaxRunsWithoutNewWinner = 50,
MaxRunMinutes = 24L * 60L,
TreeMethod = "hist",
Trees = list(classifier = 1000, regression = 1000),
eta = list(classifier = 0.05, regression = 0.05),
max_depth = list(classifier = 4L, regression = 4L),
min_child_weight = list(classifier = 1, regression = 1),
subsample = list(classifier = 0.55, regression = 0.55),
colsample_bytree = list(classifier = 0.55, regression = 0.55)
)

```

### Arguments

data	Supply your full series data set here
NonNegativePred	TRUE or FALSE
Threshold	Select confusion matrix measure to optimize for pulling in threshold. Choose from 'MCC', 'Acc', 'TPR', 'TNR', 'FNR', 'FPR', 'FDR', 'FOR', 'F1_Score', 'F2_Score', 'F0.5_Score', 'NPV', 'PPV', 'ThreatScore', 'Utility'
RoundPreds	Rounding predictions to an integer value. TRUE or FALSE. Defaults to FALSE
TrainOnFull	Set to TRUE to train on full data
TargetColumnName	List the column name of your target variables column. E.g. 'Target'
DateColumnName	List the column name of your date column. E.g. 'DateTime'
HierarchGroups	Vector of hierachy categorical columns.
GroupVariables	Defaults to NULL. Use NULL when you have a single series. Add in GroupVariables when you have a series for every level of a group or multiple groups.
EncodingMethod	Choose from 'binary', 'poly_encode', 'backward_difference', 'helmert' for multiclass cases and additionally 'm_estimator', 'credibility', 'woe', 'target_encoding' for classification use cases.
TimeWeights	Timeweights creation. Supply a value, such as 0.9999
FC_Periods	Set the number of periods you want to have forecasts for. E.g. 52 for weekly data to forecast a year ahead
TimeUnit	List the time unit your data is aggregated by. E.g. '1min', '5min', '10min', '15min', '30min', 'hour', 'day', 'week', 'month', 'quarter', 'year'.
TimeGroups	Select time aggregations for adding various time aggregated GDL features.
NumOfParDepPlots	Supply a number for the number of partial dependence plots you want returned
TargetTransformation	Run AutoTransformationCreate() to find best transformation for the target variable. Tests YeoJohnson, BoxCox, and Asigh (also Asin and Logit for proportion target variables).

Methods	Choose from 'YeoJohnson', 'BoxCox', 'Asinh', 'Log', 'LogPlus1', 'Sqrt', 'Asin', or 'Logit'. If more than one is selected, the one with the best normalization pearson statistic will be used. Identity is automatically selected and compared.
AnomalyDetection	NULL for not using the service. Other, provide a list, e.g. AnomalyDetection = list('tstat_high' = 4, tstat_low = -4)
XREGS	Additional data to use for model development and forecasting. Data needs to be a complete series which means both the historical and forward looking values over the specified forecast window needs to be supplied.
Lags	Select the periods for all lag variables you want to create. E.g. c(1:5,52)
MA_Periods	Select the periods for all moving average variables you want to create. E.g. c(1:5,52)
SD_Periods	Select the periods for all moving standard deviation variables you want to create. E.g. c(1:5,52)
Skew_Periods	Select the periods for all moving skewness variables you want to create. E.g. c(1:5,52)
Kurt_Periods	Select the periods for all moving kurtosis variables you want to create. E.g. c(1:5,52)
Quantile_Periods	Select the periods for all moving quantiles variables you want to create. E.g. c(1:5,52)
Quantiles_Selected	Select from the following 'q5', 'q10', 'q15', 'q20', 'q25', 'q30', 'q35', 'q40', 'q45', 'q50', 'q55', 'q60', 'q65', 'q70', 'q75', 'q80', 'q85', 'q90', 'q95'
Difference	Puts the I in ARIMA for single series and grouped series.
FourierTerms	Set to the max number of pairs. E.g. 2 means to generate two pairs for by each group level and iterations if hierarchy is enabled.
CalendarVariables	NULL, or select from 'second', 'minute', 'hour', 'wday', 'mday', 'yday', 'week', 'isoweek', 'month', 'quarter', 'year'
HolidayVariable	NULL, or select from 'USPublicHolidays', 'EasterGroup', 'ChristmasGroup', 'OtherEcclesticalFeasts'
HolidayLookback	Number of days in range to compute number of holidays from a given date in the data. If NULL, the number of days are computed for you.
HolidayLags	Number of lags to build off of the holiday count variable.
HolidayMovingAverages	Number of moving averages to build off of the holiday count variable.
TimeTrendVariable	Set to TRUE to have a time trend variable added to the model. Time trend is numeric variable indicating the numeric value of each record in the time series (by group). Time trend starts at 1 for the earliest point in time and increments by one for each success time point.
ZeroPadSeries	Set to 'all', 'inner', or NULL. See TimeSeriesFill for explanation
DataTruncate	Set to TRUE to remove records with missing values from the lags and moving average features created
SplitRatios	E.g c(0.7,0.2,0.1) for train, validation, and test sets

PartitionType	Select 'random' for random data partitioning 'timeseries' for partitioning by time frames
Timer	Set to FALSE to turn off the updating print statements for progress
DebugMode	Defaults to FALSE. Set to TRUE to get a print statement of each high level comment in function
EvalMetric	Select from 'RMSE', 'MAE', 'MAPE', 'Poisson', 'Quantile', 'LogLinQuantile', 'Lq', 'NumErrors', 'SMAPE', 'R2', 'MSLE', 'MedianAbsoluteError'
GridTune	Set to TRUE to run a grid tune
PassInGrid	Defaults to NULL
ModelCount	Set the number of models to try in the grid tune
MaxRunsWithoutNewWinner	Default is 50
MaxRunMinutes	Default is 60*60
TreeMethod	"hist" or "gpu_hist"
Trees	= list("classifier" = 1000, "regression" = 1000)
eta	= list("classifier" = 0.05, "regression" = 0.05)
max_depth	= list("classifier" = 4L, "regression" = 4L)
min_child_weight	= list("classifier" = 1.0, "regression" = 1.0)
subsample	= list("classifier" = 0.55, "regression" = 0.55)
colsample_bytree	= list("classifier" = 0.55, "regression" = 0.55)

### Value

Returns a data.table of original series and forecasts, the catboost model objects (everything returned from AutoCatBoostRegression()), a time series forecast plot, and transformation info if you set TargetTransformation to TRUE. The time series forecast plot will plot your single series or aggregate your data to a single series and create a plot from that.

### Author(s)

Adrian Antico

### See Also

Other Automated Panel Data Forecasting: [AutoCatBoostCARMA\(\)](#), [AutoCatBoostHurdleCARMA\(\)](#), [AutoCatBoostVectorCARMA\(\)](#), [AutoH2OCARMA\(\)](#), [AutoLightGBMCARMA\(\)](#), [AutoLightGBMHurdleCARMA\(\)](#), [AutoXGBoostCARMA\(\)](#)

### Examples

```
## Not run:

# Single group variable and xregs ----

# Load Walmart Data from Dropbox----
data <- data.table::fread(
  'https://www.dropbox.com/s/2str3ek4f4cheqi/walmart_train.csv?dl=1')
```

```

# Subset for Stores / Departments With Full Series
data <- data[, Counts := .N, by = c('Store','Dept')][Counts == 143][
  , Counts := NULL]

# Subset Columns (remove IsHoliday column)----
keep <- c('Store','Dept','Date','Weekly_Sales')
data <- data[, ..keep]
data <- data[Store == 1][, Store := NULL]
xregs <- data.table::copy(data)
data.table::setnames(xregs, 'Dept', 'GroupVar')
data.table::setnames(xregs, 'Weekly_Sales', 'Other')
data <- data[as.Date(Date) < as.Date('2012-09-28')]

# Add zeros for testing
data[runif(.N) < 0.25, Weekly_Sales := 0]

# Build forecast
CatBoostResults <- RemixAutoML::AutoXGBoostHurdleCARMA(

  # data args
  data = data, # TwoGroup_Data,
  TargetColumnName = 'Weekly_Sales',
  DateColumnName = 'Date',
  HierarchGroups = NULL,
  GroupVariables = c('Dept'),
  EncodingMethod = "credibility",
  TimeWeights = 1,
  TimeUnit = 'weeks',
  TimeGroups = c('weeks','months'),

  # Production args
  TrainOnFull = FALSE,
  SplitRatios = c(1 - 20 / 138, 10 / 138, 10 / 138),
  PartitionType = 'random',
  FC_Periods = 4,
  Timer = TRUE,
  DebugMode = TRUE,

  # Target transformations
  TargetTransformation = TRUE,
  Methods = c('BoxCox', 'Asinh', 'Asin', 'Log',
    'LogPlus1', 'Sqrt', 'Logit', 'YeoJohnson'),
  Difference = FALSE,
  NonNegativePred = FALSE,
  RoundPreds = FALSE,

  # Date features
  CalendarVariables = c('week', 'wom', 'month', 'quarter'),
  HolidayVariable = c('USPublicHolidays',
    'EasterGroup',
    'ChristmasGroup','OtherEcclesticalFeasts'),
  HolidayLookback = NULL,
  HolidayLags = 1,
  HolidayMovingAverages = 1:2,

  # Time series features
  Lags = list('weeks' = seq(2L, 10L, 2L),

```

```

    'months' = c(1:3)),
  MA_Periods = list('weeks' = seq(2L, 10L, 2L),
    'months' = c(2,3)),
  SD_Periods = NULL,
  Skew_Periods = NULL,
  Kurt_Periods = NULL,
  Quantile_Periods = NULL,
  Quantiles_Selected = c('q5','q95'),

  # Bonus features
  AnomalyDetection = NULL,
  XREGS = xregs,
  FourierTerms = 2,
  TimeTrendVariable = TRUE,
  ZeroPadSeries = NULL,
  DataTruncate = FALSE,

  # ML Args
  NumOfParDepPlots = 100L,
  EvalMetric = 'RMSE',
  GridTune = FALSE,
  PassInGrid = NULL,
  ModelCount = 5,
  MaxRunsWithoutNewWinner = 50,
  MaxRunMinutes = 60*60,

  # XGBoost Args
  TreeMethod = "hist",
  Trees = list("classifier" = 1000, "regression" = 1000),
  eta = list("classifier" = 0.05, "regression" = 0.05),
  max_depth = list("classifier" = 4L, "regression" = 4L),
  min_child_weight = list("classifier" = 1.0, "regression" = 1.0),
  subsample = list("classifier" = 0.55, "regression" = 0.55),
  colsample_bytree = list("classifier" = 0.55, "regression" = 0.55))

# Two group variables and xregs

# Load Walmart Data from Dropbox----
data <- data.table::fread(
  'https://www.dropbox.com/s/2str3ek4f4cheqi/walmart_train.csv?dl=1')

# Subset for Stores / Departments With Full Series
data <- data[, Counts := .N, by = c('Store','Dept')][Counts == 143][
  , Counts := NULL]

# Put negative values at 0
data[, Weekly_Sales := data.table::fifelse(Weekly_Sales < 0, 0, Weekly_Sales)]

# Subset Columns (remove IsHoliday column)----
keep <- c('Store','Dept','Date','Weekly_Sales')
data <- data[, ..keep]
data <- data[Store %in% c(1,2)]

xregs <- data.table::copy(data)
xregs[, GroupVar := do.call(paste, c(.SD, sep = ' ')), .SDcols = c('Store','Dept')]
xregs[, c('Store','Dept') := NULL]
data.table::setnames(xregs, 'Weekly_Sales', 'Other')

```

```

xregs[, Other := jitter(Other, factor = 25)]
data <- data[as.Date(Date) < as.Date('2012-09-28')]

# Add some zeros for testing
data[runif(.N) < 0.25, Weekly_Sales := 0]

# Build forecast
Output <- RemixAutoML::AutoXGBoostHurdleCARMA(

  # data args
  data = data,
  TargetColumnName = 'Weekly_Sales',
  DateColumnName = 'Date',
  HierarchGroups = NULL,
  GroupVariables = c('Store', 'Dept'),
  EncodingMethod = "credibility",
  TimeWeights = 1,
  TimeUnit = 'weeks',
  TimeGroups = c('weeks', 'months'),

  # Production args
  TrainOnFull = TRUE,
  SplitRatios = c(1 - 20 / 138, 10 / 138, 10 / 138),
  PartitionType = 'random',
  FC_Periods = 4,
  Timer = TRUE,
  DebugMode = TRUE,

  # Target transformations
  TargetTransformation = TRUE,
  Methods = c('BoxCox', 'Asinh', 'Asin', 'Log',
              'LogPlus1', 'Sqrt', 'Logit', 'YeoJohnson'),
  Difference = FALSE,
  NonNegativePred = FALSE,
  Threshold = NULL,
  RoundPreds = FALSE,

  # Date features
  CalendarVariables = c('week', 'wom', 'month', 'quarter'),
  HolidayVariable = c('USPublicHolidays',
                     'EasterGroup',
                     'ChristmasGroup', 'OtherEcclesticalFeasts'),
  HolidayLookback = NULL,
  HolidayLags = 1,
  HolidayMovingAverages = 1:2,

  # Time series features
  Lags = list('weeks' = seq(2L, 10L, 2L),
              'months' = c(1:3)),
  MA_Periods = list('weeks' = seq(2L, 10L, 2L),
                    'months' = c(2,3)),
  SD_Periods = NULL,
  Skew_Periods = NULL,
  Kurt_Periods = NULL,
  Quantile_Periods = NULL,
  Quantiles_Selected = c('q5', 'q95'),

```

```

# Bonus features
AnomalyDetection = NULL,
XREGS = xregs,
FourierTerms = 2,
TimeTrendVariable = TRUE,
ZeroPadSeries = NULL,
DataTruncate = FALSE,

# ML Args
NumOfParDepPlots = 100L,
EvalMetric = 'RMSE',
GridTune = FALSE,
PassInGrid = NULL,
ModelCount = 5,
MaxRunsWithoutNewWinner = 50,
MaxRunMinutes = 60*60,

# XGBoost Args
TreeMethod = "hist",
Trees = list("classifier" = 1000, "regression" = 1000),
eta = list("classifier" = 0.05, "regression" = 0.05),
max_depth = list("classifier" = 4L, "regression" = 4L),
min_child_weight = list("classifier" = 1.0, "regression" = 1.0),
subsample = list("classifier" = 0.55, "regression" = 0.55),
colsample_bytree = list("classifier" = 0.55, "regression" = 0.55))

## End(Not run)

```

---

AutoXGBoostHurdleModel

*AutoXGBoostHurdleModel*


---

## Description

AutoXGBoostHurdleModel is generalized hurdle modeling framework

## Usage

```

AutoXGBoostHurdleModel(
  TreeMethod = "hist",
  TrainOnFull = FALSE,
  PassInGrid = NULL,
  NThreads = max(1L, parallel::detectCores() - 2L),
  ModelID = "ModelTest",
  Paths = NULL,
  MetaDataPaths = NULL,
  data,
  ValidationData = NULL,
  TestData = NULL,
  Buckets = 0L,
  TargetColumnName = NULL,
  FeatureColNames = NULL,
  PrimaryDateColumn = NULL,

```

```

WeightsColumnName = NULL,
ClassWeights = c(1, 1),
IDcols = NULL,
DebugMode = FALSE,
EncodingMethod = "credibility",
TransformNumericColumns = NULL,
Methods = c("Asinh", "Asin", "Log", "LogPlus1", "Sqrt", "Logit"),
SplitRatios = c(0.7, 0.2, 0.1),
SaveModelObjects = FALSE,
ReturnModelObjects = TRUE,
NumOfParDepPlots = 1L,
GridTune = FALSE,
grid_eval_metric = "accuracy",
MaxModelsInGrid = 1L,
BaselineComparison = "default",
MaxRunsWithoutNewWinner = 10L,
MaxRunMinutes = 60L,
Trees = list(classifier = 1000, regression = 1000),
eta = list(classifier = 0.05, regression = 0.05),
max_depth = list(classifier = 4L, regression = 4L),
min_child_weight = list(classifier = 1, regression = 1),
subsample = list(classifier = 0.55, regression = 0.55),
colsample_bytree = list(classifier = 0.55, regression = 0.55)
)

```

### Arguments

TreeMethod	Set to hist or gpu_hist depending on if you have an xgboost installation capable of gpu processing
TrainOnFull	Set to TRUE to train model on 100 percent of data
PassInGrid	Pass in a grid for changing up the parameter settings for catboost
NThreads	Set to the number of threads you would like to dedicate to training
ModelID	Define a character name for your models
Paths	The path to your folder where you want your model information saved
MetaDataPaths	A character string of your path file to where you want your model evaluation output saved. If left NULL, all output will be saved to Paths.
data	Source training data. Do not include a column that has the class labels for the buckets as they are created internally.
ValidationData	Source validation data. Do not include a column that has the class labels for the buckets as they are created internally.
TestData	Source test data. Do not include a column that has the class labels for the buckets as they are created internally.
Buckets	A numeric vector of the buckets used for subsetting the data. NOTE: the final Bucket value will first create a subset of data that is less than the value and a second one thereafter for data greater than the bucket value.
TargetColumnName	Supply the column name or number for the target variable
FeatureColNames	Supply the column names or number of the features (not included the Primary-DateColumn)



PrimaryDateColumn	Date column for sorting
WeightsColumnName	Weighs column name
ClassWeights	Look up the classifier model help file
IDcols	Includes PrimaryDateColumn and any other columns you want returned in the validation data with predictions
DebugMode	For debugging
EncodingMethod	Choose from 'binary', 'poly_encode', 'backward_difference', 'helmert' for multiclass cases and additionally 'm_estimator', 'credibility', 'woe', 'target_encoding' for classification use cases.
TransformNumericColumns	Transform numeric column inside the AutoCatBoostRegression() function
Methods	Choose from 'Asinh', 'Asin', 'Log', 'LogPlus1', 'Sqrt', 'Logit'
SplitRatios	Supply vector of partition ratios. For example, c(0.70,0.20,0,10)
SaveModelObjects	Set to TRUE to save the model objects to file in the folders listed in Paths
ReturnModelObjects	Set to TRUE to return all model objects
NumOfParDepPlots	Set to pull back N number of partial dependence calibration plots.
GridTune	Set to TRUE if you want to grid tune the models
grid_eval_metric	Select the metric to optimize in grid tuning. "accuracy", "microauc", "logloss"
MaxModelsInGrid	Set to a numeric value for the number of models to try in grid tune
BaselineComparison	"default"
MaxRunsWithoutNewWinner	Number of runs without a new winner before stopping the grid tuning
MaxRunMinutes	Max number of minutes to allow the grid tuning to run for
Trees	Provide a named list to have different number of trees for each model. Trees = list("classifier" = seq(1000,2000,100), "regression" = seq(1000,2000,100))
eta	Provide a named list to have different number of eta for each model.
max_depth	Provide a named list to have different number of max_depth for each model.
min_child_weight	Provide a named list to have different number of min_child_weight for each model.
subsample	Provide a named list to have different number of subsample for each model.
colsample_bytree	Provide a named list to have different number of colsample_bytree for each model.

**Author(s)**

Adrian Antico

**See Also**

Other Supervised Learning - Hurdle Modeling: [AutoCatBoostHurdleModel\(\)](#), [AutoH2oDRFHurdleModel\(\)](#), [AutoH2oGBMHurdleModel\(\)](#), [AutoLightGBMHurdleModel\(\)](#)

**Examples**

```
## Not run:
# Test data.table
XGBoost_QA <- data.table::CJ(
  TOF = c(TRUE,FALSE),
  Classification = c(TRUE,FALSE),
  Success = "Failure",
  ScoreSuccess = "Failure",
  PartitionInFunction = c(TRUE,FALSE), sorted = FALSE
)

# Remove impossible combinations
XGBoost_QA <- XGBoost_QA[!(PartitionInFunction & TOF)]
XGBoost_QA[, RunNumber := seq_len(.N)]

# Path File
Path <- getwd()

#      TOF Classification Success PartitionInFunction RunNumber
# 1:  TRUE           TRUE Failure                FALSE         1
# 2:  TRUE           FALSE Failure                FALSE         2
# 3: FALSE           TRUE Failure                TRUE          3
# 4: FALSE           TRUE Failure                FALSE         4
# 5: FALSE           FALSE Failure                TRUE          5
# 6: FALSE           FALSE Failure                FALSE         6

# AutoCatBoostHurdleModel
# run = 5
# run = 6
for(run in seq_len(XGBoost_QA[,.N])) {

  # Define values
  tof <- XGBoost_QA[run, TOF]
  PartitionInFunction <- XGBoost_QA[run, PartitionInFunction]
  Classify <- XGBoost_QA[run, Classification]
  Tar <- "Adrian"

  # Get data
  if(Classify) {
    data <- RemixAutoML::FakeDataGenerator(N = 15000, ZIP = 1)
  } else {
    data <- RemixAutoML::FakeDataGenerator(N = 100000, ZIP = 2)
  }

  # Partition Data
  if(!tof && !PartitionInFunction) {
    Sets <- RemixAutoML::AutoDataPartition(
      data = data,
      NumDataSets = 3,
      Ratios = c(0.7,0.2,0.1),
      PartitionType = "random",
```

```

    StratifyColumnNames = "Adrian",
    TimeColumnName = NULL)
TTrainData <- Sets$TrainData
VValidationData <- Sets$ValidationData
TTestData <- Sets$TestData
rm(Sets)
} else {
  TTrainData <- data.table::copy(data)
  VValidationData <- NULL
  TTestData <- NULL
}

# Run function
TestModel <- tryCatch({RemixAutoML::AutoXGBoostHurdleModel(

  # Operationalization
  ModelID = 'ModelTest',
  SaveModelObjects = FALSE,
  ReturnModelObjects = TRUE,
  NThreads = parallel::detectCores(),

  # Data related args
  data = TTrainData,
  ValidationData = VValidationData,
  PrimaryDateColumn = "DateTime",
  TestData = TTestData,
  WeightsColumnName = NULL,
  TrainOnFull = tof,
  Buckets = if(Classify) 0L else c(0,2,3),
  TargetColumnName = "Adrian",
  FeatureColNames = names(TTrainData)[!names(data) %in% c("Adrian","IDcol_1","IDcol_2","IDcol_3","IDcol_4",
  IDcols = c("IDcol_1","IDcol_2","IDcol_3","IDcol_4","IDcol_5","DateTime"),
  DebugMode = TRUE,

  # Metadata args
  EncodingMethod = "credibility",
  Paths = normalizePath('./'),
  MetaDataPaths = NULL,
  TransformNumericColumns = NULL,
  Methods = c('Asinh', 'Asin', 'Log', 'LogPlus1', 'Logit'),
  ClassWeights = c(1,1),
  SplitRatios = if(PartitionInFunction) c(0.70, 0.20, 0.10) else NULL,
  NumOfParDepPlots = 10L,

  # Grid tuning setup
  PassInGrid = NULL,
  GridTune = FALSE,
  BaselineComparison = 'default',
  MaxModelsInGrid = 1L,
  MaxRunsWithoutNewWinner = 20L,
  MaxRunMinutes = 60L*60L,

  # XGBoost parameters
  TreeMethod = "hist",
  Trees = list("classifier" = 50, "regression" = 50),
  eta = list("classifier" = 0.05, "regression" = 0.05),
  max_depth = list("classifier" = 4L, "regression" = 4L),

```

```

    min_child_weight = list("classifier" = 1.0, "regression" = 1.0),
    subsample = list("classifier" = 0.55, "regression" = 0.55),
    colsample_bytree = list("classifier" = 0.55, "regression" = 0.55))), error = function(x) NULL)

# Outcome
if(!is.null(TestModel)) XGBoost_QA[run, Success := "Success"]
data.table::fwrite(XGBoost_QA, file = "C:/Users/Bizon/Documents/GitHub/QA_Code/QA_CSV/AutoXGBoostHurdleModelScoring.csv")

# Remove Target Variable
TTrainData[, c("Target_Buckets", "Adrian") := NULL]

# Score XGBoost Hurdle Model
Output <- tryCatch({RemixAutoML::AutoXGBoostHurdleModelScoring(
  TestData = TTrainData,
  Path = Path,
  ModelID = "ModelTest",
  Modellist = TestModel$Modellist,
  ArgsList = TestModel$ArgsList,
  Threshold = NULL}), error = function(x) NULL)

# Outcome
if(!is.null(Output)) XGBoost_QA[run, Score := "Success"]
TestModel <- NULL
Output <- NULL
TTrainData <- NULL
VValidationData <- NULL
TTestData <- NULL
gc(); Sys.sleep(5)
data.table::fwrite(XGBoost_QA, file = file.path(Path, "AutoXGBoostHurdleModel_QA.csv"))
}

## End(Not run)

```

---

AutoXGBoostHurdleModelScoring

*AutoXGBoostHurdleModelScoring*


---

## Description

AutoXGBoostHurdleModelScoring can score AutoXGBoostHurdleModel() models

## Usage

```

AutoXGBoostHurdleModelScoring(
  TestData = NULL,
  Path = NULL,
  ModelID = NULL,
  ArgsList = NULL,
  Modellist = NULL,
  Threshold = NULL,
  CARMA = FALSE
)

```

**Arguments**

TestData	scoring data.table
Path	Supply if ArgsList is NULL or ModelList is null.
ModelID	Supply if ArgsList is NULL or ModelList is null. Same as used in model training.
ArgsList	Output from the hurdle model
ModelList	Output from the hurdle model
Threshold	NULL to use raw probabilities to predict. Otherwise, supply a threshold
CARMA	Keep FALSE. Used for CARMA functions internals

**Value**

A data.table with the final predicted value, the intermediate model predictions, and your source data

**Author(s)**

Adrian Antico

**See Also**

Other Automated Model Hurdle Modeling: [AutoCatBoostHurdleModelScoring\(\)](#), [AutoLightGBMHurdleModelScoring\(\)](#)

**Examples**

```
## Not run:

# Define file path
Path <- getwd()

# Create hurdle data with correlated features
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.70,
  N = 25000,
  ID = 3,
  FactorCount = 2L,
  AddDate = TRUE,
  ZIP = 1,
  Classification = FALSE,
  MultiClass = FALSE)

# Define features
Features <- names(data)[!names(data) %in%
  c("Adrian", "IDcol_1", "IDcol_2", "IDcol_3", "DateTime")]

Output <- RemixAutoML::AutoXGBoostHurdleModel(

  # Operationalization args
  TrainOnFull = FALSE,
  PassInGrid = NULL,

  # Metadata args
  NThreads = max(1L, parallel::detectCores()-2L),
  ModelID = "ModelTest",
```

```

Paths = Path,
MetaDataPaths = NULL,

# data args
data,
ValidationData = NULL,
TestData = NULL,
Buckets = 0L,
TargetColumnName = NULL,
FeatureColNames = NULL,
PrimaryDateColumn = NULL,
WeightsColumnName = NULL,
IDcols = NULL,
ClassWeights = c(1,1),
DebugMode = FALSE,

# options
EncodingMethod = "credibility",
TransformNumericColumns = NULL,
Methods = c('Asinh', 'Asin', 'Log', 'LogPlus1', 'Sqrt', 'Logit'),
SplitRatios = c(0.70, 0.20, 0.10),
ReturnModelObjects = TRUE,
SaveModelObjects = FALSE,
NumOfParDepPlots = 10L,

# grid tuning args
GridTune = FALSE,
grid_eval_metric = "accuracy",
MaxModelsInGrid = 1L,
BaselineComparison = "default",
MaxRunsWithoutNewWinner = 10L,
MaxRunMinutes = 60L,

# XGBoost parameters
TreeMethod = "hist",
Trees = list("classifier" = 1000, "regression" = 1000),
eta = list("classifier" = 0.05, "regression" = 0.05),
max_depth = list("classifier" = 4L, "regression" = 4L),
min_child_weight = list("classifier" = 1.0, "regression" = 1.0),
subsample = list("classifier" = 0.55, "regression" = 0.55),
colsample_bytree = list("classifier" = 0.55, "regression" = 0.55))

# Score XGBoost Hurdle Model
HurdleScores <- RemixAutoML::AutoXGBoostHurdleModelScoring(
  TestData = data,
  Path = Path,
  ModelID = "ModelTest",
  ModelList = NULL,
  ArgsList = NULL,
  Threshold = NULL)

## End(Not run)

```

## Description

AutoXGBoostMultiClass is an automated XGBoost modeling framework with grid-tuning and model evaluation that runs a variety of steps. First, a stratified sampling (by the target variable) is done to create train and validation sets. Then, the function will run a random grid tune over N number of models and find which model is the best (a default model is always included in that set). Once the model is identified and built, several other outputs are generated: validation data with predictions, evaluation metrics, variable importance, and column names used in model fitting.

## Usage

```
AutoXGBoostMultiClass(
  OutputSelection = c("Importances", "EvalPlots", "EvalMetrics", "Score_TrainData"),
  data = NULL,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = NULL,
  FeatureColNames = NULL,
  WeightsColumnName = NULL,
  IDcols = NULL,
  model_path = NULL,
  metadata_path = NULL,
  ModelID = "FirstModel",
  LossFunction = "multi:softprob",
  EncodingMethod = "credibility",
  ReturnFactorLevels = TRUE,
  ReturnModelObjects = TRUE,
  SaveModelObjects = FALSE,
  Verbose = 0L,
  DebugMode = FALSE,
  NumOfParDepPlots = 3L,
  NThreads = parallel::detectCores(),
  eval_metric = "merror",
  grid_eval_metric = "accuracy",
  TreeMethod = "hist",
  GridTune = FALSE,
  BaselineComparison = "default",
  MaxModelsInGrid = 10L,
  MaxRunsWithoutNewWinner = 20L,
  MaxRunMinutes = 24L * 60L,
  PassInGrid = NULL,
  Trees = 50L,
  eta = NULL,
  max_depth = NULL,
  min_child_weight = NULL,
  subsample = NULL,
  colsample_bytree = NULL
)
```

**Arguments**

OutputSelection	You can select what type of output you want returned. Choose from c("Importances", "EvalPlots", "EvalMetrics", "PDFs", "Score_TrainData")
data	This is your data set for training and testing your model
TrainOnFull	Set to TRUE to train on full data
ValidationData	This is your holdout data set used in modeling either refine your hyperparameters.
TestData	This is your holdout data set. Catboost using both training and validation data in the training process so you should evaluate out of sample performance with this data set.
TargetColumnName	Either supply the target column name OR the column number where the target is located (but not mixed types). Note that the target column needs to be a 0   1 numeric variable.
FeatureColNames	Either supply the feature column names OR the column number where the target is located (but not mixed types)
WeightsColumnName	Supply a column name for your weights column. Leave NULL otherwise
IDcols	A vector of column names or column numbers to keep in your data but not include in the modeling.
model_path	A character string of your path file to where you want your output saved
metadata_path	A character string of your path file to where you want your model evaluation output saved. If left NULL, all output will be saved to model_path.
ModelID	A character string to name your model and output
LossFunction	Use 'multi:softmax', I set it up to return the class label and the individual probabilities, just like catboost. Doesn't come like that off the shelf
EncodingMethod	Choose from 'binary', 'm_estimator', 'credibility', 'woe', 'target_encoding', 'poly_encode', 'backward_difference', 'helmert'
ReturnFactorLevels	TRUE or FALSE. Set to FALSE to not return factor levels.
ReturnModelObjects	Set to TRUE to output all modeling objects (E.g. plots and evaluation metrics)
SaveModelObjects	Set to TRUE to return all modeling objects to your environment
Verbose	Set to 0 if you want to suppress model evaluation updates in training
DebugMode	Set to TRUE to get a print out of the steps taken internally
NumOfParDepPlots	Tell the function the number of partial dependence calibration plots you want to create.
NThreads	Set the maximum number of threads you'd like to dedicate to the model run. E.g. 8
eval_metric	This is the metric used to identify best grid tuned model. Choose from "logloss", "error", "aucpr", "auc"
grid_eval_metric	"accuracy", "logloss", "microauc"



TreeMethod	Choose from "hist", "gpu_hist"
GridTune	Set to TRUE to run a grid tuning procedure
BaselineComparison	Set to either "default" or "best". Default is to compare each successive model build to the baseline model using max trees (from function args). Best makes the comparison to the current best model.
MaxModelsInGrid	Number of models to test from grid options.
MaxRunsWithoutNewWinner	A number
MaxRunMinutes	In minutes
PassInGrid	Default is NULL. Provide a data.table of grid options from a previous run.
Trees	Bandit grid partitioned. Supply a single value for non-grid tuning cases. Otherwise, supply a vector for the trees numbers you want to test. For running grid tuning, a NULL value supplied will mean these values are tested seq(1000L, 10000L, 1000L)
eta	Bandit grid partitioned. Supply a single value for non-grid tuning cases. Otherwise, supply a vector for the LearningRate values to test. For running grid tuning, a NULL value supplied will mean these values are tested c(0.01,0.02,0.03,0.04)
max_depth	Bandit grid partitioned. Number, or vector for depth to test. For running grid tuning, a NULL value supplied will mean these values are tested seq(4L, 16L, 2L)
min_child_weight	Number, or vector for min_child_weight to test. For running grid tuning, a NULL value supplied will mean these values are tested seq(1.0, 10.0, 1.0)
subsample	Number, or vector for subsample to test. For running grid tuning, a NULL value supplied will mean these values are tested seq(0.55, 1.0, 0.05)
colsample_bytree	Number, or vector for colsample_bytree to test. For running grid tuning, a NULL value supplied will mean these values are tested seq(0.55, 1.0, 0.05)

**Value**

Saves to file and returned in list: VariableImportance.csv, Model, ValidationData.csv, Evaluation-Metrics.csv, GridCollect, GridList, and TargetLevels

**Author(s)**

Adrian Antico

**See Also**

Other Automated Supervised Learning - Multiclass Classification: [AutoCatBoostMultiClass\(\)](#), [AutoH2oDRFMultiClass\(\)](#), [AutoH2oGAMMultiClass\(\)](#), [AutoH2oGBMMultiClass\(\)](#), [AutoH2oGLMMultiClass\(\)](#), [AutoH2oMLMultiClass\(\)](#)

**Examples**

```

## Not run:
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 1000L,
  ID = 2L,
  ZIP = 0L,
  AddDate = FALSE,
  Classification = FALSE,
  MultiClass = TRUE)

# Run function
TestModel <- RemixAutoML::AutoXGBoostMultiClass(

  # GPU or CPU
  TreeMethod = "hist",
  NThreads = parallel::detectCores(),

  # Metadata args
  OutputSelection = c("Importances", "EvalPlots", "EvalMetrics", "PDFs", "Score_TrainData"),
  model_path = normalizePath("./"),
  metadata_path = normalizePath("./"),
  ModelID = "Test_Model_1",
  EncodingMethod = "binary",
  ReturnFactorLevels = TRUE,
  ReturnModelObjects = TRUE,
  SaveModelObjects = FALSE,

  # Data args
  data = data,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = "Adrian",
  FeatureColNames = names(data)[!names(data) %in%
    c("IDcol_1", "IDcol_2", "Adrian")],
  WeightsColumnName = NULL,
  IDcols = c("IDcol_1", "IDcol_2"),

  # Model evaluation args
  eval_metric = "merror",
  LossFunction = 'multi:softprob',
  grid_eval_metric = "accuracy",
  NumOfParDepPlots = 3L,

  # Grid tuning args
  PassInGrid = NULL,
  GridTune = FALSE,
  BaselineComparison = "default",
  MaxModelsInGrid = 10L,
  MaxRunsWithoutNewWinner = 20L,
  MaxRunMinutes = 24L*60L,
  Verbose = 1L,
  DebugMode = FALSE,

  # ML args

```

```

Trees = 50L,
eta = 0.05,
max_depth = 4L,
min_child_weight = 1.0,
subsample = 0.55,
colsample_bytree = 0.55)

## End(Not run)

```

---

AutoXGBoostRegression *AutoXGBoostRegression*

---

## Description

AutoXGBoostRegression is an automated XGBoost modeling framework with grid-tuning and model evaluation that runs a variety of steps. First, the function will run a random grid tune over N number of models and find which model is the best (a default model is always included in that set). Once the model is identified and built, several other outputs are generated: validation data with predictions, evaluation plot, evaluation boxplot, evaluation metrics, variable importance, partial dependence calibration plots, partial dependence calibration box plots, and column names used in model fitting.

## Usage

```

AutoXGBoostRegression(
  OutputSelection = c("Importances", "EvalPlots", "EvalMetrics", "Score_TrainData"),
  data = NULL,
  TrainOnFull = FALSE,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = NULL,
  FeatureColNames = NULL,
  PrimaryDateColumn = NULL,
  WeightsColumnName = NULL,
  IDcols = NULL,
  model_path = NULL,
  metadata_path = NULL,
  DebugMode = FALSE,
  SaveInfoToPDF = FALSE,
  ModelID = "FirstModel",
  EncodingMethod = "credibility",
  ReturnFactorLevels = TRUE,
  ReturnModelObjects = TRUE,
  SaveModelObjects = FALSE,
  TransformNumericColumns = NULL,
  Methods = c("Asinh", "Log", "LogPlus1", "Sqrt", "Asin", "Logit"),
  Verbose = 0L,
  NumOfParDepPlots = 3L,
  NThreads = parallel::detectCores(),
  LossFunction = "reg:squarederror",
  eval_metric = "rmse",
  grid_eval_metric = "r2",

```

```

    TreeMethod = "hist",
    GridTune = FALSE,
    BaselineComparison = "default",
    MaxModelsInGrid = 10L,
    MaxRunsWithoutNewWinner = 20L,
    MaxRunMinutes = 24L * 60L,
    PassInGrid = NULL,
    Trees = 50L,
    eta = NULL,
    max_depth = NULL,
    min_child_weight = NULL,
    subsample = NULL,
    colsample_bytree = NULL
  )

```

### Arguments

OutputSelection	You can select what type of output you want returned. Choose from c("Importances", "EvalPlots", "EvalMetrics", "PDFs", "Score_TrainData")
data	This is your data set for training and testing your model
TrainOnFull	Set to TRUE to train on full data
ValidationData	This is your holdout data set used in modeling either refine your hyperparameters.
TestData	This is your holdout data set. Catboost using both training and validation data in the training process so you should evaluate out of sample performance with this data set.
TargetColumnName	Either supply the target column name OR the column number where the target is located (but not mixed types).
FeatureColNames	Either supply the feature column names OR the column number where the target is located (but not mixed types)
PrimaryDateColumn	Supply a date or datetime column for model evaluation plots
WeightsColumnName	Supply a column name for your weights column. Leave NULL otherwise
IDcols	A vector of column names or column numbers to keep in your data but not include in the modeling.
model_path	A character string of your path file to where you want your output saved
metadata_path	A character string of your path file to where you want your model evaluation output saved. If left NULL, all output will be saved to model_path.
DebugMode	Set to TRUE to get a print out of the steps taken throughout the function
SaveInfoToPDF	Set to TRUE to save model insights to pdf
ModelID	A character string to name your model and output
EncodingMethod	Choose from 'binary', 'm_estimator', 'credibility', 'woe', 'target_encoding', 'poly_encode', 'backward_difference', 'helmert'
ReturnFactorLevels	Set to TRUE to have the factor levels returned with the other model objects

ReturnModelObjects	Set to TRUE to output all modeling objects (E.g. plots and evaluation metrics)
SaveModelObjects	Set to TRUE to return all modeling objects to your environment
TransformNumericColumns	Set to NULL to do nothing; otherwise supply the column names of numeric variables you want transformed
Methods	Choose from "BoxCox", "Asinh", "Asin", "Log", "LogPlus1", "Sqrt", "Logit", "YeoJohnson". Function will determine if one cannot be used because of the underlying data.
Verbose	Set to 0 if you want to suppress model evaluation updates in training
NumOfParDepPlots	Tell the function the number of partial dependence calibration plots you want to create.
NThreads	Set the maximum number of threads you'd like to dedicate to the model run. E.g. 8
LossFunction	Default is 'reg:squarederror'. Other options include 'reg:squaredlogerror', 'reg:pseudohubererror', 'count:poisson', 'survival:cox', 'survival:aft', 'aft_loss_distribution', 'reg:gamma', 'reg:tweedie'
eval_metric	This is the metric used to identify best grid tuned model. Choose from "r2", "RMSE", "MSE", "MAE"
grid_eval_metric	"mae", "mape", "rmse", "r2". Case sensitive
TreeMethod	Choose from "hist", "gpu_hist"
GridTune	Set to TRUE to run a grid tuning procedure. Set a number in MaxModelsInGrid to tell the procedure how many models you want to test.
BaselineComparison	Set to either "default" or "best". Default is to compare each successive model build to the baseline model using max trees (from function args). Best makes the comparison to the current best model.
MaxModelsInGrid	Number of models to test from grid options (243 total possible options)
MaxRunsWithoutNewWinner	Runs without new winner to end procedure
MaxRunMinutes	In minutes
PassInGrid	Default is NULL. Provide a data.table of grid options from a previous run.
Trees	Bandit grid partitioned. Supply a single value for non-grid tuning cases. Otherwise, supply a vector for the trees numbers you want to test. For running grid tuning, a NULL value supplied will mean these values are tested seq(1000L, 10000L, 1000L)
eta	Bandit grid partitioned. Supply a single value for non-grid tuning cases. Otherwise, supply a vector for the LearningRate values to test. For running grid tuning, a NULL value supplied will mean these values are tested c(0.01,0.02,0.03,0.04)
max_depth	Bandit grid partitioned. Number, or vector for depth to test. For running grid tuning, a NULL value supplied will mean these values are tested seq(4L, 16L, 2L)

**min\_child\_weight**      Number, or vector for min\_child\_weight to test. For running grid tuning, a NULL value supplied will mean these values are tested seq(1.0, 10.0, 1.0)

**subsample**              Number, or vector for subsample to test. For running grid tuning, a NULL value supplied will mean these values are tested seq(0.55, 1.0, 0.05)

**colsample\_bytree**        Number, or vector for colsample\_bytree to test. For running grid tuning, a NULL value supplied will mean these values are tested seq(0.55, 1.0, 0.05)

### Value

Saves to file and returned in list: VariableImportance.csv, Model, ValidationData.csv, Evaluation-Plot.png, EvaluationBoxPlot.png, EvaluationMetrics.csv, ParDepPlots.R a named list of features with partial dependence calibration plots, ParDepBoxPlots.R, GridCollect, and GridList

### Author(s)

Adrian Antico

### See Also

Other Automated Supervised Learning - Regression: [AutoCatBoostRegression\(\)](#), [AutoH2oDRFRegression\(\)](#), [AutoH2oGAMRegression\(\)](#), [AutoH2oGBMRegression\(\)](#), [AutoH2oGLMRegression\(\)](#), [AutoH2oMLRegression\(\)](#), [AutoLightGBMRegression\(\)](#), [AutoNLS\(\)](#)

### Examples

```
## Not run:
# Create some dummy correlated data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 1000,
  ID = 2,
  ZIP = 0,
  AddDate = FALSE,
  Classification = FALSE,
  MultiClass = FALSE)

# Run function
TestModel <- RemixAutoML::AutoXGBoostRegression(

  # GPU or CPU
  TreeMethod = 'hist',
  NThreads = parallel::detectCores(),
  LossFunction = 'reg:squarederror',

  # Metadata args
  OutputSelection = c('Importances', 'EvalPlots', 'EvalMetrics', 'Score_TrainData'),
  model_path = normalizePath("./"),
  metadata_path = NULL,
  ModelID = "Test_Model_1",
  EncodingMethod = 'credibility',
  ReturnFactorLevels = TRUE,
  ReturnModelObjects = TRUE,
  SaveModelObjects = FALSE,
```

```

SaveInfoToPDF = FALSE,
DebugMode = FALSE,

# Data args
data = data,
TrainOnFull = FALSE,
ValidationData = NULL,
TestData = NULL,
TargetColumnName = 'Adrian',
FeatureColNames = names(data)[!names(data) %in%
  c('IDcol_1', 'IDcol_2', 'Adrian')],
PrimaryDateColumn = NULL,
WeightsColumnName = NULL,
IDcols = c('IDcol_1', 'IDcol_2'),
TransformNumericColumns = NULL,
Methods = c('Asinh', 'Asin', 'Log', 'LogPlus1', 'Sqrt', 'Logit'),

# Model evaluation args
eval_metric = 'rmse',
NumOfParDepPlots = 3L,

# Grid tuning args
PassInGrid = NULL,
GridTune = FALSE,
grid_eval_metric = 'r2',
BaselineComparison = 'default',
MaxModelsInGrid = 10L,
MaxRunsWithoutNewWinner = 20L,
MaxRunMinutes = 24L*60L,
Verbose = 1L,

# ML args
Trees = 50L,
eta = 0.05,
max_depth = 4L,
min_child_weight = 1.0,
subsample = 0.55,
colsample_bytree = 0.55)

## End(Not run)

```

---

AutoXGBoostScoring	<i>AutoXGBoostScoring</i>
--------------------	---------------------------

---

## Description

AutoXGBoostScoring is an automated scoring function that compliments the AutoXGBoost model training functions. This function requires you to supply features for scoring. It will run `ModelDataPrep()` and the `DummifyDT()` function to prepare your features for xgboost data conversion and scoring.

## Usage

```
AutoXGBoostScoring(
```

```

    TargetType = NULL,
    ScoringData = NULL,
    ReturnShapValues = FALSE,
    FeatureColumnNames = NULL,
    IDcols = NULL,
    EncodingMethod = "binary",
    FactorLevelsList = NULL,
    TargetLevels = NULL,
    OneHot = FALSE,
    ModelObject = NULL,
    ModelPath = NULL,
    ModelID = NULL,
    ReturnFeatures = TRUE,
    TransformNumeric = FALSE,
    BackTransNumeric = FALSE,
    TargetColumnName = NULL,
    TransformationObject = NULL,
    TransID = NULL,
    TransPath = NULL,
    MDP_Impute = TRUE,
    MDP_CharToFactor = TRUE,
    MDP_RemoveDates = TRUE,
    MDP_MissFactor = "0",
    MDP_MissNum = -1
  )

```

### Arguments

TargetType	Set this value to "regression", "classification", or "multiclass" to score models built using AutoXGBoostRegression(), AutoXGBoostClassify() or AutoXGBoostMultiClass()
ScoringData	This is your data.table of features for scoring. Can be a single row or batch.
ReturnShapValues	Set to TRUE to return shap values for the predicted values
FeatureColumnNames	Supply either column names or column numbers used in the AutoXGBoost__() function
IDcols	Supply ID column numbers for any metadata you want returned with your predicted values
EncodingMethod	Choose from 'binary', 'm_estimator', 'credibility', 'woe', 'target_encoding', 'poly_encode', 'backward_difference', 'helmert'
FactorLevelsList	Supply the factor variables' list from DummifyDT()
TargetLevels	Supply the target levels output from AutoXGBoostMultiClass() or the scoring function will go looking for it in the file path you supply.
ModelObject	Supply a model for scoring, otherwise it will have to search for it in the file path you specify
ModelPath	Supply your path file used in the AutoXGBoost__() function
ModelID	Supply the model ID used in the AutoXGBoost__() function
ReturnFeatures	Set to TRUE to return your features with the predicted values.



TransformNumeric	Set to TRUE if you have features that were transformed automatically from an Auto__Regression() model AND you haven't already transformed them.
BackTransNumeric	Set to TRUE to generate back-transformed predicted values. Also, if you return features, those will also be back-transformed.
TargetColumnName	Input your target column name used in training if you are utilizing the transformation service
TransformationObject	Set to NULL if you didn't use transformations or if you want the function to pull from the file output from the Auto__Regression() function. You can also supply the transformation data.table object with the transformation details versus having it pulled from file.
TransID	Set to the ID used for saving the transformation data.table object or set it to the ModelID if you are pulling from file from a build with Auto__Regression().
TransPath	Set the path file to the folder where your transformation data.table detail object is stored. If you used the Auto__Regression() to build, set it to the same path as ModelPath.
MDP_Impute	Set to TRUE if you did so for modeling and didn't do so before supplying ScoringData in this function
MDP_CharToFactor	Set to TRUE to turn your character columns to factors if you didn't do so to your ScoringData that you are supplying to this function
MDP_RemoveDates	Set to TRUE if you have date of timestamp columns in your ScoringData
MDP_MissFactor	If you set MDP_Impute to TRUE, supply the character values to replace missing values with
MDP_MissNum	If you set MDP_Impute to TRUE, supply a numeric value to replace missing values with

**Value**

A data.table of predicted values with the option to return model features as well.

**Author(s)**

Adrian Antico

**See Also**

Other Automated Model Scoring: [AutoCatBoostScoring\(\)](#), [AutoH2OMLScoring\(\)](#), [AutoLightGBMScoring\(\)](#)

**Examples**

```
## Not run:
Preds <- AutoXGBoostScoring(
  TargetType = "regression",
  ScoringData = data,
  ReturnShapValues = FALSE,
  FeatureColumnNames = 2:12,
  IDcols = NULL,
```

```

EncodingMethod = "binary",
FactorLevelsList = NULL,
TargetLevels = NULL,
ModelObject = NULL,
ModelPath = "home",
ModelID = "ModelTest",
ReturnFeatures = TRUE,
TransformNumeric = FALSE,
BackTransNumeric = FALSE,
TargetColumnName = NULL,
TransformationObject = NULL,
TransID = NULL,
TransPath = NULL,
MDP_Impute = TRUE,
MDP_CharToFactor = TRUE,
MDP_RemoveDates = TRUE,
MDP_MissFactor = "0",
MDP_MissNum = -1)

## End(Not run)

```

---

Bisection

*Bisection*


---

## Description

Finds roots for a given interval of values for a given function using bisection method

Algorithms

## Usage

```
Bisection(f = function(x) x^2 - 4 * x + 3, a = 0, b = 2)
```

## Arguments

f	mathematical function
a	lower bound numeric value
b	upper bound numeric value

## Author(s)

Adrian Antico

## Examples

```

## Not run:
RemixAutoML::Bisection(f = function(x) x ^ 2 - 4 * x + 3, a = 0, b = 2)
# 1

## End(Not run)

```

---

BlankRow	<i>BlankRow</i>
----------	-----------------

---

**Description**

BlankRow add blank row with width w

**Usage**

```
BlankRow(W)
```

**Arguments**

W                      width of column

**Value**

Adds a row to your UI of width W

**Author(s)**

Adrian Antico

**See Also**

Other Shiny: [ArgNullCheck2\(\)](#), [ArgNullCheck\(\)](#), [DateInput\(\)](#), [GenerateEvaluationMetrics\(\)](#), [NumericInput\(\)](#), [PickerInput\\_GetLevels\(\)](#), [PickerInput\(\)](#), [PreparePlotData\(\)](#), [ReactiveLoadCSV\(\)](#), [ReturnParam\(\)](#), [StoreArgs\(\)](#), [TextInput\(\)](#), [observeEventLoad\(\)](#)

**Examples**

```
## Not run:  
RemixAutoML::BlankRow(12)  
  
## End(Not run)
```

---

CategoricalEncoding	<i>CategoricalEncoding</i>
---------------------	----------------------------

---

**Description**

Categorical encoding for factor and character columns

**Usage**

```
CategoricalEncoding(
  data = NULL,
  ML_Type = "classification",
  GroupVariables = NULL,
  TargetVariable = NULL,
  Method = NULL,
  SavePath = NULL,
  Scoring = FALSE,
  ImputeValueScoring = NULL,
  ReturnFactorLevelList = TRUE,
  SupplyFactorLevelList = NULL,
  KeepOriginalFactors = TRUE
)
```

**Arguments**

<code>data</code>	Source data.table
<code>ML_Type</code>	Only use with Method "credibility". Select from 'classification' or 'regression'.
<code>GroupVariables</code>	Columns to encode
<code>Method</code>	Method to utilize. Choose from 'm_estimator', 'credibility', 'woe', 'target_encoding', 'poly_encode', 'backward_difference', 'helmert'
<code>SavePath</code>	Path to save artifacts for recreating in scoring environments
<code>Scoring</code>	Set to TRUE for scoring mode.
<code>ImputeValueScoring</code>	If levels cannot be matched on scoring data you can supply a value to impute the NA's. Otherwise, leave NULL and manage them outside the function
<code>ReturnFactorLevelList</code>	TRUE by default. Returns a list of the factor variable and transformations needed for regenerating them in a scoring environment. Alternatively, if you save them to file, they can be called for use in a scoring environment.
<code>SupplyFactorLevelList</code>	The FactorComponents list that gets returned. Supply this to recreate features in scoring environment
<code>KeepOriginalFactors</code>	Defaults to TRUE. Set to FALSE to remove the original factor columns
<code>TargetVariable</code>	Target column name

**Author(s)**

Adrian Antico

**See Also**

Other Feature Engineering: [AutoDataPartition\(\)](#), [AutoDiffLagN\(\)](#), [AutoHierarchicalFourier\(\)](#), [AutoInteraction\(\)](#), [AutoLagRollMode\(\)](#), [AutoLagRollStatsScoring\(\)](#), [AutoLagRollStats\(\)](#), [AutoTransformationCreate\(\)](#), [AutoTransformationScore\(\)](#), [AutoWord2VecModeler\(\)](#), [AutoWord2VecScoring\(\)](#), [CreateCalendarVariables\(\)](#), [CreateHolidayVariables\(\)](#), [DummifyDT\(\)](#), [H2OAutoencoderScoring\(\)](#), [H2OAutoencoder\(\)](#), [ModelDataPrep\(\)](#), [TimeSeriesFill\(\)](#)

**Examples**

```

## Not run:
# Create fake data with 10 categorical
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 1000000,
  ID = 2L,
  ZIP = 0,
  FactorCount = 10L,
  AddDate = FALSE,
  Classification = TRUE,
  MultiClass = FALSE)

# Take your pick
Meth <- c('m_estimator',
          'credibility',
          'woe',
          'target_encoding',
          'poly_encode',
          'backward_difference',
          'helmert')

# Pass to function
MethNum <- 1

# Mock test data with same factor levels
test <- data.table::copy(data)

# Run in Train Mode
data <- RemixAutoML::CategoricalEncoding(
  data = data,
  ML_Type = "classification",
  GroupVariables = paste0("Factor_", 1:10),
  TargetVariable = "Adrian",
  Method = Meth[MethNum],
  SavePath = getwd(),
  Scoring = FALSE,
  ReturnFactorLevelList = FALSE,
  SupplyFactorLevelList = NULL,
  KeepOriginalFactors = FALSE)

# View results
print(data)

# Run in Score Mode by pulling in the csv's
test <- RemixAutoML::CategoricalEncoding(
  data = data,
  ML_Type = "classification",
  GroupVariables = paste0("Factor_", 1:10),
  TargetVariable = "Adrian",
  Method = Meth[MethNum],
  SavePath = getwd(),
  Scoring = TRUE,
  ImputeValueScoring = 222,
  ReturnFactorLevelList = FALSE,
  SupplyFactorLevelList = NULL,

```

```
KeepOriginalFactors = FALSE)

## End(Not run)
```

---

CharNull	<i>CharNull</i>
----------	-----------------

---

**Description**

CharNull

**Usage**

```
CharNull(x)
```

**Arguments**

x	Value
---	-------

---

ChartTheme	<i>ChartTheme</i>
------------	-------------------

---

**Description**

This function helps your ggplots look professional with the choice of the two main colors that will dominate the theme

**Usage**

```
ChartTheme(
  Size = 12,
  AngleX = 35,
  AngleY = 0,
  ChartColor = "lightsteelblue1",
  BorderColor = "darkblue",
  TextColor = "darkblue",
  GridColor = "white",
  BackGroundColor = "gray95",
  LegendPosition = "bottom"
)
```

**Arguments**

Size	The size of the axis labels and title
AngleX	The angle of the x axis labels
AngleY	The angle of the Y axis labels
ChartColor	"lightsteelblue1",
BorderColor	"darkblue",

```

    TextColor      "darkblue",
    GridColor      "white",
    BackGroundColor
                    "gray95",
    LegendPosition Where to place legend

```

**Value**

An object to pass along to ggplot objects following the "+" sign

**Author(s)**

Adrian Antico

**See Also**

Other Graphics: [multiplot\(\)](#)

**Examples**

```

## Not run:
data <- data.table::data.table(DateTime = as.Date(Sys.time()),
  Target = stats::filter(rnorm(1000,
                                mean = 50,
                                sd = 20),
    filter=rep(1,10),
    circular=TRUE))
data[, temp := seq(1:1000)][, DateTime := DateTime - temp][
  , temp := NULL]
data <- data[order(DateTime)]
p <- ggplot2::ggplot(data, ggplot2::aes(x = DateTime, y = Target)) +
  ggplot2::geom_line()
p <- p + ChartTheme(Size = 12)

## End(Not run)

```

---

CreateCalendarVariables

*CreateCalendarVariables*

---

**Description**

CreateCalendarVariables Rapidly creates calendar variables based on the date column you provide

**Usage**

```

CreateCalendarVariables(
  data,
  DateCols = NULL,
  AsFactor = FALSE,
  TimeUnits = "wday"
)

```

**Arguments**

<code>data</code>	This is your data
<code>DateCols</code>	Supply either column names or column numbers of your date columns you want to use for creating calendar variables
<code>AsFactor</code>	Set to TRUE if you want factor type columns returned; otherwise integer type columns will be returned
<code>TimeUnits</code>	Supply a character vector of time units for creating calendar variables. Options include: "second", "minute", "hour", "wday", "mday", "yday", "week", "isoweek", "wom" (week of month), "month", "quarter", "year"

**Value**

Returns your `data.table` with the added calendar variables at the end

**Author(s)**

Adrian Antico

**See Also**

Other Feature Engineering: [AutoDataPartition\(\)](#), [AutoDiffLagN\(\)](#), [AutoHierarchicalFourier\(\)](#), [AutoInteraction\(\)](#), [AutoLagRollMode\(\)](#), [AutoLagRollStatsScoring\(\)](#), [AutoLagRollStats\(\)](#), [AutoTransformationCreate\(\)](#), [AutoTransformationScore\(\)](#), [AutoWord2VecModeler\(\)](#), [AutoWord2VecScoring\(\)](#), [CategoricalEncoding\(\)](#), [CreateHolidayVariables\(\)](#), [DummifyDT\(\)](#), [H2OAutoencoderScoring\(\)](#), [H2OAutoencoder\(\)](#), [ModelDataPrep\(\)](#), [TimeSeriesFill\(\)](#)

**Examples**

```
## Not run:
# Create fake data with a Date column----
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.75,
  N = 25000L,
  ID = 2L,
  ZIP = 0L,
  FactorCount = 4L,
  AddDate = TRUE,
  Classification = FALSE,
  MultiClass = FALSE)
for(i in seq_len(20L)) {
  print(i)
  data <- data.table::rbindlist(
    list(data, RemixAutoML::FakeDataGenerator(
      Correlation = 0.75,
      N = 25000L,
      ID = 2L,
      ZIP = 0L,
      FactorCount = 4L,
      AddDate = TRUE,
      Classification = FALSE,
      MultiClass = FALSE)))
}

# Create calendar variables - automatically excludes
```



```

# the second, minute, and hour selections since
# it is not timestamp data
runtime <- system.time(
  data <- RemixAutoML::CreateCalendarVariables(
    data = data,
    DateCols = "DateTime",
    AsFactor = FALSE,
    TimeUnits = c("second",
                  "minute",
                  "hour",
                  "wday",
                  "mday",
                  "yday",
                  "week",
                  "isoweek",
                  "wom",
                  "month",
                  "quarter",
                  "year")))

head(data)
print(runtime)

## End(Not run)

```

---

CreateHolidayVariables

*CreateHolidayVariables*


---

## Description

CreateHolidayVariables Rapidly creates holiday count variables based on the date columns you provide

## Usage

```

CreateHolidayVariables(
  data,
  DateCols = NULL,
  LookbackDays = NULL,
  HolidayGroups = c("USPublicHolidays", "EasterGroup", "ChristmasGroup",
                    "OtherEcclesticalFeasts"),
  Holidays = NULL,
  Print = FALSE
)

```

## Arguments

data	This is your data
DateCols	Supply either column names or column numbers of your date columns you want to use for creating calendar variables
LookbackDays	Default NULL which investigates Date - Lag1Date to compute Holiday's per period. Otherwise it will lookback LookbackDays.

HolidayGroups	Pick groups
Holidays	Pick holidays
Print	Set to TRUE to print iteration number to console

**Value**

Returns your data.table with the added holiday indicator variable

**Author(s)**

Adrian Antico

**See Also**

Other Feature Engineering: [AutoDataPartition\(\)](#), [AutoDiffLagN\(\)](#), [AutoHierarchicalFourier\(\)](#), [AutoInteraction\(\)](#), [AutoLagRollMode\(\)](#), [AutoLagRollStatsScoring\(\)](#), [AutoLagRollStats\(\)](#), [AutoTransformationCreate\(\)](#), [AutoTransformationScore\(\)](#), [AutoWord2VecModeler\(\)](#), [AutoWord2VecScoring\(\)](#), [CategoricalEncoding\(\)](#), [CreateCalendarVariables\(\)](#), [DummifyDT\(\)](#), [H2OAutoencoderScoring\(\)](#), [H2OAutoencoder\(\)](#), [ModelDataPrep\(\)](#), [TimeSeriesFill\(\)](#)

**Examples**

```
## Not run:
# Create fake data with a Date----
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.75,
  N = 25000L,
  ID = 2L,
  ZIP = 0L,
  FactorCount = 4L,
  AddDate = TRUE,
  Classification = FALSE,
  MultiClass = FALSE)
for(i in seq_len(20L)) {
  print(i)
  data <- data.table::rbindlist(list(data,
  RemixAutoML::FakeDataGenerator(
    Correlation = 0.75,
    N = 25000L,
    ID = 2L,
    ZIP = 0L,
    FactorCount = 4L,
    AddDate = TRUE,
    Classification = FALSE,
    MultiClass = FALSE)))
}
# Run function and time it
runtime <- system.time(
  data <- CreateHolidayVariables(
    data,
    DateCols = "DateTime",
    LookbackDays = NULL,
    HolidayGroups = c("USPublicHolidays", "EasterGroup",
      "ChristmasGroup", "OtherEcclesticalFeasts"),
    Holidays = NULL,
    Print = FALSE))
```

```
head(data)
print(runtime)

## End(Not run)
```

---

CumGainsChart	<i>CumGainsChart</i>
---------------	----------------------

---

**Description**

Create a cumulative gains chart

**Usage**

```
CumGainsChart(
  data = NULL,
  PredictedColumnName = "p1",
  TargetColumnName = NULL,
  NumBins = 20,
  SavePlot = FALSE,
  Name = NULL,
  metapath = NULL,
  modelpath = NULL
)
```

**Arguments**

data	Test data with predictions. data.table
PredictedColumnName	Name of column that is the model score
TargetColumnName	Name of your target variable column
NumBins	Number of percentile bins to plot
SavePlot	FALSE by default
Name	File name for saving
metapath	Path to directory
modelpath	Path to directory

**Author(s)**

Adrian Antico

**See Also**

Other Model Evaluation and Interpretation: [AutoShapeShap\(\)](#), [EvalPlot\(\)](#), [ParDepCalPlots\(\)](#), [ROCPlot\(\)](#), [RedYellowGreen\(\)](#), [ResidualPlots\(\)](#), [SingleRowShapeShap\(\)](#), [threshOptim\(\)](#)

---

DateInput	<i>DateInput</i>
-----------	------------------

---

## Description

DateInput automatically builds a date input with ProjectList argument usage if it exists

## Usage

```
DateInput(
  InputID = "TS_CARMA_HolidayMovingAverages",
  Label = "Import Data Creation Date",
  Value = Sys.Date(),
  Min = "1970-01-01",
  Max = "2100-01-01",
  Format = "yyyy-mm-dd"
)
```

## Arguments

InputID	Feeds ProjectList and inputId. Argument saved in ProjectList
Label	Feeds label
Value	Default
Min	Min value
Max	Max value
Format	Date format

## Value

PickerInput object for server.R to go into renderUI(PickerInput())

## Author(s)

Adrian Antico

## See Also

Other Shiny: [ArgNullCheck2\(\)](#), [ArgNullCheck\(\)](#), [BlankRow\(\)](#), [GenerateEvaluationMetrics\(\)](#), [NumericInput\(\)](#), [PickerInput\\_GetLevels\(\)](#), [PickerInput\(\)](#), [PreparePlotData\(\)](#), [ReactiveLoadCSV\(\)](#), [ReturnParam\(\)](#), [StoreArgs\(\)](#), [TextInput\(\)](#), [observeEventLoad\(\)](#)

## Examples

```
## Not run:
output$TS_Date <- renderUI({
  RemixAutoML::DateInput(InputID = "TS_CARMA_HolidayMovingAverages",
    Label = "Import Data Creation Date",
    Value = Sys.Date(),
    Min = "1970-01-01",
    Max = "2100-01-01",
    Format = "yyyy-mm-dd"))})
```

```
## End(Not run)
```

---

DummifyDT

*DummifyDT*


---

## Description

DummifyDT creates dummy variables for the selected columns. Either one-hot encoding, N+1 columns for N levels, or N columns for N levels.

## Usage

```
DummifyDT(
  data,
  cols,
  TopN = NULL,
  KeepFactorCols = FALSE,
  OneHot = FALSE,
  SaveFactorLevels = FALSE,
  SavePath = NULL,
  ImportFactorLevels = FALSE,
  FactorLevelsList = NULL,
  ClustScore = FALSE,
  ReturnFactorLevels = FALSE,
  GroupVar = FALSE
)
```

## Arguments

data	The data set to run the micro auc on
cols	A vector with the names of the columns you wish to dichotomize
TopN	Default is NULL. Scalar to apply to all categorical columns or a vector to apply to each categorical variable. Only create dummy variables for the TopN number of levels. Will be either TopN or max(levels)
KeepFactorCols	Set to TRUE to keep the original columns used in the dichotomization process
OneHot	Set to TRUE to run one hot encoding, FALSE to generate N columns for N levels
SaveFactorLevels	Set to TRUE to save unique levels of each factor column to file as a csv
SavePath	Provide a file path to save your factor levels. Use this for models that you have to create dummy variables for.
ImportFactorLevels	Instead of using the data you provide, import the factor levels csv to ensure you build out all of the columns you trained with in modeling.
FactorLevelsList	Supply a list of factor variable levels
ClustScore	This is for scoring AutoKMeans. It converts the added dummy column names to conform with H2O dummy variable naming convention

**ReturnFactorLevels**

If you want a named list of all the factor levels returned, set this to TRUE. Doing so will cause the function to return a list with the source data.table and the list of factor variables' levels

**GroupVar**

Ignore this

**Value**

Either a data table with new dummy variables columns and optionally removes base columns (if ReturnFactorLevels is FALSE), otherwise a list with the data.table and a list of the factor levels.

**Author(s)**

Adrian Antico

**See Also**

Other Feature Engineering: [AutoDataPartition\(\)](#), [AutoDiffLagN\(\)](#), [AutoHierarchicalFourier\(\)](#), [AutoInteraction\(\)](#), [AutoLagRollMode\(\)](#), [AutoLagRollStatsScoring\(\)](#), [AutoLagRollStats\(\)](#), [AutoTransformationCreate\(\)](#), [AutoTransformationScore\(\)](#), [AutoWord2VecModeler\(\)](#), [AutoWord2VecScoring\(\)](#), [CategoricalEncoding\(\)](#), [CreateCalendarVariables\(\)](#), [CreateHolidayVariables\(\)](#), [H2OAutoencoderScoring\(\)](#), [H2OAutoencoder\(\)](#), [ModelDataPrep\(\)](#), [TimeSeriesFill\(\)](#)

**Examples**

```
## Not run:
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 25000,
  ID = 2L,
  ZIP = 0,
  FactorCount = 10L,
  AddDate = FALSE,
  Classification = FALSE,
  MultiClass = FALSE)

# Create dummy variables
data <- RemixAutoML::DummifyDT(
  data = data,
  cols = c("Factor_1",
           "Factor_2",
           "Factor_3",
           "Factor_4",
           "Factor_5",
           "Factor_6",
           "Factor_8",
           "Factor_9",
           "Factor_10"),
  TopN = c(rep(3,9)),
  KeepFactorCols = TRUE,
  OneHot = FALSE,
  SaveFactorLevels = TRUE,
  SavePath = getwd(),
  ImportFactorLevels = FALSE,
  FactorLevelsList = NULL,
  ClustScore = FALSE,
```

```

    ReturnFactorLevels = FALSE)

# Create Fake Data for Scoring Replication
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 25000,
  ID = 2L,
  ZIP = 0,
  FactorCount = 10L,
  AddDate = FALSE,
  Classification = FALSE,
  MultiClass = FALSE)

# Scoring Version
data <- RemixAutoML::DummifyDT(
  data = data,
  cols = c("Factor_1",
            "Factor_2",
            "Factor_3",
            "Factor_4",
            "Factor_5",
            "Factor_6",
            "Factor_8",
            "Factor_9",
            "Factor_10"),
  TopN = c(rep(3,9)),
  KeepFactorCols = TRUE,
  OneHot = FALSE,
  SaveFactorLevels = TRUE,
  SavePath = getwd(),
  ImportFactorLevels = TRUE,
  FactorLevelsList = NULL,
  ClustScore = FALSE,
  ReturnFactorLevels = FALSE)

## End(Not run)

```

---

EDA\_Histograms

---

EDA\_Histograms

---

## Description

Creates histograms

## Usage

```

EDA_Histograms(
  data = NULL,
  PlotColumns = NULL,
  SampleCount = 1e+05,
  SavePath = NULL,
  FactorCountPerPlot = 10,
  AddDensityLine = FALSE,
  PrintOutput = FALSE,

```

```

    Size = 12,
    AngleX = 35,
    AngleY = 0,
    ChartColor = "lightsteelblue1",
    BorderColor = "darkblue",
    TextColor = "darkblue",
    GridColor = "white",
    BackGroundColor = "gray95",
    LegendPosition = "bottom"
)

```

### Arguments

<code>data</code>	Input data.table
<code>PlotColumns</code>	Default NULL. If NULL, all columns will be plotted (except date cols). Otherwise, supply a character vector of columns names to plot
<code>SampleCount</code>	Number of random samples to use from data. data is first shuffled and then random samples taken
<code>SavePath</code>	Output file path to where you can optionally save pdf
<code>FactorCountPerPlot</code>	Default 10
<code>AddDensityLine</code>	Set to TRUE to add a density line to the plots
<code>PrintOutput</code>	Default FALSE. TRUE will print results upon running function
<code>Size</code>	Default 12
<code>AngleX</code>	Default 35
<code>AngleY</code>	Default 0
<code>ChartColor</code>	Default "lightsteelblue1"
<code>BorderColor</code>	Default "darkblue"
<code>TextColor</code>	Default "darkblue"
<code>GridColor</code>	Default "white"
<code>BackGroundColor</code>	Default "gray95"
<code>LegendPosition</code>	Default "bottom"

### Author(s)

Adrian Antico

### See Also

Other EDA: [AutoWordFreq\(\)](#), [Mode\(\)](#), [PlotGUI\(\)](#), [ScatterCopula\(\)](#), [UserBaseEvolution\(\)](#)



---

EvalPlot

*EvalPlot*


---

## Description

This function automatically builds calibration plots and calibration boxplots for model evaluation using regression, quantile regression, and binary and multinomial classification

## Usage

```
EvalPlot(
  data,
  PredictionColName = c("PredictedValues"),
  TargetColName = c("ActualValues"),
  GraphType = c("calibration"),
  PercentileBucket = 0.05,
  aggrfun = function(x) mean(x, na.rm = TRUE)
)
```

## Arguments

data	Data containing predicted values and actual values for comparison
PredictionColName	String representation of column name with predicted values from model
TargetColName	String representation of column name with target values from model
GraphType	Calibration or boxplot - calibration aggregated data based on summary statistic; boxplot shows variation
PercentileBucket	Number of buckets to partition the space on (0,1) for evaluation
aggrfun	The statistics function used in aggregation, listed as a function

## Value

Calibration plot or boxplot

## Author(s)

Adrian Antico

## See Also

Other Model Evaluation and Interpretation: [AutoShapeShap\(\)](#), [CumGainsChart\(\)](#), [ParDepCalPlots\(\)](#), [ROCPlot\(\)](#), [RedYellowGreen\(\)](#), [ResidualPlots\(\)](#), [SingleRowShapeShap\(\)](#), [threshOptim\(\)](#)

## Examples

```
## Not run:
# Create fake data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.70, N = 10000000, Classification = TRUE)
data.table::setnames(data, "IDcol_1", "Predict")
```

```
# Run function
RemixAutoML::EvalPlot(
  data,
  PredictionColName = "Predict",
  TargetColName = "Adrian",
  GraphType = "calibration",
  PercentileBucket = 0.05,
  agrfun = function(x) mean(x, na.rm = TRUE))

## End(Not run)
```

---

FakeDataGenerator	<i>FakeDataGenerator</i>
-------------------	--------------------------

---

**Description**

Create fake data for examples

**Usage**

```
FakeDataGenerator(
  Correlation = 0.7,
  N = 1000L,
  ID = 5L,
  FactorCount = 2L,
  AddDate = TRUE,
  AddComment = FALSE,
  AddWeightsColumn = FALSE,
  ZIP = 5L,
  TimeSeries = FALSE,
  TimeSeriesTimeAgg = "day",
  ChainLadderData = FALSE,
  Classification = FALSE,
  MultiClass = FALSE
)
```

**Arguments**

Correlation	Set the correlation value for simulated data
N	Number of records
ID	Number of IDcols to include
FactorCount	Number of factor type columns to create
AddDate	Set to TRUE to include a date column
AddComment	Set to TRUE to add a comment column
ZIP	Zero Inflation Model target variable creation. Select from 0 to 5 to create that number of distinctly distributed data, stratified from small to large
TimeSeries	For testing AutoBanditSarima
TimeSeriesTimeAgg	Choose from "1min", "5min", "10min", "15min", "30min", "hour", "day", "week", "month", "quarter", "year",

ChainLadderData      Set to TRUE to return Chain Ladder Data for using AutoMLChainLadderTrainer

Classification      Set to TRUE to build classification data

MultiClass      Set to TRUE to build MultiClass data

**Author(s)**

Adrian Antico

**Examples**

```
## Not run:
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.70,
  N = 1000L,
  ID = 2L,
  FactorCount = 2L,
  AddDate = TRUE,
  AddWeightsColumn = FALSE,
  AddComment = FALSE,
  ZIP = 2L,
  TimeSeries = FALSE,
  ChainLadderData = FALSE,
  Classification = FALSE,
  MultiClass = FALSE)

## End(Not run)
```

---

FilterLogicData

*FilterLogicData*


---

**Description**

FilterLogicData

**Usage**

```
FilterLogicData(
  data1,
  input,
  FilterLogic = input[["FilterLogic"]],
  FilterVariable = input[["FilterVariable_1"]],
  FilterValue = input[["FilterValue_1a"]],
  FilterValue2 = input[["FilterValue_1b"]],
  Debug = FALSE
)
```

**Arguments**

data1	data.table
input	passthrough
FilterLogic	passthrough

FilterVariable passthrough  
FilterValue passthrough  
FilterValue2 passthrough

---

FilterValues	<i>FilterValues</i>
--------------	---------------------

---

**Description**

FilterValues

**Usage**

```
FilterValues(data, VarName = input[["FilterVariable_1"]], type = 1)
```

**Arguments**

data data.table  
VarName Variable name  
type 1 for min, 2 for max

---

GenerateEvaluationMetrics	<i>GenerateEvaluationMetrics</i>
---------------------------	----------------------------------

---

**Description**

GenerateEvaluationMetrics calculates evaluation metrics for out of sample forecast and evaluation data

**Usage**

```
GenerateEvaluationMetrics(  
  EvalData = NULL,  
  TargetName = NULL,  
  DateName = NULL,  
  GroupNames = NULL  
)
```

**Arguments**

EvalData Source data in shiny app  
TargetName Target variable name  
DateName Date variable name  
GroupNames Group variable names

**Value**

PreparePlotData object for server.R to

**Author(s)**

Adrian Antico

**See Also**

Other Shiny: [ArgNullCheck2\(\)](#), [ArgNullCheck\(\)](#), [BlankRow\(\)](#), [DateInput\(\)](#), [NumericInput\(\)](#), [PickerInput\\_GetLevels\(\)](#), [PickerInput\(\)](#), [PreparePlotData\(\)](#), [ReactiveLoadCSV\(\)](#), [ReturnParam\(\)](#), [StoreArgs\(\)](#), [TextInput\(\)](#), [observeEventLoad\(\)](#)

**Examples**

```
## Not run:
PlotData <- RemixAutoML::PreparePlotData(input, TargetVariable = "TargetVariables", DateVariable = "DateVariable")

## End(Not run)
```

GenTSAnomVars

*GenTSAnomVars***Description**

GenTSAnomVars is an automated z-score anomaly detection via GLM-like procedure. Data is z-scaled and grouped by factors and time periods to determine which points are above and below the control limits in a cumulative time fashion. Then a cumulative rate is created as the final variable. Set `KeepAllCols` to `FALSE` to utilize the intermediate features to create rolling stats from them. The anomalies are separated into those that are extreme on the positive end versus those that are on the negative end.

**Usage**

```
GenTSAnomVars(
  data,
  ValueCol = "Value",
  GroupVars = NULL,
  DateVar = "DATE",
  HighThreshold = 1.96,
  LowThreshold = -1.96,
  KeepAllCols = TRUE,
  IsDataScaled = FALSE
)
```

**Arguments**

<code>data</code>	the source residuals data.table
<code>ValueCol</code>	the numeric column to run anomaly detection over
<code>GroupVars</code>	this is a group by variable
<code>DateVar</code>	this is a time variable for grouping
<code>HighThreshold</code>	this is the threshold on the high end
<code>LowThreshold</code>	this is the threshold on the low end
<code>KeepAllCols</code>	set to <code>TRUE</code> to remove the intermediate features
<code>IsDataScaled</code>	set to <code>TRUE</code> if you already scaled your data

**Value**

The original data.table with the added columns merged in. When KeepAllCols is set to FALSE, you will get back two columns: AnomHighRate and AnomLowRate - these are the cumulative anomaly rates over time for when you get anomalies from above the thresholds (e.g. 1.96) and below the thresholds.

**Author(s)**

Adrian Antico

**See Also**

Other Unsupervised Learning: [AutoClusteringScoring\(\)](#), [AutoClustering\(\)](#), [H2OIsolationForestScoring\(\)](#), [H2OIsolationForest\(\)](#), [ResidualOutliers\(\)](#)

**Examples**

```
## Not run:
data <- data.table::data.table(
  DateTime = as.Date(Sys.time()),
  Target = stats::filter(
    rnorm(10000, mean = 50, sd = 20),
    filter=rep(1,10),
    circular=TRUE))
data[, temp := seq(1:10000)][, DateTime := DateTime - temp][
  , temp := NULL]
data <- data[order(DateTime)]
x <- data.table::as.data.table(sde::GBM(N=10000)*1000)
data[, predicted := x[-1,]]
data[, Fact1 := sample(letters, size = 10000, replace = TRUE)]
data[, Fact2 := sample(letters, size = 10000, replace = TRUE)]
data[, Fact3 := sample(letters, size = 10000, replace = TRUE)]
stuff <- GenTSAnomVars(
  data,
  ValueCol = "Target",
  GroupVars = c("Fact1", "Fact2", "Fact3"),
  DateVar = "DateTime",
  HighThreshold = 1.96,
  LowThreshold = -1.96,
  KeepAllCols = TRUE,
  IsDataScaled = FALSE)

## End(Not run)
```

---

GetFilterValueLabel	<i>GetFilterValueLabel</i>
---------------------	----------------------------

---

**Description**

GetFilterValueLabel

**Usage**

```
GetFilterValueLabel(data, VarName = NULL, type = 1)
```

Arguments

data	data.table
VarName	Variable name
type	1 for min, 2 for max

---

GetFilterValueMultiple
<i>GetFilterValueMultiple</i>

---

Description

GetFilterValueMultiple

Usage

```
GetFilterValueMultiple(data, VarName = NULL, type = 1)
```

Arguments

data	data.table
VarName	Variable name
type	1 for min, 2 for max

---

H2OAutoencoder	<i>H2OAutoencoder</i>
----------------	-----------------------

---

Description

H2OAutoencoder for anomaly detection and or dimensionality reduction

Usage

```
H2OAutoencoder(  
  AnomalyDetection = FALSE,  
  DimensionReduction = TRUE,  
  data,  
  Features = NULL,  
  RemoveFeatures = FALSE,  
  NThreads = max(1L, parallel::detectCores() - 2L),  
  MaxMem = "28G",  
  H2OStart = TRUE,  
  H2OShutdown = TRUE,  
  ModelID = "TestModel",  
  model_path = NULL,  
  LayerStructure = NULL,  
  NodeShrinkRate = (sqrt(5) - 1)/2,  
  ReturnLayer = 4L,  
  per_feature = TRUE,
```

```

    Activation = "Tanh",
    Epochs = 5L,
    L2 = 0.1,
    ElasticAveraging = TRUE,
    ElasticAveragingMovingRate = 0.9,
    ElasticAveragingRegularization = 0.001
  )

```

## Arguments

AnomalyDetection	Set to TRUE to run anomaly detection
DimensionReduction	Set to TRUE to run dimension reduction
data	The data.table with the columns you wish to have analyzed
Features	NULL Column numbers or column names
RemoveFeatures	Set to TRUE if you want the features you specify in the Features argument to be removed from the data returned
NThreads	max(1L, parallel::detectCores()-2L)
MaxMem	"28G"
H2OStart	TRUE to start H2O inside the function
H2OShutdown	Setting to TRUE will shutdown H2O when it done being used internally.
ModelID	"TestModel"
model_path	If NULL no model will be saved. If a valid path is supplied the model will be saved there
LayerStructure	If NULL, layers and sizes will be created for you, using NodeShrinkRate and 7 layers will be created.
NodeShrinkRate	$= (\text{sqrt}(5) - 1) / 2$ ,
ReturnLayer	Which layer of the NNet to return. Choose from 1-7 with 4 being the layer with the least amount of nodes
per_feature	Set to TRUE to have per feature anomaly detection generated. Otherwise and overall value will be generated
Activation	Choose from "Tanh", "TanhWithDropout", "Rectifier", "RectifierWithDropout", "Maxout", "MaxoutWithDropout"
Epochs	Quantile value to find the cutoff value for classifying outliers
L2	Specify the amount of memory to allocate to H2O. E.g. "28G"
ElasticAveraging	Specify the number of threads (E.g. cores * 2)
ElasticAveragingMovingRate	Specify the number of decision trees to build
ElasticAveragingRegularization	Specify the row sample rate per tree

## Value

A data.table



**Author(s)**

Adrian Antico

**See Also**

Other Feature Engineering: [AutoDataPartition\(\)](#), [AutoDiffLagN\(\)](#), [AutoHierarchicalFourier\(\)](#), [AutoInteraction\(\)](#), [AutoLagRollMode\(\)](#), [AutoLagRollStatsScoring\(\)](#), [AutoLagRollStats\(\)](#), [AutoTransformationCreate\(\)](#), [AutoTransformationScore\(\)](#), [AutoWord2VecModeler\(\)](#), [AutoWord2VecScoring\(\)](#), [CategoricalEncoding\(\)](#), [CreateCalendarVariables\(\)](#), [CreateHolidayVariables\(\)](#), [DummifyDT\(\)](#), [H2OAutoencoderScoring\(\)](#), [ModelDataPrep\(\)](#), [TimeSeriesFill\(\)](#)

**Examples**

```
## Not run:
#####
# Training
#####

# Create simulated data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.70,
  N = 1000L,
  ID = 2L,
  FactorCount = 2L,
  AddDate = TRUE,
  AddComment = FALSE,
  ZIP = 2L,
  TimeSeries = FALSE,
  ChainLadderData = FALSE,
  Classification = FALSE,
  MultiClass = FALSE)

# Run algo
Output <- RemixAutoML::H2OAutoencoder(

  # Select the service
  AnomalyDetection = TRUE,
  DimensionReduction = TRUE,

  # Data related args
  data = data,
  Features = names(data)[2L:(ncol(data)-1L)],
  per_feature = FALSE,
  RemoveFeatures = FALSE,
  ModelID = "TestModel",
  model_path = getwd(),

  # H2O Environment
  NThreads = max(1L, parallel::detectCores()-2L),
  MaxMem = "28G",
  H2OStart = TRUE,
  H2OShutdown = TRUE,

  # H2O ML Args
  LayerStructure = NULL,
  NodeShrinkRate = (sqrt(5) - 1) / 2,
```

```

    ReturnLayer = 4L,
    Activation = "Tanh",
    Epochs = 5L,
    L2 = 0.10,
    ElasticAveraging = TRUE,
    ElasticAveragingMovingRate = 0.90,
    ElasticAveragingRegularization = 0.001)

# Inspect output
data <- Output$Data
Model <- Output$Model

# If ValidationData is not null
ValidationData <- Output$ValidationData

#####
# Scoring
#####

# Create simulated data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.70,
  N = 1000L,
  ID = 2L,
  FactorCount = 2L,
  AddDate = TRUE,
  AddComment = FALSE,
  ZIP = 2L,
  TimeSeries = FALSE,
  ChainLadderData = FALSE,
  Classification = FALSE,
  MultiClass = FALSE)

# Run algo
data <- RemixAutoML::H2OAutoencoderScoring(

  # Select the service
  AnomalyDetection = TRUE,
  DimensionReduction = TRUE,

  # Data related args
  data = data,
  Features = names(data)[2L:ncol(data)],
  RemoveFeatures = TRUE,
  per_feature = FALSE,
  ModelObject = NULL,
  ModelID = "TestModel",
  model_path = getwd(),

  # H2O args
  NThreads = max(1L, parallel::detectCores()-2L),
  MaxMem = "28G",
  H2OStart = TRUE,
  H2OShutdown = TRUE,
  ReturnLayer = 4L)

## End(Not run)

```

---

H2OAutoencoderScoring *H2OAutoencoderScoring*


---

**Description**

H2OAutoencoderScoring for anomaly detection and or dimensionality reduction

**Usage**

```
H2OAutoencoderScoring(
  data,
  Features = NULL,
  RemoveFeatures = FALSE,
  ModelObject = NULL,
  AnomalyDetection = TRUE,
  DimensionReduction = TRUE,
  ReturnLayer = 4L,
  per_feature = TRUE,
  NThreads = max(1L, parallel::detectCores() - 2L),
  MaxMem = "28G",
  H2OStart = TRUE,
  H2OShutdown = TRUE,
  ModelID = "TestModel",
  model_path = NULL
)
```

**Arguments**

data	The data.table with the columns you wish to have analyzed
Features	NULL Column numbers or column names
RemoveFeatures	Set to TRUE if you want the features you specify in the Features argument to be removed from the data returned
ModelObject	If NULL then the model will be loaded from file. Otherwise, it will use what is supplied
AnomalyDetection	Set to TRUE to run anomaly detection
DimensionReduction	Set to TRUE to run dimension reduction
ReturnLayer	Which layer of the NNet to return. Choose from 1-7 with 4 being the layer with the least amount of nodes
per_feature	Set to TRUE to have per feature anomaly detection generated. Otherwise and overall value will be generated
NThreads	max(1L, parallel::detectCores()-2L)
MaxMem	"28G"
H2OStart	TRUE to start H2O inside the function
H2OShutdown	Setting to TRUE will shutdown H2O when it done being used internally.
ModelID	"TestModel"
model_path	If NULL no model will be saved. If a valid path is supplied the model will be saved there

**Value**

A data.table

**Author(s)**

Adrian Antico

**See Also**

Other Feature Engineering: [AutoDataPartition\(\)](#), [AutoDiffLagN\(\)](#), [AutoHierarchicalFourier\(\)](#), [AutoInteraction\(\)](#), [AutoLagRollMode\(\)](#), [AutoLagRollStatsScoring\(\)](#), [AutoLagRollStats\(\)](#), [AutoTransformationCreate\(\)](#), [AutoTransformationScore\(\)](#), [AutoWord2VecModeler\(\)](#), [AutoWord2VecScoring\(\)](#), [CategoricalEncoding\(\)](#), [CreateCalendarVariables\(\)](#), [CreateHolidayVariables\(\)](#), [DummifyDT\(\)](#), [H2OAutoencoder\(\)](#), [ModelDataPrep\(\)](#), [TimeSeriesFill\(\)](#)

**Examples**

```
## Not run:
#####
# Training
#####

# Create simulated data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.70,
  N = 1000L,
  ID = 2L,
  FactorCount = 2L,
  AddDate = TRUE,
  AddComment = FALSE,
  ZIP = 2L,
  TimeSeries = FALSE,
  ChainLadderData = FALSE,
  Classification = FALSE,
  MultiClass = FALSE)

# Run algo
data <- RemixAutoML::H2OAutoencoder(

  # Select the service
  AnomalyDetection = TRUE,
  DimensionReduction = TRUE,

  # Data related args
  data = data,
  ValidationData = NULL,
  Features = names(data)[2L:(ncol(data)-1L)],
  per_feature = FALSE,
  RemoveFeatures = TRUE,
  ModelID = "TestModel",
  model_path = getwd(),

  # H2O Environment
  NThreads = max(1L, parallel::detectCores()-2L),
  MaxMem = "28G",
  H2OStart = TRUE,
```

```

H2OShutdown = TRUE,

# H2O ML Args
LayerStructure = NULL,
ReturnLayer = 4L,
Activation = "Tanh",
Epochs = 5L,
L2 = 0.10,
ElasticAveraging = TRUE,
ElasticAveragingMovingRate = 0.90,
ElasticAveragingRegularization = 0.001)

#####
# Scoring
#####

# Create simulated data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.70,
  N = 1000L,
  ID = 2L,
  FactorCount = 2L,
  AddDate = TRUE,
  AddComment = FALSE,
  ZIP = 2L,
  TimeSeries = FALSE,
  ChainLadderData = FALSE,
  Classification = FALSE,
  MultiClass = FALSE)

# Run algo
data <- RemixAutoML::H2OAutoencoderScoring(

  # Select the service
  AnomalyDetection = TRUE,
  DimensionReduction = TRUE,

  # Data related args
  data = data,
  Features = names(data)[2L:ncol(data)],
  RemoveFeatures = TRUE,
  per_feature = FALSE,
  ModelObject = NULL,
  ModelID = "TestModel",
  model_path = getwd(),

  # H2O args
  NThreads = max(1L, parallel::detectCores()-2L),
  MaxMem = "28G",
  H2OStart = TRUE,
  H2OShutdown = TRUE,
  ReturnLayer = 4L)

## End(Not run)

```

---

H2OIsolationForest	<i>H2OIsolationForest</i>
--------------------	---------------------------

---

## Description

H2OIsolationForestScoring for dimensionality reduction and / or anomaly detection

## Usage

```
H2OIsolationForest(
  data,
  Features = NULL,
  IDcols = NULL,
  ModelID = "TestModel",
  SavePath = NULL,
  Threshold = 0.975,
  MaxMem = "28G",
  NThreads = -1,
  NTrees = 100,
  MaxDepth = 8,
  MinRows = 1,
  RowSampleRate = (sqrt(5) - 1)/2,
  ColSampleRate = 1,
  ColSampleRatePerLevel = 1,
  ColSampleRatePerTree = 1,
  CategoricalEncoding = c("AUTO"),
  Debug = FALSE
)
```

## Arguments

data	The data.table with the columns you wish to have analyzed
Features	A character vector with the column names to utilize in the isolation forest
IDcols	A character vector with the column names to not utilize in the isolation forest but have returned with the data output. Otherwise those columns will be removed
ModelID	Name for model that gets saved to file if SavePath is supplied and valid
SavePath	Path directory to store saved model
Threshold	Quantile value to find the cutoff value for classifying outliers
MaxMem	Specify the amount of memory to allocate to H2O. E.g. "28G"
NThreads	Specify the number of threads (E.g. cores * 2)
NTrees	Specify the number of decision trees to build
MaxDepth	Max tree depth
MinRows	Minimum number of rows allowed per leaf
RowSampleRate	Number of rows to sample per tree
ColSampleRate	Sample rate for each split
ColSampleRatePerLevel	Sample rate for each level

ColSampleRatePerTree	Sample rate per tree
CategoricalEncoding	Choose from "AUTO", "Enum", "OneHotInternal", "OneHotExplicit", "Binary", "Eigen", "LabelEncoder", "SortByResponse", "EnumLimited"
Debug	Debugging

**Value**

Source data.table with predictions. Note that any columns not listed in Features nor IDcols will not be returned with data. If you want columns returned but not modeled, supply them as IDcols

**Author(s)**

Adrian Antico

**See Also**

Other Unsupervised Learning: [AutoClusteringScoring\(\)](#), [AutoClustering\(\)](#), [GenTSAnomVars\(\)](#), [H2OIsolationForestScoring\(\)](#), [ResidualOutliers\(\)](#)

**Examples**

```
## Not run:
# Create simulated data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.70,
  N = 50000,
  ID = 2L,
  FactorCount = 2L,
  AddDate = TRUE,
  ZIP = 0L,
  TimeSeries = FALSE,
  ChainLadderData = FALSE,
  Classification = FALSE,
  MultiClass = FALSE)

# Run algo
data <- RemixAutoML::H2OIsolationForest(
  data,
  Features = names(data)[2L:ncol(data)],
  IDcols = c("Adrian", "IDcol_1", "IDcol_2"),
  ModelID = "Adrian",
  SavePath = getwd(),
  Threshold = 0.95,
  MaxMem = "28G",
  NThreads = -1,
  NTrees = 100,
  MaxDepth = 8,
  MinRows = 1,
  RowSampleRate = (sqrt(5)-1)/2,
  ColSampleRate = 1,
  ColSampleRatePerLevel = 1,
  ColSampleRatePerTree = 1,
  CategoricalEncoding = c("AUTO"),
  Debug = TRUE)
```

```
# Remove output from data and then score
data[, eval(names(data)[17:ncol(data)]) := NULL]

# Run algo
Outliers <- RemixAutoML::H2OIsolationForestScoring(
  data,
  Features = names(data)[2:ncol(data)],
  IDcols = c("Adrian", "IDcol_1", "IDcol_2"),
  H2OStart = TRUE,
  H2OShutdown = TRUE,
  ModelID = "TestModel",
  SavePath = getwd(),
  Threshold = 0.95,
  MaxMem = "28G",
  NThreads = -1,
  Debug = FALSE)

## End(Not run)
```

---

H2OIsolationForestScoring

*H2OIsolationForestScoring*


---

## Description

H2OIsolationForestScoring for dimensionality reduction and / or anomaly detection scoring on new data

## Usage

```
H2OIsolationForestScoring(
  data,
  Features = NULL,
  IDcols = NULL,
  H2OStart = TRUE,
  H2OShutdown = TRUE,
  ModelID = "TestModel",
  SavePath = NULL,
  Threshold = 0.975,
  MaxMem = "28G",
  NThreads = -1,
  Debug = FALSE
)
```

## Arguments

data	The data.table with the columns you wish to have analyzed
Features	A character vector with the column names to utilize in the isolation forest
IDcols	A character vector with the column names to not utilize in the isolation forest but have returned with the data output. Otherwise those columns will be removed
H2OStart	TRUE to have H2O started inside function



H2OShutdown	TRUE to shutdown H2O inside function
ModelID	Name for model that gets saved to file if SavePath is supplied and valid
SavePath	Path directory to store saved model
Threshold	Quantile value to find the cutoff value for classifying outliers
MaxMem	Specify the amount of memory to allocate to H2O. E.g. "28G"
NThreads	Specify the number of threads (E.g. cores * 2)
Debug	Debugging

**Value**

Source data.table with predictions. Note that any columns not listed in Features nor IDcols will not be returned with data. If you want columns returned but not modeled, supply them as IDcols

**Author(s)**

Adrian Antico

**See Also**

Other Unsupervised Learning: [AutoClusteringScoring\(\)](#), [AutoClustering\(\)](#), [GenTSAnomVars\(\)](#), [H2OIsolationForest\(\)](#), [ResidualOutliers\(\)](#)

**Examples**

```
## Not run:
# Create simulated data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.70,
  N = 50000,
  ID = 2L,
  FactorCount = 2L,
  AddDate = TRUE,
  ZIP = 0L,
  TimeSeries = FALSE,
  ChainLadderData = FALSE,
  Classification = FALSE,
  MultiClass = FALSE)

# Run algo
data <- RemixAutoML::H2OIsolationForest(
  data,
  Features = names(data)[2L:ncol(data)],
  IDcols = c("Adrian", "IDcol_1", "IDcol_2"),
  ModelID = "Adrian",
  SavePath = getwd(),
  Threshold = 0.95,
  MaxMem = "28G",
  NThreads = -1,
  NTrees = 100,
  SampleRate = (sqrt(5)-1)/2,
  MaxDepth = 8,
  MinRows = 1,
  ColSampleRate = 1,
  ColSampleRatePerLevel = 1,
```

```

ColSampleRatePerTree = 1,
CategoricalEncoding = c("AUTO"),
Debug = TRUE)

# Remove output from data and then score
data[, eval(names(data)[17:ncol(data)]) := NULL]

# Run algo
Outliers <- RemixAutoML::H2OIsolationForestScoring(
  data,
  Features = names(data)[2:ncol(data)],
  IDcols = c("Adrian", "IDcol_1", "IDcol_2"),
  H2OStart = TRUE,
  H2OShutdown = TRUE,
  ModelID = "TestModel",
  SavePath = getwd(),
  Threshold = 0.95,
  MaxMem = "28G",
  NThreads = -1,
  Debug = FALSE)

## End(Not run)

```

---

InsertSortedValue

*InsertSortedValue*


---

## Description

Update a sorted vector with a new value that preserves sort order

Algorithms

## Usage

```
InsertSortedValue(Vec, Val, order = "left")
```

## Arguments

Val	value to insert
order	'left' or 'right', insert value location
vec	numeric vector

## Author(s)

Adrian Antico

## Examples

```

## Not run:
RemixAutoML::InsertSortedValue(vec = seq(2, 2000, 2), Val = 741, order = "left")

## End(Not run)

```

---

IntNull	<i>IntNull</i>
---------	----------------

---

**Description**

IntNull

**Usage**

IntNull(x)

**Arguments**

x	value
---	-------

---

KeyVarsInit	<i>KeyVarsInit</i>
-------------	--------------------

---

**Description**

KeyVarsInit

**Usage**

KeyVarsInit(data, VarName = NULL, type = 1)

**Arguments**

data	data.table
VarName	Variable name
type	1 for min, 2 for max

---

Mode	<i>Mode</i>
------	-------------

---

**Description**

Statistical mode. Only returns the first mode if there are many

**Usage**

Mode(x)

**Arguments**

x	vector
---	--------

Author(s)

Adrian Antico

See Also

Other EDA: [AutoWordFreq\(\)](#), [EDA\\_Histograms\(\)](#), [PlotGUI\(\)](#), [ScatterCopula\(\)](#), [UserBaseEvolution\(\)](#)

---

ModelDataPrep	<i>ModelDataPrep</i>
---------------	----------------------

---

Description

This function replaces inf values with NA, converts characters to factors, and imputes with constants

Usage

```
ModelDataPrep(  
  data,  
  Impute = TRUE,  
  CharToFactor = TRUE,  
  FactorToChar = FALSE,  
  IntToNumeric = TRUE,  
  LogicalToBinary = FALSE,  
  DateToChar = FALSE,  
  IDateConversion = FALSE,  
  RemoveDates = FALSE,  
  MissFactor = "0",  
  MissNum = -1,  
  IgnoreCols = NULL  
)
```

Arguments

data	This is your source data you'd like to modify
Impute	Defaults to TRUE which tells the function to impute the data
CharToFactor	Defaults to TRUE which tells the function to convert characters to factors
FactorToChar	Converts to character
IntToNumeric	Defaults to TRUE which tells the function to convert integers to numeric
LogicalToBinary	Converts logical values to binary numeric values
DateToChar	Converts date columns into character columns
IDateConversion	Convert IDateTime to POSIXct and IDate to Date types
RemoveDates	Defaults to FALSE. Set to TRUE to remove date columns from your data.table
MissFactor	Supply the value to impute missing factor levels
MissNum	Supply the value to impute missing numeric values
IgnoreCols	Supply column numbers for columns you want the function to ignore

**Value**

Returns the original data table with corrected values

**Author(s)**

Adrian Antico

**See Also**

Other Feature Engineering: [AutoDataPartition\(\)](#), [AutoDiffLagN\(\)](#), [AutoHierarchicalFourier\(\)](#), [AutoInteraction\(\)](#), [AutoLagRollMode\(\)](#), [AutoLagRollStatsScoring\(\)](#), [AutoLagRollStats\(\)](#), [AutoTransformationCreate\(\)](#), [AutoTransformationScore\(\)](#), [AutoWord2VecModeler\(\)](#), [AutoWord2VecScoring\(\)](#), [CategoricalEncoding\(\)](#), [CreateCalendarVariables\(\)](#), [CreateHolidayVariables\(\)](#), [DummifyDT\(\)](#), [H2OAutoencoderScoring\(\)](#), [H2OAutoencoder\(\)](#), [TimeSeriesFill\(\)](#)

**Examples**

```
## Not run:
# Create fake data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.75,
  N = 250000L,
  ID = 2L,
  ZIP = 0L,
  FactorCount = 6L,
  AddDate = TRUE,
  Classification = FALSE,
  MultiClass = FALSE)

# Check column types
str(data)

# Convert some factors to character
data <- RemixAutoML::ModelDataPrep(
  data,
  Impute      = TRUE,
  CharToFactor = FALSE,
  FactorToChar = TRUE,
  IntToNumeric = TRUE,
  LogicalToBinary = FALSE,
  DateToChar   = FALSE,
  IDateConversion = FALSE,
  RemoveDates  = TRUE,
  MissFactor   = "0",
  MissNum      = -1,
  IgnoreCols   = c("Factor_1"))

# Check column types
str(data)

## End(Not run)
```

---

ModelInsightsReport     *ModelInsightsReport*


---

## Description

ModelInsightsReport is an Rmarkdown report for viewing the model insights generated by Remix-AutoML supervised learning functions

## Usage

```
ModelInsightsReport(
  KeepOutput = NULL,
  TrainData = NULL,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = NULL,
  PredictionColumnName = "Predict",
  FeatureColumnNames = NULL,
  DateColumnName = NULL,
  TargetType = "regression",
  ModelID = "ModelTest",
  Algo = "catboost",
  SourcePath = NULL,
  OutputPath = NULL,
  RemixOutput = NULL,
  Test_Importance_dt = NULL,
  Validation_Importance_dt = NULL,
  Train_Importance_dt = NULL,
  Test_Interaction_dt = NULL,
  Validation_Interaction_dt = NULL,
  Train_Interaction_dt = NULL,
  GlobalVars = ls()
)
```

## Arguments

KeepOutput	NULL A list of output names to select. Pass in as a character vector. E.g. c('Test_VariableImportance', 'Train_VariableImportance')
TrainData	data.table or something that converts to data.table via as.data.table
ValidationData	data.table or something that converts to data.table via as.data.table
TestData	data.table or something that converts to data.table via as.data.table
TargetColumnName	NULL. Target variable column name as character
PredictionColumnName	NULL. Predicted value column name as character. 'p1' for RemixAutoML functions
FeatureColumnNames	NULL. Feature column names as character vector.
DateColumnName	NULL. Date column name as character

TargetType	'regression', 'classification', or 'multiclass'
ModelID	ModelID used in the RemixAutoML supervised learning function
Algo	'catboost' or 'other'. Use 'catboost' if using RemixAutoML::AutoCatBoost_() functions. Otherwise, 'other'
SourcePath	Path to directory with RemixAutoML Model Output
OutputPath	Path to directory where the html will be saved
RemixOutput	Returned output from regression, classification, and multiclass Remix Auto_() models. Currently supports CatBoost, XGBoost, and LightGBM models
Test_Importance_dt	NULL.. Ignore if using RemixAutoML Models. Otherwise, supply a two column data.table with colnames 'Variable' and 'Importance'
Validation_Importance_dt	NULL.. Ignore if using RemixAutoML Models. Otherwise, supply a two column data.table with colnames 'Variable' and 'Importance'
Train_Importance_dt	NULL.. Ignore if using RemixAutoML Models. Otherwise, supply a two column data.table with colnames 'Variable' and 'Importance'
Test_Interaction_dt	NULL.. Ignore if using RemixAutoML Models. Otherwise, supply a three column data.table with colnames 'Features1', 'Features2' and 'score'
Validation_Interaction_dt	NULL.. Ignore if using RemixAutoML Models. Otherwise, supply a three column data.table with colnames 'Features1', 'Features2' and 'score'
Train_Interaction_dt	NULL.. Ignore if using RemixAutoML Models. Otherwise, supply a three column data.table with colnames 'Features1', 'Features2' and 'score'
GlobalVars	ls() don't use
Path	Path to Model Output if RemixOutput is left NULL

**Author(s)**

Adrian Antico

**Examples**

```
## Not run:

#####
# CatBoost
#####

# Create some dummy correlated data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.85,
  N = 10000,
  ID = 2,
  ZIP = 0,
  AddDate = FALSE,
  Classification = FALSE,
  MultiClass = FALSE)
```

```

# Copy data
data1 <- data.table::copy(data)

# Run function
RemixOutput <- RemixAutoML::AutoCatBoostRegression(

  # GPU or CPU and the number of available GPUs
  TrainOnFull = FALSE,
  task_type = 'GPU',
  NumGPUs = 1,
  DebugMode = FALSE,

  # Metadata args
  OutputSelection = c('Importances','EvalPlots','EvalMetrics','Score_TrainData'),
  ModelID = 'Test_Model_1',
  model_path = getwd(),
  metadata_path = getwd(),
  SaveModelObjects = FALSE,
  SaveInfoToPDF = FALSE,
  ReturnModelObjects = TRUE,

  # Data args
  data = data1,
  ValidationData = NULL,
  TestData = NULL,
  TargetColumnName = 'Adrian',
  FeatureColNames = names(data1)[!names(data1) %in% c('IDcol_1','IDcol_2','Adrian')],
  PrimaryDateColumn = NULL,
  WeightsColumnName = NULL,
  IDcols = c('IDcol_1','IDcol_2'),
  TransformNumericColumns = 'Adrian',
  Methods = c('Asinh','Asin','Log','LogPlus1','Sqrt','Logit'),

  # Model evaluation
  eval_metric = 'RMSE',
  eval_metric_value = 1.5,
  loss_function = 'RMSE',
  loss_function_value = 1.5,
  MetricPeriods = 10L,
  NumOfParDepPlots = ncol(data1)-1L-2L,

  # Grid tuning args
  PassInGrid = NULL,
  GridTune = FALSE,
  MaxModelsInGrid = 30L,
  MaxRunsWithoutNewWinner = 20L,
  MaxRunMinutes = 60*60,
  BaselineComparison = 'default',

  # ML args
  langevin = FALSE,
  diffusion_temperature = 10000,
  Trees = 500,
  Depth = 9,
  L2_Leaf_Reg = NULL,
  RandomStrength = 1,
  BorderCount = 128,

```



```

    LearningRate = NULL,
    RSM = 1,
    BootStrapType = NULL,
    GrowPolicy = 'SymmetricTree',
    model_size_reg = 0.5,
    feature_border_type = 'GreedyLogSum',
    sampling_unit = 'Object',
    subsample = NULL,
    score_function = 'Cosine',
    min_data_in_leaf = 1)

# Create Model Insights Report
RemixAutoML::ModelInsightsReport(

  # Items to keep in global environment when
  #   function finishes execution
  KeepOutput = 'Test_VariableImportance',

  # DataSets
  TrainData = NULL,
  ValidationData = NULL,
  TestData = NULL,

  # Meta info
  TargetColumnName = NULL,
  PredictionColumnName = NULL,
  FeatureColumnNames = NULL,
  DateColumnName = NULL,

  # Variable Importance
  Test_Importance_dt = NULL,
  Validation_Importance_dt = NULL,
  Train_Importance_dt = NULL,
  Test_Interaction_dt = NULL,
  Validation_Interaction_dt = NULL,
  Train_Interaction_dt = NULL,

  # Control options
  TargetType = 'regression',
  ModelID = 'ModelTest',
  Algo = 'catboost',
  SourcePath = getwd(),
  OutputPath = getwd(),
  RemixOutput = RemixOutput)

## End(Not run)

```

---

multiplot

*multiplot*


---

## Description

Sick of copying this one into your code? Well, not anymore.

**Usage**

```
multiplot(plotlist = NULL)
```

**Arguments**

plotlist            This is the list of your charts

**Value**

Multiple ggplots on a single image

**Author(s)**

Adrian Antico

**See Also**

Other Graphics: [ChartTheme\(\)](#)

**Examples**

```
## Not run:
Correl <- 0.85
data <- data.table::data.table(Target = runif(100))
data[, x1 := qnorm(Target)]
data[, x2 := runif(100)]
data[, Independent_Variable1 := log(
  pnorm(Correl * x1 + sqrt(1-Correl^2) * qnorm(x2)))]
data[, Predict := (
  pnorm(Correl * x1 + sqrt(1-Correl^2) * qnorm(x2)))]
p1 <- RemixAutoML::ParDepCalPlots(
  data,
  PredictionColName = "Predict",
  TargetColName = "Target",
  IndepVar = "Independent_Variable1",
  GraphType = "calibration",
  PercentileBucket = 0.20,
  FactLevels = 10,
  Function = function(x) mean(x, na.rm = TRUE))
p2 <- RemixAutoML::ParDepCalPlots(
  data,
  PredictionColName = "Predict",
  TargetColName = "Target",
  IndepVar = "Independent_Variable1",
  GraphType = "boxplot",
  PercentileBucket = 0.20,
  FactLevels = 10,
  Function = function(x) mean(x, na.rm = TRUE))
RemixAutoML::multiplot(plotlist = list(p1,p2))

## End(Not run)
```

---

NumericInput	<i>NumericInput</i>
--------------	---------------------

---

## Description

NumericInput automatically builds a numeric input with tryCatch's and ProjectList argument usage if it exists

## Usage

```
NumericInput(
  InputID = "TS_CARMA_HolidayMovingAverages",
  Label = "Select Holiday Count MA's",
  Step = 10,
  Value = 1,
  Min = 1,
  Max = 10
)
```

## Arguments

InputID	Feeds ProjectList and inputId. Argument saved in ProjectList
Label	Feeds label
Step	Feeds size in the options list
Value	Default
Min	Min value
Max	Max value

## Value

PickerInput object for server.R to go into renderUI(PickerInput())

## Author(s)

Adrian Antico

## See Also

Other Shiny: [ArgNullCheck2\(\)](#), [ArgNullCheck\(\)](#), [BlankRow\(\)](#), [DateInput\(\)](#), [GenerateEvaluationMetrics\(\)](#), [PickerInput\\_GetLevels\(\)](#), [PickerInput\(\)](#), [PreparePlotData\(\)](#), [ReactiveLoadCSV\(\)](#), [ReturnParam\(\)](#), [StoreArgs\(\)](#), [TextInput\(\)](#), [observeEventLoad\(\)](#)

## Examples

```
## Not run:
output$TS_CARMA_HolidayMovingAverages <- renderUI({
  RemixAutoML::NumericInput(InputID = "TS_CARMA_HolidayMovingAverages",
    Label = "Select Holiday Count MA's",
    Min = 1,
    Max = 1,
    Value = 1,
```

```
Step = 1))  
  
## End(Not run)
```

---

NumNull	<i>NumNull</i>
---------	----------------

---

**Description**

NumNull

**Usage**

```
NumNull(x)
```

**Arguments**

x                      value

---

observeEventLoad	<i>observeEventLoad</i>
------------------	-------------------------

---

**Description**

Used to load .Rdata files in Shiny and assign the object a name

**Usage**

```
observeEventLoad(input, InputVal = NULL, ObjectName = NULL)
```

**Arguments**

input                      Passthrough  
InputVal                    The values that goes after input\$  
ObjectName                  The name of the object to assign the load output to

**Author(s)**

Adrian Antico

**See Also**

Other Shiny: [ArgNullCheck2\(\)](#), [ArgNullCheck\(\)](#), [BlankRow\(\)](#), [DateInput\(\)](#), [GenerateEvaluationMetrics\(\)](#), [NumericInput\(\)](#), [PickerInput\\_GetLevels\(\)](#), [PickerInput\(\)](#), [PreparePlotData\(\)](#), [ReactiveLoadCSV\(\)](#), [ReturnParam\(\)](#), [StoreArgs\(\)](#), [TextInput\(\)](#)

---

ParDepCalPlots	<i>ParDepCalPlots</i>
----------------	-----------------------

---

**Description**

This function automatically builds partial dependence calibration plots and partial dependence calibration boxplots for model evaluation using regression, quantile regression, and binary and multinomial classification

**Usage**

```
ParDepCalPlots(  
  data,  
  PredictionColName = c("PredictedValues"),  
  TargetColName = c("ActualValues"),  
  IndepVar = c("Independent_Variable_Name"),  
  GraphType = c("calibration"),  
  PercentileBucket = 0.05,  
  FactLevels = 10,  
  Function = function(x) mean(x, na.rm = TRUE),  
  DateColumn = NULL,  
  DateAgg_3D = NULL,  
  PlotYMeanColor = "black",  
  PlotXMeanColor = "chocolate",  
  PlotXLowColor = "purple",  
  PlotXHighColor = "purple"  
)
```

**Arguments**

data	Data containing predicted values and actual values for comparison
PredictionColName	Predicted values column names
TargetColName	Target value column names
IndepVar	Independent variable column names
GraphType	calibration or boxplot - calibration aggregated data based on summary statistic; boxplot shows variation
PercentileBucket	Number of buckets to partition the space on (0,1) for evaluation
FactLevels	The number of levels to show on the chart (1. Levels are chosen based on frequency; 2. all other levels grouped and labeled as "Other")
Function	Supply the function you wish to use for aggregation.
DateColumn	Add date column for 3D scatterplot
DateAgg_3D	Aggregate date column by 'day', 'week', 'month', 'quarter', 'year'

**Value**

Partial dependence calibration plot or boxplot

**Author(s)**

Adrian Antico

**See Also**

Other Model Evaluation and Interpretation: [AutoShapeShap\(\)](#), [CumGainsChart\(\)](#), [EvalPlot\(\)](#), [ROCPlot\(\)](#), [RedYellowGreen\(\)](#), [ResidualPlots\(\)](#), [SingleRowShapeShap\(\)](#), [threshOptim\(\)](#)

**Examples**

```
## Not run:
# Create fake data
data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.70, N = 10000000, Classification = FALSE)
data.table::setnames(data, "Independent_Variable2", "Predict")

# Build plot
Plot <- RemixAutoML::ParDepCalPlots(
  data,
  PredictionColName = "Predict",
  TargetColName = "Adrian",
  IndepVar = "Independent_Variable1",
  GraphType = "calibration",
  PercentileBucket = 0.20,
  FactLevels = 10,
  Function = function(x) mean(x, na.rm = TRUE),
  DateColumn = NULL,
  DateAgg_3D = NULL)

## End(Not run)
```

---

 PickerInput

*PickerInput*


---

**Description**

PickerInput automatically builds a picker input with tryCatch's and ProjectList argument usage if it exists

**Usage**

```
PickerInput(
  InputID = "TS_CARMA_HolidayMovingAverages",
  Label = "Select Holiday Count MA's",
  Choices = as.character(0:50),
  SelectedDefault = as.character(c(1, 2)),
  Size = 10,
  SelectedText = "count > 1",
  Multiple = TRUE,
  ActionBox = TRUE,
  Debug = FALSE
)
```

**Arguments**

InputID	Feeds ProjectList and inputId. Argument saved in ProjectList
Label	Feeds label
Choices	Feeds choices
SelectedDefault	Feeds selected for cases where ProjectList has a null element
Size	Feeds size in the options list
SelectedText	Feeds selected-text-format in options list
Multiple	Feeds multiple for enabling selecting more than one element from list
ActionBox	Feeds actions-box for option list
Debug	FALSE

**Value**

PickerInput object for server.R to go into renderUI(PickerInput())

**Author(s)**

Adrian Antico

**See Also**

Other Shiny: [ArgNullCheck2\(\)](#), [ArgNullCheck\(\)](#), [BlankRow\(\)](#), [DateInput\(\)](#), [GenerateEvaluationMetrics\(\)](#), [NumericInput\(\)](#), [PickerInput\\_GetLevels\(\)](#), [PreparePlotData\(\)](#), [ReactiveLoadCSV\(\)](#), [ReturnParam\(\)](#), [StoreArgs\(\)](#), [TextInput\(\)](#), [observeEventLoad\(\)](#)

**Examples**

```
## Not run:
output$TS_CARMA_HolidayMovingAverages <- renderUI({
  RemixAutoML::PickerInput(InputID = "TS_CARMA_HolidayMovingAverages", Label = "Select Holiday Count MA's", Choices = ProjectList,
    SelectedDefault = as.character(c(1,2)), Size = 10, SelectedText = "count > 1", Multiple = TRUE)
})
## End(Not run)
```

---

PickerInput\_GetLevels *PickerInput\_GetLevels*

---

**Description**

PickerInput\_GetLevels automatically builds a picker input with tryCatch's and ProjectList argument usage if it exists

**Usage**

```
PickerInput_GetLevels(
  input,
  data = "SourceData",
  NumGroupVar = 3,
  InputID = "TS_CARMA_HolidayMovingAverages",
  InputID2 = "timeSeriesGroupVars",
  Choices = as.character(0:50),
  SelectedDefault = as.character(c(1, 2)),
  Size = 10,
  SelectedText = "count > 1",
  Multiple = TRUE,
  ActionBox = TRUE
)
```

**Arguments**

input	input object within shiny context
data	'SourceData' or whatever the name of your data is
NumGroupVar	Which group var to select
InputID	Feeds ProjectList and inputId. Argument saved in ProjectList
InputID2	Secondary object name
Choices	Feeds choices
SelectedDefault	Feeds selected for cases where ProjectList has a null element
Size	Feeds size in the options list
SelectedText	Feeds selected-text-format in options list
Multiple	Feeds multiple for enabling selecting more than one element from list
ActionBox	Feeds actions-box for option list

**Value**

PickerInput object for server.R to go into renderUI(PickerInput())

**Author(s)**

Adrian Antico

**See Also**

Other Shiny: [ArgNullCheck2\(\)](#), [ArgNullCheck\(\)](#), [BlankRow\(\)](#), [DateInput\(\)](#), [GenerateEvaluationMetrics\(\)](#), [NumericInput\(\)](#), [PickerInput\(\)](#), [PreparePlotData\(\)](#), [ReactiveLoadCSV\(\)](#), [ReturnParam\(\)](#), [StoreArgs\(\)](#), [TextInput\(\)](#), [observeEventLoad\(\)](#)

**Examples**

```
## Not run:
output$TS_CARMA_HolidayMovingAverages <- renderUI({
  RemixAutoML::PickerInput_GetLevels(
    input, InputID = "TS_CARMA_HolidayMovingAverages", Label = "Select Holiday Count MA's", Choices = as.character(0:50),
    SelectedDefault = as.character(c(1,2)), Size = 10, SelectedText = "count > 1", Multiple = TRUE, ActionBox = TRUE
  )
})
```



```
## End(Not run)
```

---

PlotGUI	<i>PlotGUI</i>
---------	----------------

---

**Description**

Spin up the esquisse plotting gui

**Usage**

```
PlotGUI()
```

**See Also**

Other EDA: [AutoWordFreq\(\)](#), [EDA\\_Histograms\(\)](#), [Mode\(\)](#), [ScatterCopula\(\)](#), [UserBaseEvolution\(\)](#)

---

PreparePlotData	<i>PreparePlotData</i>
-----------------	------------------------

---

**Description**

PreparePlotData automatically builds a picker input with tryCatch's and ProjectList argument usage if it exists

**Usage**

```
PreparePlotData(  
  input,  
  PlotDataForecast,  
  SubsetOnly = FALSE,  
  Aggregate = NULL,  
  TargetVariable = NULL,  
  DateVariable = NULL,  
  GroupVariables = NULL,  
  G1Levels = NULL,  
  G2Levels = NULL,  
  G3Levels = NULL,  
  Debug = FALSE  
)
```

**Arguments**

input	input object within shiny context
PlotDataForecast	Source data in shiny app
SubsetOnly	Set to TRUE to only subset data
Aggregate	Session object indicating whether to use mean or sum

TargetVariable	Target variable name
DateVariable	Date variable name
GroupVariables	Group variable names
G1Levels	Name of group 1 levels list element
G2Levels	Name of group 2 levels list element
G3Levels	Name of group 3 levels list element
Debug	FALSE

### Value

PreparePlotData object for server.R to

### Author(s)

Adrian Antico

### See Also

Other Shiny: [ArgNullCheck2\(\)](#), [ArgNullCheck\(\)](#), [BlankRow\(\)](#), [DateInput\(\)](#), [GenerateEvaluationMetrics\(\)](#), [NumericInput\(\)](#), [PickerInput\\_GetLevels\(\)](#), [PickerInput\(\)](#), [ReactiveLoadCSV\(\)](#), [ReturnParam\(\)](#), [StoreArgs\(\)](#), [TextInput\(\)](#), [observeEventLoad\(\)](#)

### Examples

```
## Not run:
PlotData <- RemixAutoML::PreparePlotData(
  input,
  PlotDataForecast,
  SubsetOnly = FALSE,
  Aggregate = "mean",
  TargetVariable = "TargetVariables",
  DateVariable = "DateVariables",
  GroupVariables = GroupVariables,
  G1Levels = "TS_Group1Levels",
  G2Levels = "TS_Group2Levels",
  G3Levels = "TS_Group3Levels")

## End(Not run)
```

---

PrintToPDF

*PrintToPDF*

---

### Description

PrintToPDF

**Usage**

```
PrintToPDF(
  Path,
  OutputName,
  ObjectList = NULL,
  Tables = FALSE,
  MaxPages = 500,
  Title = "Model Output",
  Width = 12,
  Height = 7,
  Paper = "USr",
  BackgroundColor = "transparent",
  ForegroundColor = "black"
)
```

**Arguments**

Path	Path file to the location where you want your pdf saved
OutputName	Supply a name for the file you want saved
ObjectList	List of objects to print to pdf
Tables	TRUE for data tables, FALSE for plots
MaxPages	Default of 500
Title	The title of the pdf
Width	Default is 12
Height	Default is 7
Paper	'USr' for landscape. 'special' means that Width and Height are used to determine page size
BackgroundColor	Default is 'transparent'
ForegroundColor	Default is 'black'

**Author(s)**

Adrian Antico

---

ReactiveLoadCSV

---

ReactiveLoadCSV

---

**Description**

Use this function to import csv's, track the time it was imported, and remove other objects

**Usage**

```
ReactiveLoadCSV(
  input,
  InputVal = NULL,
  ProjectList = NULL,
  DateUpdateName = NULL,
  RemoveObjects = NULL
)
```

**Arguments**

input	Passthrough
InputVal	Values that follows input\$
ProjectList	Supply the project list if available. NULL otherwise
DateUpdateName	Supply the name for the ProjectList to store the import time
RemoveObjects	List of objects to remove

**Author(s)**

Adrian Antico

**See Also**

Other Shiny: [ArgNullCheck2\(\)](#), [ArgNullCheck\(\)](#), [BlankRow\(\)](#), [DateInput\(\)](#), [GenerateEvaluationMetrics\(\)](#), [NumericInput\(\)](#), [PickerInput\\_GetLevels\(\)](#), [PickerInput\(\)](#), [PreparePlotData\(\)](#), [ReturnParam\(\)](#), [StoreArgs\(\)](#), [TextInput\(\)](#), [observeEventLoad\(\)](#)

---

RedYellowGreen

*RedYellowGreen*


---

**Description**

This function will find the optimal thresholds for applying the main label and for finding the optimal range for doing nothing when you can quantify the cost of doing nothing

**Usage**

```
RedYellowGreen(
  data,
  PredictColNumber = 2,
  ActualColNumber = 1,
  TruePositiveCost = 0,
  TrueNegativeCost = 0,
  FalsePositiveCost = -10,
  FalseNegativeCost = -50,
  MidTierCost = -2,
  Cores = 8,
  Precision = 0.01,
  Boundaries = c(0.05, 0.75)
)
```

**Arguments**

<code>data</code>	data is the data table with your predicted and actual values from a classification model
<code>PredictColNumber</code>	The column number where the prediction variable is located (in binary form)
<code>ActualColNumber</code>	The column number where the target variable is located
<code>TruePositiveCost</code>	This is the utility for generating a true positive prediction
<code>TrueNegativeCost</code>	This is the utility for generating a true negative prediction
<code>FalsePositiveCost</code>	This is the cost of generating a false positive prediction
<code>FalseNegativeCost</code>	This is the cost of generating a false negative prediction
<code>MidTierCost</code>	This is the cost of doing nothing (or whatever it means to not classify in your case)
<code>Cores</code>	Number of cores on your machine
<code>Precision</code>	Set the decimal number to increment by between 0 and 1
<code>Boundaries</code>	Supply a vector of two values c(lower bound, upper bound) where the first value is the smallest threshold you want to test and the second value is the largest value you want to test. Note, if your results are at the boundaries you supplied, you should extent the boundary that was reached until the values is within both revised boundaries.

**Value**

A data table with all evaluated strategies, parameters, and utilities, along with a 3d scatterplot of the results

**Author(s)**

Adrian Antico

**See Also**

Other Model Evaluation and Interpretation: [AutoShapeShap\(\)](#), [CumGainsChart\(\)](#), [EvalPlot\(\)](#), [ParDepCalPlots\(\)](#), [ROCPlot\(\)](#), [ResidualPlots\(\)](#), [SingleRowShapeShap\(\)](#), [threshOptim\(\)](#)

**Examples**

```
## Not run:
data <- data.table::data.table(Target = runif(10))
data[, x1 := qnorm(Target)]
data[, x2 := runif(10)]
data[, Predict := log(pnorm(0.85 * x1 +
  sqrt(1-0.85^2) * qnorm(x2)))]
data[, ':= ' (x1 = NULL, x2 = NULL)]
data <- RedYellowGreen(
  data,
  PredictColNumber = 2,
```

```

ActualColNumber = 1,
TruePositiveCost = 0,
TrueNegativeCost = 0,
FalsePositiveCost = -1,
FalseNegativeCost = -2,
MidTierCost = -0.5,
Precision = 0.01,
Cores = 1,
Boundaries = c(0.05,0.75))

## End(Not run)

```

---

ResidualOutliers

*ResidualOutliers*


---

## Description

ResidualOutliers is an automated time series outlier detection function that utilizes tsoutliers and auto.arima. It looks for five types of outliers: "AO" Additive outlier - a singular extreme outlier that surrounding values aren't affected by; "IO" Innovational outlier - Initial outlier with subsequent anomalous values; "LS" Level shift - An initial outlier with subsequent observations being shifted by some constant on average; "TC" Transient change - initial outlier with lingering effects that dissipate exponentially over time; "SLS" Seasonal level shift - similar to level shift but on a seasonal scale.

## Usage

```

ResidualOutliers(
  data,
  DateColName = NULL,
  TargetColName = NULL,
  PredictedColName = NULL,
  TimeUnit = "day",
  Lags = 5,
  Diff = 1,
  MA = 5,
  SLags = 0,
  SDiff = 1,
  SMA = 0,
  tstat = 2,
  FixedParams = FALSE
)

```

## Arguments

data	the source residuals data.table
DateColName	The name of your data column to use in reference to the target variable
TargetColName	The name of your target variable column
PredictedColName	The name of your predicted value column. If you supply this, you will run anomaly detection of the difference between the target variable and your predicted value. If you leave PredictedColName NULL then you will run anomaly detection over the target variable.

TimeUnit	The time unit of your date column: hour, day, week, month, quarter, year
Lags	the largest lag or moving average (seasonal too) values for the arima fit
Diff	The largest d value for differencing
MA	Max moving average
SLags	Max seasonal lags
SDiff	The largest d value for seasonal differencing
SMA	Max seasonal moving averages
tstat	the t-stat value for tsoutliers
FixedParams	Set to TRUE or FALSE. If TRUE, a stats::Arima() model is fitted with those parameter values. If FALSE, then an auto.arima is built with the parameter values representing the max those values can be.

**Value**

A named list containing FullData = original data.table with outliers data and ARIMA\_MODEL = the arima model object

**Author(s)**

Adrian Antico

**See Also**

Other Unsupervised Learning: [AutoClusteringScoring\(\)](#), [AutoClustering\(\)](#), [GenTSAnomVars\(\)](#), [H2OIsolationForestScoring\(\)](#), [H2OIsolationForest\(\)](#)

**Examples**

```
## Not run:
data <- data.table::data.table(
  DateTime = as.Date(Sys.time()),
  Target = as.numeric(
    stats::filter(
      rnorm(1000, mean = 50, sd = 20),
      filter=rep(1,10),
      circular=TRUE)))
data[, temp := seq(1:1000)][, DateTime := DateTime - temp][, temp := NULL]
data.table::setorderv(x = data, cols = 'DateTime', 1)
data[, Predicted := as.numeric(
  stats::filter(
    rnorm(1000, mean = 50, sd = 20),
    filter=rep(1,10),
    circular=TRUE))]
Output <- ResidualOutliers(
  data = data,
  DateColName = "DateTime",
  TargetColName = "Target",
  PredictedColName = NULL,
  TimeUnit = "day",
  Lags = 5,
  Diff = 1,
  MA = 5,
  SLags = 0,
```

```

    SDiff = 0,
    SMA = 0,
    tstat = 4)
data <- Output[['FullData']]
model <- Output[['ARIMA_MODEL']]
outliers <- data[type != "<NA>"]

## End(Not run)

```

---

ResidualPlots

*ResidualPlots*


---

## Description

Residual plots for regression models

## Usage

```

ResidualPlots(
  TestData = NULL,
  Target = "Adrian",
  Predicted = "Independent_Variable1",
  DateColumnName = NULL,
  Gam_Fit = FALSE
)

```

## Arguments

```

  TestData      = NULL,
  Target        = "Adrian",
  Predicted     = "Independent_Variable1",
  DateColumnName "DateTime"
  Gam_Fit      = TRUE

```

## Author(s)

Adrian Antico

## See Also

Other Model Evaluation and Interpretation: [AutoShapeShap\(\)](#), [CumGainsChart\(\)](#), [EvalPlot\(\)](#), [ParDepCalPlots\(\)](#), [ROCPlot\(\)](#), [RedYellowGreen\(\)](#), [SingleRowShapeShap\(\)](#), [threshOptim\(\)](#)

## Examples

```

## Not run:
# Create fake data
test_data <- RemixAutoML::FakeDataGenerator(
  Correlation = 0.80,
  N = 250000,
  ID = 0,
  FactorCount = 0,

```



```

    AddDate = TRUE,
    AddComment = FALSE,
    AddWeightsColumn = FALSE,
    ZIP = 0)

# Build Plots
output <- RemixAutoML::ResidualPlots(
  TestData = test_data,
  Target = "Adrian",
  Predicted = "Independent_Variable1",
  DateColumnName = "DateTime",
  Gam_Fit = TRUE)

## End(Not run)

```

---

ReturnParam	<i>Save VarName values within a project</i>
-------------	---

---

## Description

Automatically save VarNames to project list

## Usage

```
ReturnParam(input, VarName, Type, Default, Switch = FALSE)
```

## Arguments

input	This is the input value within a Shiny context
VarName	The name of the VarNameument you want to store
Type	"character" "numeric" "logical"
Default	default value
Switch	= FALSE

## Value

Updates ProjectList inside function

## Author(s)

Adrian Antico

## See Also

Other Shiny: [ArgNullCheck2\(\)](#), [ArgNullCheck\(\)](#), [BlankRow\(\)](#), [DateInput\(\)](#), [GenerateEvaluationMetrics\(\)](#), [NumericInput\(\)](#), [PickerInput\\_GetLevels\(\)](#), [PickerInput\(\)](#), [PreparePlotData\(\)](#), [ReactiveLoadCSV\(\)](#), [StoreArgs\(\)](#), [TextInput\(\)](#), [observeEventLoad\(\)](#)

Examples

```
## Not run:
Aggregate <- RemixAutoML::ReturnParam(input, VarName = "TS_AggregateFunction", Type = "character", Default = "
## End(Not run)
```

---

ROCPlot	<i>ROCPlot</i>
---------	----------------

---

Description

Internal usage for classification methods. Returns an ROC plot

Usage

```
ROCPlot(
  data = ValidationData,
  TargetName = TargetColumnName,
  SavePlot = SaveModelObjects,
  Name = ModelID,
  metapath = metadata_path,
  modelpath = model_path
)
```

Arguments

data	validation data
TargetName	Target variable name
SavePlot	TRUE or FALSE
Name	Name for saving
metapath	Passthrough
modelpath	Passthrough

Value

ROC Plot for classification models

Author(s)

Adrian Antico

See Also

Other Model Evaluation and Interpretation: [AutoShapeShap\(\)](#), [CumGainsChart\(\)](#), [EvalPlot\(\)](#), [ParDepCalPlots\(\)](#), [RedYellowGreen\(\)](#), [ResidualPlots\(\)](#), [SingleRowShapeShap\(\)](#), [threshOptim\(\)](#)

---

**RunRemixAutoML***RunRemixAutoML*

---

**Description**

GUI for running RemixAutoML functions. Time series evaluation and forecasting, machine learning, etc.

**Usage**

```
RunRemixAutoML(  
  data = NULL,  
  ModelOutput = NULL,  
  TargetName = NULL,  
  PredictName = NULL,  
  DateName = NULL,  
  Debug = FALSE  
)
```

**Author(s)**

Adrian Antico

**See Also**

Other GUI: [AppsPlotting\(\)](#)

---

**ScatterCopula***ScatterCopula*

---

**Description**

Dual plot. One on original scale and one using empirical copula data

**Usage**

```
ScatterCopula(  
  data = NULL,  
  x_var = NULL,  
  y_var = NULL,  
  GroupVariable = NULL,  
  FacetCol = NULL,  
  FacetRow = NULL,  
  SizeVar1 = NULL,  
  SampleCount = 100000L,  
  FitGam = TRUE,  
  color = "darkblue",  
  point_size = 0.5,  
  text_size = 12,  
  x_axis_text_angle = 35,
```

```

    y_axis_text_angle = 0,
    chart_color = "lightsteelblue1",
    border_color = "darkblue",
    text_color = "darkblue",
    grid_color = "white",
    background_color = "gray95",
    legend_position = "bottom"
)

```

### Arguments

<code>data</code>	Source data.table
<code>x_var</code>	Numeric variable
<code>y_var</code>	Numeric variable
<code>GroupVariable</code>	Color options
<code>FacetCol</code>	NULL or string
<code>FacetRow</code>	NULL or string
<code>SizeVar1</code>	NULL. Use to size the dots by a variable
<code>SampleCount</code>	Number of randomized rows to utilize. For speedup and memory purposes
<code>FitGam</code>	Add gam fit to scatterplot and copula plot
<code>color</code>	= "darkblue"
<code>point_size</code>	= 0.50
<code>text_size</code>	= 12
<code>x_axis_text_angle</code>	= 35
<code>y_axis_text_angle</code>	= 0
<code>chart_color</code>	= "lightsteelblue1"
<code>border_color</code>	= "darkblue"
<code>text_color</code>	= "darkblue"
<code>grid_color</code>	= "white"
<code>background_color</code>	= "gray95"
<code>legend_position</code>	= "bottom"

### Author(s)

Adrian Antico

### See Also

Other EDA: [AutoWordFreq\(\)](#), [EDA\\_Histograms\(\)](#), [Mode\(\)](#), [PlotGUI\(\)](#), [UserBaseEvolution\(\)](#)

**Examples**

```

\donerun{
# Create data
data <- RemixAutoML::FakeDataGenerator()

# Build plot
RemixAutoML::ScatterCopula(
  data = data,
  x_var = 'Independent_Variable1',
  y_var = 'Independent_Variable2',
  GroupVariable = NULL, #'Factor_1',
  FacetCol = 'Factor_1',
  FacetRow = NULL,
  SizeVar1 = 'Independent_Variable1',
  SampleCount = 100000L,
  FitGam = FALSE,
  color = "darkblue",
  point_size = 0.50,
  text_size = 12,
  x_axis_text_angle = 35,
  y_axis_text_angle = 0,
  chart_color = "lightsteelblue1",
  border_color = "darkblue",
  text_color = "darkblue",
  grid_color = "white",
  background_color = "gray95",
  legend_position = "bottom")
}

```

---

SingleRowShapeShap	<i>SingleRowShapeShap</i>
--------------------	---------------------------

---

**Description**

SingleRowShapeShap will convert a single row of your shap data into a table

**Usage**

```
SingleRowShapeShap(ShapData = NULL, EntityID = NULL, DateColumnName = NULL)
```

**Arguments**

ShapData	Scoring data from AutoCatBoostScoring with classification or regression
----------	---

**Author(s)**

Adrian Antico

**See Also**

Other Model Evaluation and Interpretation: [AutoShapeShap\(\)](#), [CumGainsChart\(\)](#), [EvalPlot\(\)](#), [ParDepCalPlots\(\)](#), [ROCPlot\(\)](#), [RedYellowGreen\(\)](#), [ResidualPlots\(\)](#), [threshOptim\(\)](#)

---

SQL_ClearTable	<i>SQL_ClearTable</i>
----------------	-----------------------

---

**Description**

SQL\_ClearTable remove all rows from a database table

**Usage**

```
SQL_ClearTable(  
    DBConnection,  
    SQLTableName = "",  
    CloseChannel = TRUE,  
    Errors = TRUE  
)
```

**Arguments**

DBConnection	RemixAutoML::SQL_Server_DBConnection()
SQLTableName	The SQL statement you want to run
CloseChannel	TRUE to close when done, FALSE to leave the channel open
Errors	Set to TRUE to halt, FALSE to return -1 in cases of errors

**Author(s)**

Adrian Antico

**See Also**

Other Database: [AutoDataDictionaries\(\)](#), [SQL\\_DropTable\(\)](#), [SQL\\_Query\\_Push\(\)](#), [SQL\\_Query\(\)](#), [SQL\\_SaveTable\(\)](#), [SQL\\_Server\\_DBConnection\(\)](#)

---

SQL_DropTable	<i>SQL_DropTable</i>
---------------	----------------------

---

**Description**

SQL\_DropTable drop a database table

**Usage**

```
SQL_DropTable(  
    DBConnection,  
    SQLTableName = "",  
    CloseChannel = TRUE,  
    Errors = TRUE  
)
```

**Arguments**

DBConnection	RemixAutoML::SQL_Server_DBConnection()
SQLTableName	The SQL statement you want to run
CloseChannel	TRUE to close when done, FALSE to leave the channel open
Errors	Set to TRUE to halt, FALSE to return -1 in cases of errors

**Author(s)**

Adrian Antico

**See Also**

Other Database: [AutoDataDictionaries\(\)](#), [SQL\\_ClearTable\(\)](#), [SQL\\_Query\\_Push\(\)](#), [SQL\\_Query\(\)](#), [SQL\\_SaveTable\(\)](#), [SQL\\_Server\\_DBConnection\(\)](#)

---

SQL_Query	<i>SQL_Query</i>
-----------	------------------

---

**Description**

SQL\_Query get data from a database table

**Usage**

```
SQL_Query(  
  DBConnection,  
  Query,  
  ASIS = FALSE,  
  CloseChannel = TRUE,  
  RowsPerBatch = 1024  
)
```

**Arguments**

DBConnection	RemixAutoML::SQL_Server_DBConnection()
Query	The SQL statement you want to run
ASIS	Auto column typing
CloseChannel	TRUE to close when done, FALSE to leave the channel open
RowsPerBatch	Rows default is 1024

**Author(s)**

Adrian Antico

**See Also**

Other Database: [AutoDataDictionaries\(\)](#), [SQL\\_ClearTable\(\)](#), [SQL\\_DropTable\(\)](#), [SQL\\_Query\\_Push\(\)](#), [SQL\\_SaveTable\(\)](#), [SQL\\_Server\\_DBConnection\(\)](#)

---

SQL_Query_Push	<i>SQL_Query_Push</i>
----------------	-----------------------

---

**Description**

SQL\_Query\_Push push data to a database table

**Usage**

```
SQL_Query_Push(DBConnection, Query, CloseChannel = TRUE)
```

**Arguments**

DBConnection	RemixAutoML::SQL_Server_DBConnection()
Query	The SQL statement you want to run
CloseChannel	TRUE to close when done, FALSE to leave the channel open

**Author(s)**

Adrian Antico

**See Also**

Other Database: [AutoDataDictionaries\(\)](#), [SQL\\_ClearTable\(\)](#), [SQL\\_DropTable\(\)](#), [SQL\\_Query\(\)](#), [SQL\\_SaveTable\(\)](#), [SQL\\_Server\\_DBConnection\(\)](#)

---

SQL_SaveTable	<i>SQL_SaveTable</i>
---------------	----------------------

---

**Description**

SQL\_SaveTable create a database table

**Usage**

```
SQL_SaveTable(  
  DataToPush,  
  DBConnection,  
  SQLTableName = "",  
  RowNames = NULL,  
  ColNames = TRUE,  
  CloseChannel = TRUE,  
  AppendData = FALSE,  
  AddPK = TRUE,  
  Safer = TRUE  
)
```



**Arguments**

DataToPush	data to be sent to warehouse
DBConnection	RemixAutoML::SQL_Server_DBConnection()
SQLTableName	The SQL statement you want to run
RowNames	c("Segment","Date")
ColNames	Column names in first row
CloseChannel	TRUE to close when done, FALSE to leave the channel open
AppendData	TRUE or FALSE
AddPK	Add a PK column to table
Safer	TRUE

**Author(s)**

Adrian Antico

**See Also**

Other Database: [AutoDataDictionaries\(\)](#), [SQL\\_ClearTable\(\)](#), [SQL\\_DropTable\(\)](#), [SQL\\_Query\\_Push\(\)](#), [SQL\\_Query\(\)](#), [SQL\\_Server\\_DBConnection\(\)](#)

---

SQL\_Server\_DBConnection

*SQL\_Server\_DBConnection*

---

**Description**

SQL\_Server\_DBConnection makes a connection to a sql server database

**Usage**

```
SQL_Server_DBConnection(DataBaseName = "", Server = "")
```

**Arguments**

DataBaseName	Name of the database
Server	Name of the server to use

**Author(s)**

Adrian Antico

**See Also**

Other Database: [AutoDataDictionaries\(\)](#), [SQL\\_ClearTable\(\)](#), [SQL\\_DropTable\(\)](#), [SQL\\_Query\\_Push\(\)](#), [SQL\\_Query\(\)](#), [SQL\\_SaveTable\(\)](#)

---

StoreArgs	<i>Store Args values within a project</i>
-----------	---

---

## Description

Automatically save VarNameuments to project list

## Usage

```
StoreArgs(input, ProjectList, VarName, Type, Default)
```

## Arguments

input	This is the input value within a Shiny context
ProjectList	This is the VarNameument collection list
VarName	The name of the VarNameument you want to store
Type	"character" "numeric" "logical"
Default	default value that gets saved

## Value

Updates ProjectList inside function. Do not assign function to anything

## Author(s)

Adrian Antico

## See Also

Other Shiny: [ArgNullCheck2\(\)](#), [ArgNullCheck\(\)](#), [BlankRow\(\)](#), [DateInput\(\)](#), [GenerateEvaluationMetrics\(\)](#), [NumericInput\(\)](#), [PickerInput\\_GetLevels\(\)](#), [PickerInput\(\)](#), [PreparePlotData\(\)](#), [ReactiveLoadCSV\(\)](#), [ReturnParam\(\)](#), [TextInput\(\)](#), [observeEventLoad\(\)](#)

## Examples

```
## Not run:  
StoreVarNames(input, ProjectList, "NTrees", "numeric", 1000)  
  
## End(Not run)
```

---

TextInput	<i>TextInput</i>
-----------	------------------

---

## Description

TextInput automatically builds a text input with ProjectList argument usage if it exists

## Usage

```
TextInput(
  InputID = "TS_CARMA_HolidayMovingAverages",
  Label = "Path to Data",
  Value = NULL,
  Width = "100%",
  Placeholder = "NULL"
)
```

## Arguments

InputID	Feeds ProjectList and inputId. Argument saved in ProjectList
Label	Feeds label
Value	Default
Width	width arg
Format	Date format

## Value

PickerInput object for server.R to go into renderUI(PickerInput())

## Author(s)

Adrian Antico

## See Also

Other Shiny: [ArgNullCheck2\(\)](#), [ArgNullCheck\(\)](#), [BlankRow\(\)](#), [DateInput\(\)](#), [GenerateEvaluationMetrics\(\)](#), [NumericInput\(\)](#), [PickerInput\\_GetLevels\(\)](#), [PickerInput\(\)](#), [PreparePlotData\(\)](#), [ReactiveLoadCSV\(\)](#), [ReturnParam\(\)](#), [StoreArgs\(\)](#), [observeEventLoad\(\)](#)

## Examples

```
## Not run:
output$TS_Date <- renderUI({
  RemixAutoML::TextInput(InputID = "TS_CARMA_HolidayMovingAverages",
    Label = "Import Data Creation Date",
    Value = Sys.Date(),
    Placeholder = "yyyy-mm-dd"))

## End(Not run)
```

---

threshOptim	<i>threshOptim</i>
-------------	--------------------

---

### Description

threshOptim will return the utility maximizing threshold for future predictions along with the data generated to estimate the threshold

### Usage

```
threshOptim(
  data,
  actTar = "target",
  predTar = "p1",
  tpProfit = 0,
  tnProfit = 0,
  fpProfit = -1,
  fnProfit = -2,
  MinThresh = 0.001,
  MaxThresh = 0.999,
  ThresholdPrecision = 0.001
)
```

### Arguments

data	data is the data table you are building the modeling on
actTar	The column name where the actual target variable is located (in binary form)
predTar	The column name where the predicted values are located
tpProfit	This is the utility for generating a true positive prediction
tnProfit	This is the utility for generating a true negative prediction
fpProfit	This is the cost of generating a false positive prediction
fnProfit	This is the cost of generating a false negative prediction
MinThresh	Minimum value to consider for model threshold
MaxThresh	Maximum value to consider for model threshold
ThresholdPrecision	Incrementing value in search

### Value

Optimal threshold and corresponding utilities for the range of thresholds tested

### Author(s)

Adrian Antico

### See Also

Other Model Evaluation and Interpretation: [AutoShapeShap\(\)](#), [CumGainsChart\(\)](#), [EvalPlot\(\)](#), [ParDepCalPlots\(\)](#), [ROCPlot\(\)](#), [RedYellowGreen\(\)](#), [ResidualPlots\(\)](#), [SingleRowShapeShap\(\)](#)

**Examples**

```
## Not run:
data <- data.table::data.table(Target = runif(10))
data[, x1 := qnorm(Target)]
data[, x2 := runif(10)]
data[, Predict := log(pnorm(0.85 * x1 + sqrt(1-0.85^2) * qnorm(x2)))]
data[, ':= ' (x1 = NULL, x2 = NULL)]
data <- threshOptim(data      = data,
                    actTar   = "Target",
                    predTar  = "Predict",
                    tpProfit = 0,
                    tnProfit = 0,
                    fpProfit = -1,
                    fnProfit = -2,
                    MinThresh = 0.001,
                    MaxThresh = 0.999,
                    ThresholdPrecision = 0.001)
optimalThreshold <- data$Thresholds
allResults <- data$EvaluationTable

## End(Not run)
```

---

TimeSeriesDataPrepare *TimeSeriesDataPrepare*


---

**Description**

TimeSeriesDataPrepare is a function that takes raw data and returns the necessary time series data and objects for model building. It also fills any time gaps with zeros. Use this before you run any time series model functions.

**Usage**

```
TimeSeriesDataPrepare(
  data,
  TargetName,
  DateName,
  Lags,
  SeasonalLags,
  MovingAverages,
  SeasonalMovingAverages,
  TimeUnit,
  FCPeriods,
  HoldOutPeriods,
  TSClean = TRUE,
  ModelFreq = TRUE,
  FinalBuild = FALSE
)
```

**Arguments**

data                      Source data.table for forecasting

TargetName	Name of your target variable
DateName	Name of your date variable
Lags	The max number of lags you want to test
SeasonalLags	The max number of seasonal lags you want to test
MovingAverages	The max number of moving average terms
SeasonalMovingAverages	The max number of seasonal moving average terms
TimeUnit	The level of aggregation your dataset comes in. Choices include: 1Min, 5Min, 10Min, 15Min, and 30Min, hour, day, week, month, quarter, year
FCPeriods	The number of forecast periods you want to have forecasted
HoldOutPeriods	The number of holdout samples to compare models against
TSClean	TRUE or FALSE. TRUE will kick off a time series cleaning operation. Outliers will be smoothed and imputation will be conducted.
ModelFreq	TRUE or FALSE. TRUE will enable a model-based time frequency calculation for an alternative frequency value to test models on.
FinalBuild	Set to TRUE to create data sets with full data

**Value**

Time series data sets to pass onto auto modeling functions

**Author(s)**

Adrian Antico

**Examples**

```
## Not run:
data <- data.table::fread(
  file.path(PathNormalizer(
    "C:\\Users\\aantico\\Documents\\Package\\data"),
    "tsdata.csv"))
TimeSeriesDataPrepare(
  data = data,
  TargetName = "Weekly_Sales",
  DateName = "Date",
  Lags = 5,
  MovingAverages,
  SeasonalMovingAverages,
  SeasonalLags = 1,
  TimeUnit = "week",
  FCPeriods = 10,
  HoldOutPeriods = 10,
  TSClean = TRUE,
  ModelFreq = TRUE,
  FinalBuild = FALSE)

## End(Not run)
```

---

TimeSeriesFill	<i>TimeSeriesFill</i>
----------------	-----------------------

---

## Description

TimeSeriesFill For Completing Time Series Data For Single Series or Time Series by Group

## Usage

```
TimeSeriesFill(
  data = data,
  DateColumnName = "Date",
  GroupVariables = c("Store", "Dept"),
  TimeUnit = "weeks",
  FillType = c("maxmax", "minmax", "maxmin", "minmin"),
  MaxMissingPercent = 0.05,
  SimpleImpute = FALSE
)
```

## Arguments

data	Supply your full series data set here
DateColumnName	Supply the name of your date column
GroupVariables	Supply the column names of your group variables. E.g. "Group" or c("Group1","Group2")
TimeUnit	Choose from "second", "minute", "hour", "day", "week", "month", "quarter", "year"
FillType	Choose from maxmax - Fill from the absolute min date to the absolute max date, minmax - Fill from the max date of the min set to the absolute max date, maxmin - Fill from the absolute min date to the min of the max dates, or minmin - Fill from the max date of the min dates to the min date of the max dates
MaxMissingPercent	The maximum amount of missing values an individual series can have to remain and be imputed. Otherwise, they are discarded.
SimpleImpute	Set to TRUE or FALSE. With TRUE numeric cols will fill NAs with a -1 and non-numeric cols with a "0"

## Value

Returns a data table with missing time series records filled (currently just zeros)

## Author(s)

Adrian Antico

## See Also

Other Feature Engineering: [AutoDataPartition\(\)](#), [AutoDiffLagN\(\)](#), [AutoHierarchicalFourier\(\)](#), [AutoInteraction\(\)](#), [AutoLagRollMode\(\)](#), [AutoLagRollStatsScoring\(\)](#), [AutoLagRollStats\(\)](#), [AutoTransformationCreate\(\)](#), [AutoTransformationScore\(\)](#), [AutoWord2VecModeler\(\)](#), [AutoWord2VecScoring\(\)](#), [CategoricalEncoding\(\)](#), [CreateCalendarVariables\(\)](#), [CreateHolidayVariables\(\)](#), [DummifyDT\(\)](#), [H2OAutoencoderScoring\(\)](#), [H2OAutoencoder\(\)](#), [ModelDataPrep\(\)](#)

Examples

```
## Not run:

# Pull in data
data <- data <- data.table::fread("https://www.dropbox.com/s/2str3ek4f4cheqi/walmart_train.csv?dl=1")

# Run function
data <- TimeSeriesFill(
  data,
  DateColumnName = "Date",
  GroupVariables = c("Store", "Dept"),
  TimeUnit = "weeks",
  FillType = "maxmax",
  SimpleImpute = FALSE)

## End(Not run)
```

---

UniqueLevels	<i>UniqueLevels</i>
--------------	---------------------

---

Description

UniqueLevels

Usage

```
UniqueLevels(input, data, n, GroupVars = NULL)
```

Arguments

input	passthrough
data	data.table
GroupVars	passthrough

---

UserBaseEvolution	<i>UserBaseEvolution</i>
-------------------	--------------------------

---

Description

This function creates a table of user counts over time for accumulated unique users, active unique users, new unique users, retained unique users, churned unique users, and reactivated unique users. You can run this with several specifications. You can request monthly, weekly, or daily counts and you can specify a churn window for the computations. If you want to compare how many churned users also churned from another segment of sorts, provide a list in the Cross parameter.



**Usage**

```
UserBaseEvolution(
  data,
  Cross = NULL,
  Entity = NULL,
  DateColumnName = NULL,
  TimeAgg = NULL,
  ChurnPeriods = 1
)
```

**Arguments**

data	Source data.table
Cross	Can be NULL. User base from non source. Must be a named list. Names of list are used to name columns in output table. Entity and DateColumnName must be identical across data sets.
Entity	Column name of the entity / user
DateColumnName	Name of the date column used for inclusion of users in time periods
TimeAgg	Choose from 'Month', 'Week', or 'Day'. Do not lowercase
ChurnPeriods	Defaults to 1. This means for TimeAgg = 'Month' a one month churn period is used. For TimeAgg = 'Week' you will have a one week churn period. If you set ChurnPeriods to 2 then it will be a 2 month churn or a 2 week churn. Same logic applies for daily.

**Author(s)**

Adrian Antico

**See Also**

Other EDA: [AutoWordFreq\(\)](#), [EDA\\_Histograms\(\)](#), [Mode\(\)](#), [PlotGUI\(\)](#), [ScatterCopula\(\)](#)

---

withConsoleRedirect	<i>withConsoleRedirect</i>
---------------------	----------------------------

---

**Description**

withConsoleRedirect

**Usage**

```
withConsoleRedirect(containerId, expr)
```

**Arguments**

containerId	Passthrough
expr	Code

**Examples**

```
## Not run:
library(shiny)
Example usage

ui <- fluidPage(
  pre(id = "console")
)

server <- function(input, output, session) {
  observe({
    invalidateLater(1)

    withConsoleRedirect("console", {
      str(cars)
    })
  })
}

shinyApp(ui, server)

## End(Not run)
```

# Index

- \* **Automated Funnel Data Forecasting**
  - AutoCatBoostFunnelCARMA, [30](#)
  - AutoCatBoostFunnelCARMAScoring, [37](#)
  - AutoLightGBMFunnelCARMA, [195](#)
  - AutoLightGBMFunnelCARMAScoring, [206](#)
  - AutoXGBoostFunnelCARMA, [286](#)
  - AutoXGBoostFunnelCARMAScoring, [293](#)
- \* **Automated Model Hurdle Modeling**
  - AutoCatBoostHurdleModelScoring, [53](#)
  - AutoLightGBMHurdleModelScoring, [232](#)
  - AutoXGBoostHurdleModelScoring, [308](#)
- \* **Automated Model Scoring**
  - AutoCatBoostScoring, [67](#)
  - AutoH2OMLScoring, [161](#)
  - AutoLightGBMScoring, [252](#)
  - AutoXGBoostScoring, [319](#)
- \* **Automated Panel Data Forecasting**
  - AutoCatBoostCARMA, [16](#)
  - AutoCatBoostHurdleCARMA, [40](#)
  - AutoCatBoostVectorCARMA, [72](#)
  - AutoH2OCARMA, [89](#)
  - AutoLightGBMCARMA, [176](#)
  - AutoLightGBMHurdleCARMA, [210](#)
  - AutoXGBoostCARMA, [276](#)
  - AutoXGBoostHurdleCARMA, [295](#)
- \* **Automated Supervised Learning - Binary Classification**
  - AutoCatBoostClassifier, [25](#)
  - AutoH2oDRFClassifier, [97](#)
  - AutoH2oGAMClassifier, [111](#)
  - AutoH2oGBMClassifier, [125](#)
  - AutoH2oGLMClassifier, [140](#)
  - AutoH2oMLClassifier, [153](#)
  - AutoLightGBMClassifier, [187](#)
  - AutoXGBoostClassifier, [282](#)
- \* **Automated Supervised Learning - MultiClass Classification**
  - AutoLightGBMMultiClass, [235](#)
- \* **Automated Supervised Learning - Multiclass Classification**
  - AutoCatBoostMultiClass, [56](#)
  - AutoH2oDRFMultiClass, [103](#)
  - AutoH2oGAMMultiClass, [116](#)
  - AutoH2oGBMMultiClass, [131](#)
  - AutoH2oGLMMultiClass, [144](#)
  - AutoH2oMLMultiClass, [156](#)
  - AutoXGBoostMultiClass, [310](#)
- \* **Automated Supervised Learning - Regression**
  - AutoCatBoostRegression, [61](#)
  - AutoH2oDRFRegression, [107](#)
  - AutoH2oGAMRegression, [120](#)
  - AutoH2oGBMRegression, [135](#)
  - AutoH2oGLMRegression, [148](#)
  - AutoH2oMLRegression, [158](#)
  - AutoLightGBMRegression, [243](#)
  - AutoNLS, [256](#)
  - AutoXGBoostRegression, [315](#)
- \* **Automated Time Series**
  - AutoArfima, [9](#)
  - AutoBanditNNet, [11](#)
  - AutoBanditSarima, [13](#)
  - AutoETS, [87](#)
  - AutoTBATS, [262](#)
  - AutoTS, [267](#)
- \* **Data Wrangling**
  - FakeDataGenerator, [338](#)
- \* **Database**
  - AutoDataDictionaries, [83](#)
  - SQL\_ClearTable, [382](#)
  - SQL\_DropTable, [382](#)
  - SQL\_Query, [383](#)
  - SQL\_Query\_Push, [384](#)
  - SQL\_SaveTable, [384](#)
  - SQL\_Server\_DBConnection, [385](#)
- \* **EDA**
  - AutoWordFreq, [274](#)
  - EDA\_Histograms, [335](#)
  - Mode, [355](#)
  - PlotGUI, [369](#)
  - ScatterCopula, [379](#)
  - UserBaseEvolution, [392](#)
- \* **Feature Engineering**
  - AutoDataPartition, [84](#)

- AutoDiffLagN, 85
- AutoHierarchicalFourier, 164
- AutoInteraction, 165
- AutoLagRollMode, 167
- AutoLagRollStats, 170
- AutoLagRollStatsScoring, 173
- AutoTransformationCreate, 264
- AutoTransformationScore, 266
- AutoWord2VecModeler, 270
- AutoWord2VecScoring, 272
- CategoricalEncoding, 323
- CreateCalendarVariables, 327
- CreateHolidayVariables, 329
- DummifyDT, 333
- H2OAutoencoder, 343
- H2OAutoencoderScoring, 347
- ModelDataPrep, 356
- TimeSeriesFill, 391
- \* **GUI**
  - AppsPlotting, 5
  - RunRemixAutoML, 379
- \* **Graphics**
  - ChartTheme, 326
  - multiplot, 361
- \* **Misc**
  - PrintToPDF, 370
- \* **Model Evaluation and Interpretation**
  - AutoShapeShap, 261
  - CumGainsChart, 331
  - EvalPlot, 337
  - ParDepCalPlots, 365
  - RedYellowGreen, 372
  - ResidualPlots, 376
  - ROCPlot, 378
  - SingleRowShapeShap, 381
  - threshOptim, 388
- \* **Model Insights**
  - ModelInsightsReport, 358
- \* **Recommenders**
  - AutoMarketBasketModel, 255
  - AutoRecommenderDataCreate, 258
  - AutoRecommenderScore, 259
  - AutoRecommenderTrain, 260
- \* **Shiny**
  - ArgNullCheck, 7
  - ArgNullCheck2, 8
  - BlankRow, 323
  - DateInput, 332
  - GenerateEvaluationMetrics, 340
  - NumericInput, 363
  - observeEventLoad, 364
  - PickerInput, 366
  - PickerInput\_GetLevels, 367
  - PreparePlotData, 369
  - ReactiveLoadCSV, 371
  - ReturnParam, 377
  - StoreArgs, 386
  - TextInput, 387
- \* **Supervised Learning - Hurdle Modeling**
  - AutoCatBoostHurdleModel, 48
  - AutoH2oDRFHurdleModel, 101
  - AutoH2oGBMHurdleModel, 129
  - AutoLightGBMHurdleModel, 223
  - AutoXGBoostHurdleModel, 303
- \* **Time Series Helper**
  - TimeSeriesDataPrepare, 389
- \* **Unsupervised Learning**
  - AutoClustering, 79
  - AutoClusteringScoring, 81
  - GenTSAnomVars, 341
  - H2OIsolationForest, 350
  - H2OIsolationForestScoring, 352
  - ResidualOutliers, 374
- AppsPlotting, 5, 379
- ArgNullCheck, 7, 8, 323, 332, 341, 363, 364, 367, 368, 370, 372, 377, 386, 387
- ArgNullCheck2, 7, 8, 323, 332, 341, 363, 364, 367, 368, 370, 372, 377, 386, 387
- AssignData, 8
- AutoArfima, 9, 12, 15, 88, 263, 269
- AutoBanditNNNet, 10, 11, 15, 88, 263, 269
- AutoBanditSarima, 10, 12, 13, 88, 263, 269
- AutoCatBoostCARMA, 16, 44, 76, 94, 183, 216, 280, 299
- AutoCatBoostClassifier, 25, 100, 114, 128, 143, 155, 192, 285
- AutoCatBoostFunnelCARMA, 30, 38, 202, 206, 291, 293
- AutoCatBoostFunnelCARMAScoring, 35, 37, 202, 206, 291, 293
- AutoCatBoostHurdleCARMA, 20, 40, 76, 94, 183, 216, 280, 299
- AutoCatBoostHurdleModel, 48, 103, 131, 228, 306
- AutoCatBoostHurdleModelScoring, 53, 233, 309
- AutoCatBoostMultiClass, 56, 106, 119, 134, 147, 158, 313
- AutoCatBoostRegression, 19, 61, 110, 123, 138, 152, 160, 249, 256, 318
- AutoCatBoostScoring, 67, 163, 254, 321
- AutoCatBoostVectorCARMA, 20, 44, 72, 94, 183, 216, 280, 299
- AutoClustering, 79, 82, 342, 351, 353, 375

- AutoClusteringScoring, 80, 81, 342, 351, 353, 375
- AutoDataDictionaries, 83, 382–385
- AutoDataPartition, 84, 86, 165, 166, 168, 172, 175, 265, 266, 271, 273, 324, 328, 330, 334, 345, 348, 357, 391
- AutoDiffLagN, 85, 85, 165, 166, 168, 172, 175, 265, 266, 271, 273, 324, 328, 330, 334, 345, 348, 357, 391
- AutoETS, 10, 12, 15, 87, 263, 269
- AutoH2OCARMA, 20, 44, 76, 89, 183, 216, 280, 299
- AutoH2oDRFCClassifier, 29, 97, 114, 128, 143, 155, 192, 285
- AutoH2oDRFHurdleModel, 51, 101, 131, 228, 306
- AutoH2oDRFMultiClass, 59, 103, 119, 134, 147, 158, 313
- AutoH2oDRFRegression, 65, 107, 123, 138, 152, 160, 249, 256, 318
- AutoH2oGAMClassifier, 29, 100, 111, 128, 143, 155, 192, 285
- AutoH2oGAMMultiClass, 59, 106, 116, 134, 147, 158, 313
- AutoH2oGAMRegression, 65, 110, 120, 138, 152, 160, 249, 256, 318
- AutoH2oGBMClassifier, 29, 100, 114, 125, 143, 155, 192, 285
- AutoH2oGBMHurdleModel, 51, 103, 129, 228, 306
- AutoH2oGBMMultiClass, 59, 106, 119, 131, 147, 158, 313
- AutoH2oGBMRegression, 65, 110, 123, 135, 152, 160, 249, 256, 318
- AutoH2oGLMClassifier, 29, 100, 114, 128, 140, 155, 192, 285
- AutoH2oGLMMultiClass, 59, 106, 119, 134, 144, 158, 313
- AutoH2oGLMRegression, 65, 110, 123, 138, 148, 160, 249, 256, 318
- AutoH2oMLClassifier, 29, 100, 114, 128, 143, 153, 192, 285
- AutoH2oMLMultiClass, 59, 106, 119, 134, 147, 156, 313
- AutoH2oMLRegression, 65, 110, 123, 138, 152, 158, 249, 256, 318
- AutoH2oMLScoring, 69, 161, 254, 321
- AutoHierarchicalFourier, 85, 86, 164, 166, 168, 172, 175, 265, 266, 271, 273, 324, 328, 330, 334, 345, 348, 357, 391
- AutoInteraction, 85, 86, 165, 165, 168, 172, 175, 265, 266, 271, 273, 324, 328, 330, 334, 345, 348, 357, 391
- AutoLagRollMode, 85, 86, 165, 166, 167, 172, 175, 265, 266, 271, 273, 324, 328, 330, 334, 345, 348, 357, 391
- AutoLagRollStats, 85, 86, 165, 166, 168, 170, 175, 265, 266, 271, 273, 324, 328, 330, 334, 345, 348, 357, 391
- AutoLagRollStatsScoring, 85, 86, 165, 166, 168, 172, 173, 265, 266, 271, 273, 324, 328, 330, 334, 345, 348, 357, 391
- AutoLightGBMCARMA, 20, 44, 76, 94, 176, 216, 280, 299
- AutoLightGBMClassifier, 29, 100, 114, 128, 143, 155, 187, 285
- AutoLightGBMFunnelCARMA, 35, 38, 195, 206, 291, 293
- AutoLightGBMFunnelCARMAScoring, 35, 38, 202, 205, 291, 293
- AutoLightGBMHurdleCARMA, 20, 44, 76, 94, 183, 210, 280, 299
- AutoLightGBMHurdleModel, 51, 103, 131, 223, 306
- AutoLightGBMHurdleModelScoring, 54, 232, 309
- AutoLightGBMMultiClass, 235
- AutoLightGBMRegression, 65, 110, 123, 138, 152, 160, 243, 256, 318
- AutoLightGBMScoring, 69, 163, 252, 321
- AutoMarketBasketModel, 255, 258, 259, 261
- AutoNLS, 65, 110, 123, 138, 152, 160, 249, 256, 318
- AutoRecommenderDataCreate, 255, 258, 259, 261
- AutoRecommenderScore, 255, 258, 259, 261
- AutoRecommenderTrain, 255, 258, 259, 260
- AutoShapeShap, 261, 331, 337, 366, 373, 376, 378, 381, 388
- AutoTBATS, 10, 12, 15, 88, 262, 269
- AutoTransformationCreate, 85, 86, 165, 166, 168, 172, 175, 264, 266, 271, 273, 324, 328, 330, 334, 345, 348, 357, 391
- AutoTransformationScore, 85, 86, 165, 166, 168, 172, 175, 265, 266, 271, 273, 324, 328, 330, 334, 345, 348, 357, 391
- AutoTS, 10, 12, 15, 88, 263, 267
- AutoWord2VecModeler, 85, 86, 165, 166, 168, 172, 175, 265, 266, 270, 273, 324, 328, 330, 334, 345, 348, 357, 391

- AutoWord2VecScoring, [85](#), [86](#), [165](#), [166](#), [168](#), [172](#), [175](#), [265](#), [266](#), [271](#), [272](#), [324](#), [328](#), [330](#), [334](#), [345](#), [348](#), [357](#), [391](#)
- AutoWordFreq, [274](#), [336](#), [356](#), [369](#), [380](#), [393](#)
- AutoXGBoostCARMA, [20](#), [44](#), [76](#), [94](#), [183](#), [216](#), [276](#), [299](#)
- AutoXGBoostClassifier, [29](#), [100](#), [114](#), [128](#), [143](#), [155](#), [192](#), [282](#)
- AutoXGBoostFunnelCARMA, [35](#), [38](#), [202](#), [206](#), [286](#), [293](#)
- AutoXGBoostFunnelCARMAScoring, [35](#), [38](#), [202](#), [206](#), [291](#), [293](#)
- AutoXGBoostHurdleCARMA, [20](#), [44](#), [76](#), [94](#), [183](#), [216](#), [280](#), [295](#)
- AutoXGBoostHurdleModel, [51](#), [103](#), [131](#), [228](#), [303](#)
- AutoXGBoostHurdleModelScoring, [54](#), [233](#), [308](#)
- AutoXGBoostMultiClass, [59](#), [106](#), [119](#), [134](#), [147](#), [158](#), [310](#)
- AutoXGBoostRegression, [65](#), [110](#), [123](#), [138](#), [152](#), [160](#), [249](#), [256](#), [315](#)
- AutoXGBoostScoring, [69](#), [163](#), [254](#), [319](#)
- Bisection, [322](#)
- BlankRow, [7](#), [8](#), [323](#), [332](#), [341](#), [363](#), [364](#), [367](#), [368](#), [370](#), [372](#), [377](#), [386](#), [387](#)
- CategoricalEncoding, [85](#), [86](#), [165](#), [166](#), [168](#), [172](#), [175](#), [265](#), [266](#), [271](#), [273](#), [323](#), [328](#), [330](#), [334](#), [345](#), [348](#), [357](#), [391](#)
- CharNull, [326](#)
- ChartTheme, [326](#), [362](#)
- CreateCalendarVariables, [85](#), [86](#), [165](#), [166](#), [168](#), [172](#), [175](#), [265](#), [266](#), [271](#), [273](#), [324](#), [327](#), [330](#), [334](#), [345](#), [348](#), [357](#), [391](#)
- CreateHolidayVariables, [85](#), [86](#), [165](#), [166](#), [168](#), [172](#), [175](#), [265](#), [266](#), [271](#), [273](#), [324](#), [328](#), [329](#), [334](#), [345](#), [348](#), [357](#), [391](#)
- CumGainsChart, [262](#), [331](#), [337](#), [366](#), [373](#), [376](#), [378](#), [381](#), [388](#)
- DateInput, [7](#), [8](#), [323](#), [332](#), [341](#), [363](#), [364](#), [367](#), [368](#), [370](#), [372](#), [377](#), [386](#), [387](#)
- DummifyDT, [85](#), [86](#), [165](#), [166](#), [168](#), [172](#), [175](#), [265](#), [266](#), [271](#), [273](#), [324](#), [328](#), [330](#), [333](#), [345](#), [348](#), [357](#), [391](#)
- EDA\_Histograms, [275](#), [335](#), [356](#), [369](#), [380](#), [393](#)
- EvalPlot, [262](#), [331](#), [337](#), [366](#), [373](#), [376](#), [378](#), [381](#), [388](#)
- FakeDataGenerator, [338](#)
- FilterLogicData, [339](#)
- FilterValues, [340](#)
- GenerateEvaluationMetrics, [7](#), [8](#), [323](#), [332](#), [340](#), [363](#), [364](#), [367](#), [368](#), [370](#), [372](#), [377](#), [386](#), [387](#)
- GenTSAnomVars, [80](#), [82](#), [341](#), [351](#), [353](#), [375](#)
- GetFilterValueLabel, [342](#)
- GetFilterValueMultiple, [343](#)
- H2OAutoencoder, [85](#), [86](#), [165](#), [166](#), [168](#), [172](#), [175](#), [265](#), [266](#), [271](#), [273](#), [324](#), [328](#), [330](#), [334](#), [343](#), [348](#), [357](#), [391](#)
- H2OAutoencoderScoring, [85](#), [86](#), [165](#), [166](#), [168](#), [172](#), [175](#), [265](#), [266](#), [271](#), [273](#), [324](#), [328](#), [330](#), [334](#), [345](#), [347](#), [357](#), [391](#)
- H2OIsolationForest, [80](#), [82](#), [342](#), [350](#), [353](#), [375](#)
- H2OIsolationForestScoring, [80](#), [82](#), [342](#), [351](#), [352](#), [375](#)
- InsertSortedValue, [354](#)
- IntNull, [355](#)
- KeyVarsInit, [355](#)
- Mode, [275](#), [336](#), [355](#), [369](#), [380](#), [393](#)
- ModelDataPrep, [85](#), [86](#), [165](#), [166](#), [168](#), [172](#), [175](#), [265](#), [266](#), [271](#), [273](#), [324](#), [328](#), [330](#), [334](#), [345](#), [348](#), [356](#), [391](#)
- ModelInsightsReport, [358](#)
- multiplot, [327](#), [361](#)
- NumericInput, [7](#), [8](#), [323](#), [332](#), [341](#), [363](#), [364](#), [367](#), [368](#), [370](#), [372](#), [377](#), [386](#), [387](#)
- NumNull, [364](#)
- observeEventLoad, [7](#), [8](#), [323](#), [332](#), [341](#), [363](#), [364](#), [367](#), [368](#), [370](#), [372](#), [377](#), [386](#), [387](#)
- ParDepCalPlots, [262](#), [331](#), [337](#), [365](#), [373](#), [376](#), [378](#), [381](#), [388](#)
- PickerInput, [7](#), [8](#), [323](#), [332](#), [341](#), [363](#), [364](#), [366](#), [368](#), [370](#), [372](#), [377](#), [386](#), [387](#)
- PickerInput\_GetLevels, [7](#), [8](#), [323](#), [332](#), [341](#), [363](#), [364](#), [367](#), [367](#), [370](#), [372](#), [377](#), [386](#), [387](#)
- PlotGUI, [275](#), [336](#), [356](#), [369](#), [380](#), [393](#)
- PreparePlotData, [7](#), [8](#), [323](#), [332](#), [341](#), [363](#), [364](#), [367](#), [368](#), [369](#), [372](#), [377](#), [386](#), [387](#)

PrintToPDF, [370](#)

ReactiveLoadCSV, [7](#), [8](#), [323](#), [332](#), [341](#), [363](#),  
[364](#), [367](#), [368](#), [370](#), [371](#), [377](#), [386](#),  
[387](#)

RedYellowGreen, [262](#), [331](#), [337](#), [366](#), [372](#),  
[376](#), [378](#), [381](#), [388](#)

RemixAutoML (RemixAutoML-package), [4](#)

RemixAutoML-package, [4](#)

ResidualOutliers, [80](#), [82](#), [342](#), [351](#), [353](#), [374](#)

ResidualPlots, [262](#), [331](#), [337](#), [366](#), [373](#), [376](#),  
[378](#), [381](#), [388](#)

ReturnParam, [7](#), [8](#), [323](#), [332](#), [341](#), [363](#), [364](#),  
[367](#), [368](#), [370](#), [372](#), [377](#), [386](#), [387](#)

ROCPlot, [262](#), [331](#), [337](#), [366](#), [373](#), [376](#), [378](#),  
[381](#), [388](#)

RunRemixAutoML, [6](#), [379](#)

ScatterCopula, [275](#), [336](#), [356](#), [369](#), [379](#), [393](#)

SingleRowShapeShap, [262](#), [331](#), [337](#), [366](#),  
[373](#), [376](#), [378](#), [381](#), [388](#)

SQL\_ClearTable, [84](#), [382](#), [383–385](#)

SQL\_DropTable, [84](#), [382](#), [382](#), [383–385](#)

SQL\_Query, [84](#), [382](#), [383](#), [383](#), [384](#), [385](#)

SQL\_Query\_Push, [84](#), [382](#), [383](#), [384](#), [385](#)

SQL\_SaveTable, [84](#), [382–384](#), [384](#), [385](#)

SQL\_Server\_DBConnection, [84](#), [382–385](#),  
[385](#)

StoreArgs, [7](#), [8](#), [323](#), [332](#), [341](#), [363](#), [364](#), [367](#),  
[368](#), [370](#), [372](#), [377](#), [386](#), [387](#)

TextInput, [7](#), [8](#), [323](#), [332](#), [341](#), [363](#), [364](#), [367](#),  
[368](#), [370](#), [372](#), [377](#), [386](#), [387](#)

threshOptim, [262](#), [331](#), [337](#), [366](#), [373](#), [376](#),  
[378](#), [381](#), [388](#)

TimeSeriesDataPrepare, [389](#)

TimeSeriesFill, [19](#), [85](#), [86](#), [93](#), [165](#), [166](#),  
[168](#), [172](#), [175](#), [180](#), [265](#), [266](#), [271](#),  
[273](#), [279](#), [324](#), [328](#), [330](#), [334](#), [345](#),  
[348](#), [357](#), [391](#)

UniqueLevels, [392](#)

UserBaseEvolution, [275](#), [336](#), [356](#), [369](#), [380](#),  
[392](#)

withConsoleRedirect, [393](#)