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Name	ML_Core
Version	3.2.2
Description	Common definitions for Machine Learning
License	SeeLICENSE.TXT
Copyright	Copyright (C) 2019 HPCC Systems
Authors	HPCCSystems
Platform	6.2.0

OVERVIEW

ML_Core

Core ECL Machine Learning library

Definitions for common types and data manipulation utilities.

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This module is used to turn a dataset of NumericFields into a dataset of DiscreteFields
FieldAggregates.ecl Calculate various statistical aggregations of the fields in a NumericField dataset
FromField.ecl Macro to convert a NumericField formatted, cell-based dataset to a Record formatted dataset
Generate.ecl Increase dimensionality by adding polynomial transforms of the data to create new feature columns
ModelOps2.ecl This module provides a set of operations to provide manipulation of machine learning models (version 2) in the Types.Layout_Model2 format
ToField.ecl Convert a record-oriented dataset to a cell-oriented NumericField dataset for use with Machine Learning mechanisms
Types.ecl This module provides the major data type definitions for use with the various
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Analysis

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DESCRIPTIONS

ANALYSIS Analysis

	Analysis

Analyze and assess the effectiveness of a Machine Learning model.

Sub-modules provide support for both Classification and Regression.

Each of the functions in this module support multi-work-item (i.e. Myriad interface) data, as well as multi-variate data (supported by some ML bundles). The number field, which is usually = 1 for uni-variate data is used to distinguish multiple regressors in the case of multi- variate models.

Children

1. Classification (From Analysis) : This sub-module provides functions for analyzing and assessing the effectiveness of an ML Classification model
2. Regression (From Analysis) : This sub-module provides functions for analyzing and assessing the effectiveness of an ML Regression model
3. FeatureSelection (From Analysis) : This sub module provides functions for assessing the features of a dataset, to perform feature selection

4. Clustering (From Analysis) : This sub module provides various tests that help evaluate the effectiveness of clustering algorithms

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CLASSIFICATION Classification

Analysis \

	Classification

This sub-module provides functions for analyzing and assessing the effectiveness of an ML Classification model. It can be used with any ML Bundle that supports classification.

Children

1. ClassStats (From Classification) : Given a set of expected dependent values, assess the number and percentage of records that were of each class
2. ConfusionMatrix (From Classification) : Returns the Confusion Matrix, counting the number of cases for each combination of predicted Class and actual Class
3. Accuracy (From Classification) : Assess the overall accuracy of the classification predictions
4. AccuracyByClass (From Classification) : Provides per class accuracy / relevance statistics (e.g
5. AUC (From Classification) : AUC Area under the Receiver Operating Characteristics (ROC) curve, is a measure of how well a classifier is able to distinguish between classes

---

CLASSSTATS ClassStats

Analysis \ Classification \

`DATASET(Class_Stats)`	**ClassStats**
`(DATASET(DiscreteField) actual)`	

Given a set of expected dependent values, assess the number and percentage of records that were of each class.

PARAMETER **actual** ||| TABLE (DiscreteField) — The set of training-data or test-data dependent values in DATASET(DiscreteField) format.

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED4 classifier , INTEGER4 class , INTEGER4 classCount , REAL8 classPct })** — DATASET(Class_Stats), one record per work-item, per classifier (i.e. number field) per class.

SEE ML_Core.Types.Class_Stats

CONFUSIONMATRIX ConfusionMatrix

Analysis \ Classification \

DATASET(Confusion_Detail)	**ConfusionMatrix**
(DATASET(DiscreteField) predicted, DATASET(DiscreteField) actual)	

Returns the Confusion Matrix, counting the number of cases for each combination of predicted Class and actual Class.

PARAMETER **predicted** ||| TABLE (DiscreteField) — The predicted values for each id in DATASET(DiscreteField) format.

PARAMETER **actual** ||| TABLE (DiscreteField) — The actual (i.e. expected) values for each id in DATASET(DiscreteField) format.

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED4 classifier , INTEGER4 actual_class , INTEGER4 predict_class , UNSIGNED4 occurs , BOOLEAN correct , REAL8 pctActual , REAL8 pctPred })** — DATASET(Confusion_Detail). One record for each combination of work-item, number (i.e. classifier), predicted class, and actual class.

SEE ML_Core.Types.Confusion_Detail

ACCURACY Accuracy

Analysis \ Classification \

DATASET(Classification_Accuracy)	**Accuracy**
(DATASET(DiscreteField) predicted, DATASET(DiscreteField) actual)	

Assess the overall accuracy of the classification predictions.

ML_Core.Types.Classification_Accuracy provides a detailed description of the return values.

PARAMETER **predicted** ||| TABLE (DiscreteField) — The predicted values for each id in DATASET(DiscreteField) format.

PARAMETER **actual** ||| TABLE (DiscreteField) — The actual (i.e. expected) values for each id in DATASET(DiscreteField) format.

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED4 classifier , UNSIGNED8 recCnt , UNSIGNED8 errCnt , REAL8 Raw_Accuracy , REAL8 PoD , REAL8 PoDE , REAL8 Hamming_Loss })** — DATASET(Classification_Accuracy). One record for each combination of work-item, and number (i.e. classifier).

SEE ML_Core.Types.Classification_Accuracy

ACCURACYBYCLASS AccuracyByClass

Analysis \ Classification \

DATASET(Class_Accuracy)	**AccuracyByClass**
(DATASET(DiscreteField) predicted, DATASET(DiscreteField) actual)	

Provides per class accuracy / relevance statistics (e.g. Precision / Recall, False-positive Rate).

ML_Core.Types.Class_Accuracy provides a detailed description of the return values.

PARAMETER **predicted** ||| TABLE (DiscreteField) — The predicted values for each id in DATASET(DiscreteField) format.

PARAMETER **actual** ||| TABLE (DiscreteField) — The actual (i.e. expected) values for each id in DATASET(DiscreteField) format.

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED4 classifier , INTEGER4 class , REAL8 precision , REAL8 recall , REAL8 FPR , REAL8 f_score })** — DATASET(Class_Accuracy). One record for each combination of work-item, number (i.e. classifier), and class.

SEE ML_Core.Types.Class_Accuracy

AUC AUC

Analysis \ Classification \

DATASET(AUC_Result)	**AUC**
(DATASET(Classification_Scores) scores, DATASET(DiscreteField) actual)	

AUC Area under the Receiver Operating Characteristics (ROC) curve, is a measure of how well a classifier is able to distinguish between classes. The ROC curve is a plot of the true positive rate vs. the false positive rate with varying threshold values. The value of this metric ranges from 0 to 1. Higher values are an indication of better classifiers.

PARAMETER **scores** ||| TABLE (Classification_Scores) — The probability or confidence per class that a sample belongs to that class in DATASET(Classification_Scores) format

PARAMETER **actual** ||| TABLE (DiscreteField) — The actual class to which a sample belongs in DATASET(DiscreteField) format

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED4 classifier , INTEGER4 class , REAL8 auc })** — DATASET(AUC_Result) The AUC score, per class, per classifier, per work item

SEE ML_Core.Types.AUC_Result, ML_Core.Types.Classification_Score

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REGRESSION Regression

Analysis \

	Regression

This sub-module provides functions for analyzing and assessing the effectiveness of an ML Regression model. It can be used with any ML Bundle that supports regression.

Children

1. Accuracy (From Regression) : Assess the overall accuracy of the regression predictions

---

ACCURACY Accuracy

Analysis \ Regression \

DATASET(Regression_Accuracy)	**Accuracy**
(DATASET(NumericField) predicted, DATASET(NumericField) actual)	

Assess the overall accuracy of the regression predictions.

ML_Core.Types.Regression_Accuracy provides a detailed description of the return values.

PARAMETER **predicted** ||| TABLE (NumericField) — The predicted values for each id in DATASET(NumericField) format.

PARAMETER **actual** ||| TABLE (NumericField) — The actual (i.e. expected) values for each id in DATASET(NumericField) format.

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED4 regressor , REAL8 R2 , REAL8 MSE , REAL8 RMSE })** — DATASET(Regression_Accuracy). One record for each combination of work-item, and number (i.e. regressor).

SEE ML_Core.Types.Regression_Accuracy

FEATURESELECTION FeatureSelection

Analysis \

	FeatureSelection

This sub module provides functions for assessing the features of a dataset, to perform feature selection.

Children

1. Contingency (From FeatureSelection) : Contingency Provides the contingency table for each combination of feature and sample (classifier)
2. Chi2 (From FeatureSelection) : Chi2 Provides Chi2 coefficient and number of degrees of freedom for each combination of feature and classifier

---

CONTINGENCY Contingency

Analysis \ FeatureSelection \

DATASET(Contingency_Table)	Contingency
(DATASET(DiscreteField) samples, DATASET(DiscreteField) features)	

Contingency Provides the contingency table for each combination of feature and sample (classifier). The contingency table represents the number of samples present in the data for each combination of sample category and feature category. Can only be used when both classifier and feature are discrete. The sets provided need not be sample / feature sets. They can be any two discrete fields whose contingency table is needed.

PARAMETER **samples** ||| TABLE (DiscreteField) — The samples or dependent values in DATASET(DiscreteField) format

PARAMETER **features** ||| TABLE (DiscreteField) — The features or independent values in DATASET(DiscreteField) format

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED4 fnumber , UNSIGNED4 snumber , INTEGER4 fclass , INTEGER4 sclass , INTEGER8 cnt })** — DATASET(Contingency_Table) The contingency table for each combination of sample (classifier) and feature, per work item

SEE ML_Core.Types.Contingency_Table

CHI2 Chi2

Analysis \ FeatureSelection \

DATASET(Chi2_Result)	Chi2
(DATASET(DiscreteField) features, DATASET(DiscreteField) samples)	

Chi2 Provides Chi2 coefficient and number of degrees of freedom for each combination of feature and classifier. Chi squared test is a statistical measure that helps establish the dependence of two categorical variables. In machine learning, it can be used to determine whether a classifier is dependent on a certain feature, and thus helps in feature selection. This test can only be used when both variables are categorical.

PARAMETER **samples** ||| TABLE (DiscreteField) — The samples or dependent values in DATASET(DiscreteField) format

PARAMETER **features** ||| TABLE (DiscreteField) — The features or independent values in DATASET(DiscreteField) format

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED4 fnumber , UNSIGNED4 snumber , INTEGER8 dof , REAL8 x2 , REAL8 p })** — DATASET(Chi2_Result) Chi square values and degrees of freedom for each combination of feature and classifier, per work item.

SEE ML_Core.Types.Chi2_Result

CLUSTERING Clustering

Analysis \

	Clustering

This sub module provides various tests that help evaluate the effectiveness of clustering algorithms.

Children

1. ARI (From Clustering) : ARI The Rand index is a measure of the similarity between two data clusterings

2. SampleSilhouetteScore (From Clustering) : SampleSilhouetteScore Silhouette analysis measures the closeness of a point, both with its assigned cluster and with other clusters

3. SilhouetteScore (From Clustering) : SilhouetteScore Silhouette analysis measures the closeness of a point, both with its assigned cluster and with other clusters

---

ARI ARI

Analysis \ Clustering \

DATASET(ARI_Result)	**ARI**
(DATASET(ClusterLabels) predicted, DATASET(ClusterLabels) actual)	

ARI The Rand index is a measure of the similarity between two data clusterings. Adjusted Rand Index (ARI) is a version of rand index which is corrected for chance. This measure assumes values between -1 and 1. It produces values close to zero for random clusterings, values close to 1 for good clusterings and values close to -1 for clusterings that are worse than random guesses.

PARAMETER **predicted** ||| TABLE (ClusterLabels) — The labels predicted by the model in DATASET(ClusteringLabels) Format

PARAMETER **actual** ||| TABLE (ClusterLabels) — The actual labels, or the 'Ground Truth' in DATASET(ClusteringLabels) Format

RETURN **TABLE ({ UNSIGNED2 wi , REAL8 value })** — DATASET(ARI_Result) The adjusted rand index per work item

SEE ML_Core.Types.ClusterLabels, ML_Core.Types.ARI_Result

SAMPLESILHOUETTESCORE SampleSilhouetteScore

Analysis \ Clustering \

DATASET(SampleSilhouette_Result)	**SampleSilhouetteScore**
(DATASET(NumericField) samples, DATASET(ClusterLabels) labels)	

SampleSilhouetteScore Silhouette analysis measures the closeness of a point, both with its assigned cluster and with other clusters. It provides an easy way of finding the optimum value for k during k-means clustering. Silhouette values lie in the range of (-1, 1). A value of +1 indicates that the sample point is far away from its neighboring cluster and very close to the cluster to which it is assigned. The euclidian distance metric is used to measure the distances between points.

PARAMETER **samples** ||| TABLE (NumericField) — The datapoints / independent data in DATASET(NumericField) format

PARAMETER **labels** ||| TABLE (ClusterLabels) — The labels assigned to these datapoints in DATASET(ClusterLabels) format

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED8 id , REAL8 value }) —**

SEE ML_Core.Types.SampleSilhouette_Result

RESULT DATASET(SampleSilhouette_Result) The silhouette coefficient per sample, per work item

---

SILHOUETTESCORE SilhouetteScore

Analysis \ Clustering \

DATASET(Silhouette_Result)	**SilhouetteScore**
(DATASET(NumericField) samples, DATASET(ClusterLabels) labels)	

SilhouetteScore Silhouette analysis measures the closeness of a point, both with its assigned cluster and with other clusters. It provides an easy way of finding the optimum value for k during k-means clustering. Silhouette values lie in the range of (-1, 1). A value of +1 indicates that the sample point is far away from its neighboring cluster and very close to the cluster to which it is assigned. The euclidian distance metric is used to measure the distances between points. This function produces an average over SampleSilhouetteScore

PARAMETER **samples** ||| TABLE (NumericField) — The datapoints/independent data in DATASET(NumericField) format

PARAMETER **labels** ||| TABLE (ClusterLabels) — The labels assigned to these datapoints in DATASET(ClusterLabels) format

RETURN **TABLE ({ UNSIGNED2 wi , REAL8 score }) —**

SEE ML_Core.Types.SampleSilhouette_Result, ML_Core.Analysis.SampleSilhouetteScore

RESULT DATASET(Silhouette_Result) The silhouette coefficient per work item

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AppendID

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DESCRIPTIONS

APPENDID AppendID

/ EXPORT	**AppendID**
(dIn,idfield,dOut)	

Macro takes any structured dataset, and appends a unique 1-based record ID column to it. Values will not be sequential and values will not be dense because of data skew. Gaps will appear when data ends on each node. If dense and sequential values are required, use AppendSeqID.

Note that, as a macro, nothing is returned, but attribute named in dOut will be defined to contain the resulting dataset.

Example:

```
ML\_Core.AppendID(dOrig, recID, dOrigWithId);
```

PARAMETER **dIn** ||| INTEGER8 — The name of the input dataset.

PARAMETER **idfield** ||| INTEGER8 — The name of the field to be appended containing the id for each row.

PARAMETER **dOut** ||| INTEGER8 — The name of the resulting dataset.

RETURN —

AppendSeqID

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DESCRIPTIONS

APPENDSEQID AppendSeqID

- EXPORT	**AppendSeqID**
(dIn,idfield,dOut)	

Macro takes any structured dataset, and appends a unique 1-based record ID column to it. Values will be in data sequence. Note: implemented as a count project, each node processes the data in series instead of parallel. For better cluster performance, use AppendID as long as dense, sequential ids are not needed.

Note that, as a macro, nothing is returned, but attribute named in dOut will be defined to contain the resulting dataset.

Example:

```
ML\_Core.AppendSeqID(dOrig, recID, dOrigWithId);
```

PARAMETER **dIn** ||| INTEGER8 — The name of the input dataset.

PARAMETER **idfield** ||| INTEGER8 — The name of the field to be appended containing the id for each row.

PARAMETER **dOut** ||| INTEGER8 — The name of the resulting dataset.

RETURN —

Config

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DESCRIPTIONS

CONFIG Config

	Config

Global configuration constants that can be modified if needed.

Children

1. MaxLookup (From Config) : The maximum amount of data to use in a LOOKUP JOIN
2. Discrete (From Config) : The default number of groups to use when discretizing data
3. RoundingError (From Config) : The tolerance for rounding error

---

MAXLOOKUP MaxLookup

Config \

	MaxLookup

The maximum amount of data to use in a LOOKUP JOIN.

RETURN INTEGER8 —

DISCRETE Discrete

Config \

	Discrete

The default number of groups to use when discretizing data.

RETURN **INTEGER8** —

ROUNDINGERROR RoundingError

Config \

	RoundingError

The tolerance for rounding error.

RETURN **REAL8** —

Constants

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DESCRIPTIONS

CONSTANTS Constants

	Constants

Useful constants used in ML.

Children

1. Pi (From Constants) : Constant PI
2. Root_2 (From Constants) : Constant square root of 2

PI Pi

Constants \

	Pi

Constant PI

RETURN **REAL8** —

ROOT_2 Root_2

Constants \

	Root_2

Constant square root of 2

RETURN **REAL8** —

CrossValidation

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IMPORTS

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DESCRIPTIONS

CROSSVALIDATION CrossValidation

	CrossValidation

This module is a container for any cross-validation methods

Children

1. NFoldCV (From CrossValidation) :

   N-Fold Cross Validation is a way to validate the effectiveness of a regression or classification without having to segregate test data from training data

---

NFOLDCV NFoldCV

CrossValidation \

	NFoldCV
(LearnerName, IndepDS, DepDS, NumFolds)	

N-Fold Cross Validation is a way to validate the effectiveness of a regression or classification without having to segregate test data from training data.

The results of the N-Fold Cross Validation approximate the expected result of training on all of the data samples and testing those results on other data from the same distribution.

This allows a model that is built on all available labeled data to be effectively assessed. Note that this process does not produce the target model, but only estimates the 'out-of-sample' error statistics that such a model would produce.

The method is as follows:

- Randomly split independent and dependent data into N (e.g. 10) 'folds'.
- Train N separate models, using N-1 of the folds as training data (e.g. 9).
- Test each model using the 1 fold that was not in the training set.
- Aggregate the test results across the N tests.

Any of the HPCC Machine Learning methods may be used with N-Fold Cross Validation The ML module to be used is passed as a parameter.

N-Fold Cross Validation can be used for regression or classification. If the dependent data is in NumericField format, it is treated as a regression and regression analytics are returned. If it is in DiscreteField format, then it is treated as a Classification, and Classification analytics are return.

Using the wrong dependent data type for the given learner will result in un- handled errors.

The returned MODULE exports the following attributes:

For Classification:

- ClassStats - Assesses Classes Contained in the Training Data (see Types.Class_Stats).
- Accuracy Overall Accuracy of the classification (see Types.Classification_Accuracy).
- AccuracyByClass Precision and Recall for each class (see Types.Class_Accuracy).
- ConfusionMatrix Frequency of predicted / actual class pairings (see Types.Consusion_Detail).

For Regression:

- Accuracy (see Types.Regression_Accuracy).

PARAMETER **LearnerName** ||| INTEGER8 — The attribute that holds the instantiated ML module.

PARAMETER **IndepDS** ||| INTEGER8 — The independent data to be used for training and testing.

PARAMETER **DepDS** ||| INTEGER8 — The dependent data to be used for training and testing.

PARAMETER **NumFolds** ||| INTEGER8 — The number of folds to use. Ten is typically considered adequate.

RETURN **BOOLEAN** — Result MODULE with attributes for assessing the strength of the model.

Discretize

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IMPORTS

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DESCRIPTIONS

DISCRETIZE Discretize

	Discretize

This module is used to turn a dataset of NumericFields into a dataset of DiscreteFields. This is not quite as trivial as it seems as there are a number of different ways to make the underlying data discrete; and even within one method there may be different parameters. Further - it is quite probable that different methods are going to be desired for each field.

There are two methods of interfacing:

- Call a discretization method directly to apply to all fields.
- Build a set of instructions on how to discretize each field and then call 'Do'.

The record format 'r_Method is used to build the set of instructions in the latter case.

For each discretization method (e.g. ByRounding), there is a corresponding attribute preceded by 'i_' that is used to build the r_Method instruction for using that method (e.g. i_ByRounding).

Three methods are currently provided:

- ByRounding – Numerically round the number to the nearest integer.

- ByBucketing – Split the range of each variable into a number of evenly spaced buckets.
- ByTiling – Splits the datapoints into an ordered set of equal-sized groups.

Children

1. c_Method (From Discretize) : Enumerate the available discretization methods
2. r_Method (From Discretize) : This format is used to construct an 'instruction stream' to allow a dataset to be discretized according to a set of instructions which are in (meta)data
3. i_ByRounding (From Discretize) : Construct an instruction (rMethod) that will cause certain fields to be discretized by rounding
4. ByRounding (From Discretize) : Round the values passed in to create a discrete element Scale is applied (by multiplication) first and can be used to bring the data into a desired range (rParam1), Delta is applied (by addition) second and can be used to re-base a range OR to cause truncation or roundup as required (rParam2)
5. i_ByBucketing (From Discretize) : Construct an instruction (rMethod) that will cause certain fields to be discretized by bucketing
6. ByBucketing (From Discretize) : Allocates a continuous variable into one of N buckets based upon an equal division of the RANGE of the variable
7. i_ByTiling (From Discretize) : Construct an instruction (rMethod) that will cause certain fields to be discretized by tiling
8. ByTiling (From Discretize) : Allocate a continuous variable into one of N groups such that each group (tile) contains roughly the same number of entries and that all of the elements of group 2 have a higher value than group 1, etc
9. Do (From Discretize) : Execute a set of discretization instructions in order to discretize all of the fields of the dataset using the appropriate methods

---

C_METHOD c_Method

Discretize \

	c_Method

Enumerate the available discretization methods.

RETURN UNSIGNED4 —

VALUE Rounding = 1

VALUE Bucketing = 2

VALUE Tiling = 3

R_METHOD r_Method

Discretize \

	r_Method

This format is used to construct an 'instruction stream' to allow a dataset to be discretized according to a set of instructions which are in (meta)data. It can be created directly, though the preferred method is to call i_ByRounding(...), i_ByBucketing(...), or i_ByTiling(...) to create each record.

FIELD **method** ||| UNSIGNED4 — Indicator of the method to use (see c_method).

FIELD **iParam1** ||| INTEGER8 — The first integer parameter to the discretization method.

FIELD **rParam1** ||| REAL8 — The first real parameter.

FIELD **rParam2** ||| REAL8 — The second real parameter.

FIELD **fields** ||| SET (UNSIGNED4) — No Doc

I_BYROUNDING i_ByRounding

Discretize \

	i_ByRounding
`(SET OF Types.t_FieldNumber f, REAL Scale=1.0,REAL Delta=0.0)`	

Construct an instruction (rMethod) that will cause certain fields to be discretized by rounding. See ByRounding below.

PARAMETER **f** ||| SET (UNSIGNED4) — A set of field numbers to which to apply this method.

PARAMETER **Scale** ||| REAL8 — (Optional) A number by which to multiply each field before rounding.

PARAMETER **Delta** ||| REAL8 — (Optional) An offset that is applied after scaling but before rounding.

RETURN **TABLE (r_Method)** — DATASET(r_Method) containing one record.

BYROUNDING ByRounding

Discretize \

	ByRounding
	`(DATASET(Types.NumericField) d,REAL Scale=1.0, REAL Delta=0.0)`

Round the values passed in to create a discrete element Scale is applied (by multiplication) first and can be used to bring the data into a desired range (rParam1), Delta is applied (by addition) second and can be used to re-base a range OR to cause truncation or roundup as required (rParam2).

PARAMETER **d** ||| TABLE (NumericField) — The NumericField dataset to be discretized.

PARAMETER **Scale** ||| REAL8 — (Optional) A number by which to multiply each field before rounding.

PARAMETER **Delta** ||| REAL8 — (Optional) An offset that is applied after scaling but before rounding.

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , INTEGER4 value })** — DATASET(DiscreteField) containing the discretized dataset.

I_BYBUCKETING i_ByBucketing

Discretize \

	i_ByBucketing
	`(SET OF Types.t_FieldNumber f, Types.t_Discrete N=ML_Core.Config.Discrete)`

Construct an instruction (rMethod) that will cause certain fields to be discretized by bucketing. See ByBucketing below.

PARAMETER **f** ||| SET (UNSIGNED4) — A set of field numbers to which to apply this method.

PARAMETER **N** ||| INTEGER4 — (Optional) The number of buckets into which to split the range. The default is to use the ML_Core. Config.Discrete configuration parameter.

RETURN **TABLE (r_Method)** — DATASET(r_Method) containing one record.

BYBUCKETING ByBucketing

Discretize \

	ByBucketing
(DATASET(Types.NumericField) d, Types.t_Discrete N=ML_Core.Config.Discrete)	

Allocates a continuous variable into one of N buckets based upon an equal division of the RANGE of the variable.

The buckets will NOT have an even number of elements unless the underlying distribution of the variable is uniform.

PARAMETER **d** ||| TABLE (NumericField) — The NumericField dataset to be discretized.

PARAMETER **N** ||| INTEGER4 — (Optional) The number of buckets into which to split the range. The default is to use the ML_Core. Config.Discrete configuration parameter.

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , INTEGER4 value })** — DATASET(DiscreteField) containing the discretized dataset.

I_BYTILING i_ByTiling

Discretize \

	i_ByTiling
	(SET OF Types.t_FieldNumber f, Types.t_Discrete N=ML_Core.Config.Discrete)

Construct an instruction (rMethod) that will cause certain fields to be discretized by tiling. See ByTiling below.

PARAMETER **f** ||| SET (UNSIGNED4) — A set of field numbers to which to apply this method.

PARAMETER **N** ||| INTEGER4 — (Optional) The number of tiles into which to split the data. The default is to use the ML_Core. Config.Discrete configuration parameter.

RETURN **TABLE (r_Method)** — DATASET(r_Method) containing one record.

BYTILING ByTiling

Discretize \

	ByTiling
	(DATASET(Types.NumericField) d, Types.t_Discrete N=ML_Core.Config.Discrete)

Allocate a continuous variable into one of N groups such that each group (tile) contains roughly the same number of entries and that all of the elements of group 2 have a higher value than group 1, etc.

PARAMETER **d** ||| TABLE (NumericField) — The NumericField dataset to be discretized.

PARAMETER **N** ||| INTEGER4 — (Optional) The number of tiles to create. The default is to use the ML_Core. Config.Discrete configuration parameter.

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , INTEGER4 value })** — DATASET(DiscreteField) containing the discretized dataset.

DO Do

Discretize \

	Do
`(DATASET(Types.NumericField) d, DATASET(r_Method) to_do)`	

Execute a set of discretization instructions in order to discretize all of the fields of the dataset using the appropriate methods.

Note that the file d is read once for each instruction - so it is much better to combine the instructions for multiple fields into one (provided the parameters and method are the same).

PARAMETER **d** ||| TABLE (NumericField) — The NumericField dataset to be dicretized.

PARAMETER **to_do** ||| TABLE (r_Method) — The DATASET(r_Method) that contains the discretization instructions.

RETURN **TABLE (DiscreteField)** — DATASET(DiscreteField) containing the discretized dataset.

FieldAggregates

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IMPORTS

_versions.ML_Core.V3_2_2.ML_Core.Types |
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DESCRIPTIONS

FIELDAGGREGATES FieldAggregates

	FieldAggregates
(DATASET(Types.NumericField) d)	

Calculate various statistical aggregations of the fields in a NumericField dataset.

PARAMETER **d** ||| TABLE (NumericField) — The dataset to be aggregated.

Children

1. Simple (From FieldAggregates) : Calculate basic statistics about each field
2. SimpleRanked (From FieldAggregates) : Calculate the rank (order) of each cell for each field
3. Medians (From FieldAggregates) : Calculate the median value of each field
4. MinMedNext (From FieldAggregates) : No Documentation Found
5. Buckets (From FieldAggregates) : Bucketize the datapoints into N buckets for each field
6. BucketRanges (From FieldAggregates) : Return the ranges associated with each of N buckets as computed by 'Buckets' above

7. Modes (From FieldAggregates) : Calculate the mode (i.e
8. Cardinality (From FieldAggregates) : Returns the cardinality of each field
9. RankedInput (From FieldAggregates) : No Documentation Found
10. NTiles (From FieldAggregates) : Calculate the N-tile of each datapoint within its field
11. NTileRanges (From FieldAggregates) : Return the ranges associated with each of N-tiles as computed by 'Ntiles' above
12. HistBins (From FieldAggregates) : No Documentation Found
13. HistBinRanges (From FieldAggregates) : No Documentation Found
14. PearsonCorr (From FieldAggregates) : No Documentation Found
15. SpearmanCorr (From FieldAggregates) : No Documentation Found
16. KendallCorr (From FieldAggregates) : No Documentation Found
17. GenSpearman2Corr (From FieldAggregates) : No Documentation Found

---

SIMPLE Simple

FieldAggregates \

	Simple

Calculate basic statistics about each field.

Calculates: min, max, sum, count, mean, variance, and standard deviation for each field.

There are no parameters.

Example:

```
myAggs := FieldAggregates(myDS).simple;
```

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED4 number , REAL8 minval , REAL8 maxval , REAL8 sumval , REAL8 countval , REAL8 mean , REAL8 var , REAL8 sd })** —

SIMPLERANKED SimpleRanked

FieldAggregates \

	SimpleRanked

Calculate the rank (order) of each cell for each field.

The returned data adds a 'Pos' field to each cell, indicating its rank within it's field number.

There are no parameters.

Example:

```
myRankedDS := FieldAggregates(myDS).SimpleRanked;
```

MEDIANS Medians

FieldAggregates \

	Medians

Calculate the median value of each field.

There are no parameters.

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED4 number , REAL8 median })** — DATASET({wi, number, median}), one record per work-item and field number. Example: <pre>myFieldMedians := FieldAggregates(myDS).Medians;</pre>

MINMEDNEXT MinMedNext

FieldAggregates \

	MinMedNext

No Documentation Found

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED4 number , REAL8 median , REAL8 nextval , REAL8 minval , REAL8 maxval , REAL8 sumval , REAL8 countval , REAL8 mean , REAL8 var , REAL8 sd })** —

BUCKETS Buckets

FieldAggregates \

	Buckets
(Types.t_Discrete n)	

Bucketize the datapoints into N buckets for each field.

Bucketization splits the range of the data into N equal size range buckets. The data will not normally be evenly split among buckets unless it is uniformly distributed. Contrast this with N-tile, where the data is split nearly evenly.

PARAMETER **n** ||| INTEGER4 — The number of buckets to use.

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value , UNSIGNED8 Pos , INTEGER4 bucket })** — DATASET OF {wi, id, number, value, pos, bucket}, where pos is the rank within each field, and bucket is the bucket number.

BUCKETRANGES BucketRanges

FieldAggregates \

	BucketRanges
(Types.t_Discrete n)	

Return the ranges associated with each of N buckets as computed by 'Buckets' above.

PARAMETER **n** ||| INTEGER4 — The number of buckets.

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED4 number , INTEGER4 bucket , REAL8 Min , REAL8 Max , UNSIGNED8 cnt })** — DATASET OF {wi, number, bucket, Min, and Max}, one for each bucket for each field.

MODES Modes

FieldAggregates \

	Modes

Calculate the mode (i.e. the most common value) for each field

There are no parameters.

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED4 number , REAL8 mode , UNSIGNED8 cnt })** — DATASET OF {wi, number, mode, cnt}, one per field. 'cnt' is the number of times the mode value occurred.

CARDINALITY Cardinality

FieldAggregates \

	Cardinality

Returns the cardinality of each field. That is the number of different values occurring in each field.

There are no parameters.

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED4 number , UNSIGNED8 cardinality })** — DATASET OF {wi, number, cardinality}, one per field.

RANKEDINPUT RankedInput

FieldAggregates \

	RankedInput

No Documentation Found

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value , REAL8 Pos })** —

NTILES NTiles

FieldAggregates \

	NTiles
(Types.t_Discrete n)	

Calculate the N-tile of each datapoint within its field. For example, if N is 100, we calculate percentiles.

PARAMETER **n** ||| INTEGER4 — The number of groups into which to balance the data

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value , REAL8 Pos , INTEGER4 ntile })** — DATASET OF {wi, id, number, value, pos, ntile}, where pos is the rank within each field.

NTILERANGES NTileRanges

FieldAggregates \

	NTileRanges
(Types.t_Discrete n)	

Return the ranges associated with each of N-tiles as computed by 'Ntiles' above.

PARAMETER **n** ||| INTEGER4 — The number of N-tile groups.

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED4 number , INTEGER4 ntile , REAL8 Min , REAL8 Max , UNSIGNED8 cnt })** — DATASET OF {wi, number, bucket, Min, and Max}, one for each N-tile group for each field.

HISTBINS HistBins

FieldAggregates \

	HistBins
(Types.t_Discrete n)	

No Documentation Found

PARAMETER **n** ||| INTEGER4 — No Doc

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value , INTEGER4 hbin })** —

HISTBINRANGES HistBinRanges

FieldAggregates \

	HistBinRanges
(Types.t_Discrete n)	

No Documentation Found

PARAMETER **n** ||| INTEGER4 — No Doc

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED4 number , INTEGER4 hbin , REAL8 Min , REAL8 Max , UNSIGNED8 cnt })** —

PEARSONCORR PearsonCorr

FieldAggregates \

	PearsonCorr

No Documentation Found

RETURN TABLE ({ UNSIGNED2 wi , INTEGER4 number1 , INTEGER4 number2 , REAL8 Correl }) —

SPEARMANCORR SpearmanCorr

FieldAggregates \

	SpearmanCorr

No Documentation Found

RETURN TABLE ({ UNSIGNED2 wi , INTEGER4 number1 , INTEGER4 number2 , REAL8 Correl }) —

KENDALLCORR KendallCorr

FieldAggregates \

	KendallCorr

No Documentation Found

RETURN TABLE ({ UNSIGNED2 wi , INTEGER4 number1 , INTEGER4 number2 , REAL8 Correl }) —

GENSPEARMAN2CORR GenSpearman2Corr

FieldAggregates \

	GenSpearman2Corr
(dep = 1)	

No Documentation Found

PARAMETER **dep** ||| INTEGER8 — No Doc

RETURN **TABLE ({ UNSIGNED2 wi , INTEGER4 number1 , INTEGER4 number2 , REAL8 Correl }) —**

FromField

Go Up

DESCRIPTIONS

FROMFIELD FromField

/ EXPORT	**FromField**
(dIn,lOut,dOut,dMap='')	

Macro to convert a NumericField formatted, cell-based dataset to a Record formatted dataset. Typically used to return converted NumericField data back to its original layout.

Note that as a Macro, nothing is returned, but new attributes are created in-line for use in subsequent definitions.

In the simplest case, the assumption is that the field order of the resulting table is in line with the field number in the input dataset, with the ID field as the first field.

For example:

```
myRec := RECORD
  UNSIGNED recordId;
  REAL height;
  REAL weight;
END;
Value of NumericField records with field number = 1 would go to height.
Value of NumericField records with field number = 2 would go to weight.
The id field of the NumericField record would be mapped to the recordId
field of the result.
```

If the field orders have been changed (e.g. by customizing the ToField process, a field-mapping should be specified (See dMap below). Usage Examples:

```
ML.FromField(myNFData, myRecordLayout, myRecordData);
// Datamap to reorder the weight and height fields in the example above
dataMap := DATASET([\{'weight', '1'\},
                    \{'height', '2'\}], Types.Field\_Mapping);
ML.FromField(nyNFData, myRecordLayout, myRecordData, dataMap);
```

PARAMETER **dIn** ||| INTEGER8 — The name of the input dataset in NumericField format.

PARAMETER **lOut** ||| INTEGER8 — The name of the layout record defining the records of the result dataset.

PARAMETER **dOut** ||| INTEGER8 — The name of the result dataset.

PARAMETER **dMap** ||| INTEGER8 — [OPTIONAL] A Field_Mapping dataset as produced by ToField that describes the mapping between field name and field number. The format of this map is defined by Types.Field_Mapping.

RETURN — Nothing. The MACRO creates new attributes in-line as described above.

SEE Types.NumericField

SEE Types.Field_Mapping

SEE ToField

Generate

Go Up

IMPORTS

_versions.ML_Core.V3_2_2.ML_Core.Types |

DESCRIPTIONS

GENERATE Generate

	Generate

Increase dimensionality by adding polynomial transforms of the data to create new feature columns. This can be useful, for example, when building a linear model against data that may not have linear relationships.

Children

1. tp_Method (From Generate) : Enumeration of polynomial methods
2. MethodName (From Generate) : Convert a column number into a descriptive label
3. ToPoly (From Generate) : Generate up to seven, successively higher order, features from a single given feature

---

TP_METHOD tp_Method

Generate \

	tp_Method

Enumeration of polynomial methods.

RETURN **UNSIGNED1** —

VALUE LogX = 1

VALUE X = 2

VALUE XLogX = 3

VALUE XX = 4 – X squared

VALUE XXLogX = 5

VALUE XXX = 6 – X cubed

VALUE XXXLogX = 7

METHODNAME MethodName

Generate \

	MethodName
`(tp_Method x)`	

Convert a column number into a descriptive label.

PARAMETER **x** ||| UNSIGNED1 — The column number to describe.

RETURN **STRING7** — The descriptive label.

TOPOLY ToPoly

Generate \

	ToPoly
	`(DATASET(Types.NumericField) seedCol, UNSIGNED maxN=7)`

Generate up to seven, successively higher order, features from a single given feature.

The generated features are:

1. LogX (logs are base 10)
2. X
3. XLogX
4. X^2
5. X^2LogX
6. X^3
7. X^3LogX

Note that the returned fields will be numbered 1-7, as above.

PARAMETER **seedCol** ||| TABLE (NumericField) — A single column of NumericField data. The number field is ignored.

PARAMETER **maxN** ||| UNSIGNED8 — (Optional) The number of new columns to generate. For example: If 1, then one feature, LogX is generated. If 3, then LogX, X, and X^2 features are generated. The default is 7, in which case, all features are generated.

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value })** — DATASET(NumericField) with numOriginalRecs * maxN records.

SEE Types.NumericField

ModelOps2

Go Up

IMPORTS

_versions.ML_Core.V3_2_2.ML_Core.Types |

DESCRIPTIONS

MODELOPS2 ModelOps2

	ModelOps2

This module provides a set of operations to provide manipulation of machine learning models (version 2) in the Types.Layout_Model2 format.

Layout_Model2 defines a flexible structure that allows storage of model information for any Machine Learning algorithm.

The model is based on a ”Naming Tree” paradigm.

The naming tree is a data structure that allows a hierarchical name (e.g. object-id) to be attached to each data-cell. Examples of naming-trees are OID trees such as those used in various network identifiers such as MIBs.

This structure is used within ML to store model information. It is a useful format for several reasons:

- It has the flexibility to store complex sets of data in a generic way.
- It easily stores scalar as well as matrix oriented data.
- It allows a model to contain data elements within scopes that are defined at different level. For example, part of the model may be defined globally, another may be common for a bundle, while another section is specific to a given module.

- It readily allows composite models to be created by encapsulating entire complex models (or sets of models) within branches of another model. The individual models can then be extracted from the composite model, and passed to the modules that created them.

Theory of Operation

The naming tree (NT) is conceptually simple. Each cell is identified by a hierarchical numbering scheme of arbitrary depth. Take, for example, the following NT:

```
1
  1.1
    1.1.1
    1.1.2
  1.2
    1.2.1
    1.2.2
2
```

This tree defines the following leaf (scalar) elements: 1.1.1, 1.1.2, 1.2.1, 1.2.2, 2.

Note that the deepest node on any branch is considered a leaf, and branches can be of variable depth. Note also that there is no explicit creation of branch nodes. The branches are implicitly defined by the ids of the leafs.

In this example, node 1.1 can be thought as representing an array, thought it could also be thought of as a structure of two distinct scalars, depending on whether the user expects a variable length list under 1.1 (i.e. 1.1.1 - 1.1.N) or a fixed set of cells.

Likewise node 1 can be thought of as a matrix (1.r.c, where r is the row index and c is the column index), in cases where r and c are of variable size.

This naming tree also supports the myriad interface, allowing multiple independent work-items to be represented, each of which may duplicate the same structure.

The id is represented by an ECL SET of Unsigned identifiers (e.g. [1,2,1] represents the OID 1.2.1).

Each cell is defined by three fields: wi (work-item-id), value (the cell contents) and indexes (the id).

A naming tree can be constructed as an inline dataset. For example, the following creates the tree in the example above:

```
DATASET([\{1, 3.2, [1,1,1]\},
         \{1, .0297, [1,1,2]\},
         \{1, 2.0, [1,2,1]\},
         \{1, 1550, [1,2,2]\},
```

```
\{1, 8.1, [2]\}], Layout\_Model2);
```

There are attributes in this module to assist with manipulation of naming trees:

- Creating a NT from a NumericField matrix.
- Extracting a NumericField matrix from an NT branch.
- Inserting an NT onto a branch of another NT.
- Extracting an NT from a branch of an NT.

SEE Types.Layout_Model2

Children

1. Extract (From ModelOps2) : Extract an inner sub-tree from an existing model
2. ExtendIndices (From ModelOps2) : Extend the indices of a model to fit within a deeper model
3. Insert (From ModelOps2) : Insert a model into a sub-tree of an existing model
4. ToNumericField (From ModelOps2) : Convert a two-level model or model sub-tree into a NumericField dataset
5. FromNumericField (From ModelOps2) : Convert a NumericField dataset to a 2 level model (or model subtree)
6. GetItem (From ModelOps2) : Get a single record (cell) from a model by index
7. SetItem (From ModelOps2) : Add a single record (cell) to an model at a given set of coordinates

---

EXTRACT Extract

ModelOps2 \

DATASET(Layout_Model2)	**Extract**
(DATASET(Layout_Model2) mod, t_indexes fromIndx, t_work_item fromWi=0)	

Extract an inner sub-tree from an existing model.

Work-item = 0 (default) will extract all work-items

This is the opposite of Insert. For example:

```
If I have a tree:
 1
 2
 3
  3.1
  3.2
```

and I extract from index 3, it will return the Naming Tree:

```
 1
 2
```

containing the two sub-cells of the original index 3

PARAMETER **mod** ||| TABLE (Layout_Model2) — The model from which to extract the sub-tree.

PARAMETER **fromIndx** ||| SET (UNSIGNED4) — The index from which to extract the subtree.

PARAMETER **fromWi** ||| UNSIGNED2 — The work-item to extract or 0 to extract the same sub-tree from all work-items.

RETURN **TABLE ({ UNSIGNED2 wi , REAL8 value , SET (UNSIGNED4) indexes })** — A model containing all of the sub-cells below fromIndx with the indexes adjusted to the top of the tree.

EXTENDINDICES ExtendIndices

ModelOps2 \

DATASET(Layout_Model2)	**ExtendIndices**
(DATASET(Layout_Model2) mod, t_indexes atIndex)	

Extend the indices of a model to fit within a deeper model.

For example, a cell with index [1,2] could be moved to index [1,2,3,1,2] by using atIndex := [1,2,3].

PARAMETER **mod** ||| TABLE (Layout_Model2) — The model whose indexes are to be extended.

PARAMETER **atIndex** ||| SET (UNSIGNED4) — The prefix indexes to be prepended to the indexes of each cell in mod.

RETURN **TABLE ({ UNSIGNED2 wi , REAL8 value , SET (UNSIGNED4) indexes })** — A model with extended indexes.

INSERT Insert

ModelOps2 \

DATASET(Layout_Model2)	**Insert**
(DATASET(Layout_Model2) mod1, DATASET(Layout_Model2) mod2, t_indexes atIndx)	

Insert a model into a sub-tree of an existing model.

Extends the indexes of the provided model to fit onto a branch of another model, and concatenates the two models. This is the opposite of extract. For example:

```
If I have a model:
1
2
and a second model:
1
2
3
That I would like to insert into the first tree at index 3, I would
end up with the tree:
1
2
3
 3.1
 3.2
 3.3
```

Example code:

```
mod3 := Insert(mod1, mod2, [3]);
```

PARAMETER **mod1** ||| TABLE (Layout_Model2) — The first (base) model.

PARAMETER **mod2** ||| TABLE (Layout_Model2) — The sub-model that is to be inserted into mod1.

PARAMETER **atIndx** ||| SET (UNSIGNED4) — The index prefix (in mod1) that will contain the cells from mod2.

RETURN **TABLE (Layout_Model2)** — a new model containing the cells from both models.

TONUMERICFIELD ToNumericField

ModelOps2 \

DATASET(NumericField)	**ToNumericField**
(DATASET(Layout_Model2) mod, t_indexes fromIndx = [])	

Convert a two-level model or model sub-tree into a NumericField dataset.

The last two indexes of the model subtree are used as the indexes for the NumericField matrix. The second to last index corresponds to the NF's id field and the last index corresponds to the NF's number field.

PARAMETER **mod** ||| TABLE (Layout_Model2) — The model from which to extract the NumericField matrix.

PARAMETER **fromIndx** ||| SET (UNSIGNED4) — The index from which to extract the matrix. Example: [3,1,5]. The default is from the top of the tree i.e. [].

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value })** — NumericField matrix in DATASET(NumericField) format.

FROMNUMERICFIELD FromNumericField

ModelOps2 \

DATASET(Layout_Model2)	FromNumericField
(DATASET(NumericField) nf, t_indexes atIndex=[])	

Convert a NumericField dataset to a 2 level model (or model subtree).

A two level model is created and appended to atIndex.

The first new index will contain the value of the NumericField's id field, and the second will contain the value of the NumericField's number field.

Example: If I have a NumericField with id=1 and number=3, and I use atIndex = [3,1,5], it will create a Naming Tree cell with indexes: [3,1,5,1,3].

PARAMETER **nf** ||| TABLE (NumericField) — A NumericField dataset to be converted.

PARAMETER **atIndex** ||| SET (UNSIGNED4) — The index at which to place the new subtree e.g., [3,1,5].

RETURN **TABLE ({ UNSIGNED2 wi , REAL8 value , SET (UNSIGNED4) indexes })** — DATASET(ntNumeric) Naming Tree.

GETITEM GetItem

ModelOps2 \

Layout_Model2	GetItem
(DATASET(Layout_Model2) mod, t_indexes indxs, wi_num=1)	

Get a single record (cell) from a model by index.

PARAMETER **mod** ||| TABLE (Layout_Model2) — The model (DATASET(layout_model2)) from which to extract the cell.

PARAMETER **indxs** ||| SET (UNSIGNED4) — The id of the cell to extract (e.g. [3,1,5]).

PARAMETER **wi_num** ||| INTEGER8 — The work-item number to extract the cell from, default = 1.

RETURN **ROW (Layout_Model2)** — The model cell (Layout_Model2) or an empty cell (wi=0) if not found.

SETITEM SetItem

ModelOps2 \

DATASET(Layout_Model2)	**SetItem**
(DATASET(Layout_Model2) mod, t_work_item wi, t_indexes indexes, t_fieldReal value)	

Add a single record (cell) to an model at a given set of coordinates.

PARAMETER **mod** ||| TABLE (Layout_Model2) — The model to which to add a cell.

PARAMETER **wi** ||| UNSIGNED2 — The work-item associated with the cell.

PARAMETER **indexes** ||| SET (UNSIGNED4) — The indices for the cell.

PARAMETER **value** ||| REAL8 — The value of the cell.

RETURN **TABLE (Layout_Model2)** — Model with the added cell.

ToField

Go Up

DESCRIPTIONS

TOFIELD ToField

/ EXPORT	**ToField**
(dIn, dOut, idfield=", wifield=", wivalue=", datafields=")	

Convert a record-oriented dataset to a cell-oriented NumericField dataset for use with Machine Learning mechanisms.

ToField Macro takes a record-oriented dataset, with each row containing an ID and one or more numeric fields, and expands it into the NumericField format used by ML.

Note that as a Macro, nothing is returned, but new attributes are created in-line for use in subsequent definitions.

Along with creating the NumericField table, this macro produces two simple functions to assist the user in mapping the field names to their corresponding numbers. These are "STRING dOut_ToName(UNSIGNED)" and "UNSIGNED dOut_ToNumber(STRING)", where the "dOut" portion of the function name is the name passed into that parameter of the macro.

The macro also produces a mapping table named "dOut_Map", again where "dOut" refers to the parameter, that contains a table of the field mappings. See Types.Field_Mapping for the layout of this mapping dataset. Examples:

```
ML.ToField(dOrig,dMatrix);
ML.ToField(dOrig,dMatrix,myid,'field5,field7,field10');
dMatrix\_ToName(2);    // returns 'field7'
dMatrix\_ToNumber('field10'); // returns 3
dMatrix\_Map;  // returns the mapping table of field name to number see
              // Types.Field\_Mapping
```

PARAMETER **dIn** ||| INTEGER8 — The name of the input dataset.

PARAMETER **dOut** ||| INTEGER8 — The name of the resulting dataset.

PARAMETER **idfield** ||| INTEGER8 — [OPTIONAL] The name of the field that contains the UID for each row. If omitted, it is assumed to be the first field.

PARAMETER **wifield** ||| INTEGER8 — [OPTIONAL] The name of the field that contains the work item value. A constant is used if the field name is not supplied (as provided by wivalue below).

PARAMETER **wivalue** ||| INTEGER8 — [OPTIONAL} The constant value to use for work item. The value 1 is used if not supplied.

PARAMETER **datafields** ||| INTEGER8 — [OPTIONAL] A STRING containing a comma-delimited list of the fields to be treated as axes. If omitted, all numeric fields that are not the idfield or wifield will be treated as axes. NOTE: idfield defaults to the first field in the table, so if that field is specified as an axis field, then the user should be sure to specify a value in the idfield param.

RETURN — Nothing. The MACRO creates new attributes in-line as described above.

SEE Types.NumericField

SEE Types.Field_Mapping

Types

Go Up

DESCRIPTIONS

TYPES Types

	Types

This module provides the major data type definitions for use with the various ML Bundles

Children

1. t_RecordID (From Types) : No Documentation Found
2. t_FieldNumber (From Types) : No Documentation Found
3. t_FieldReal (From Types) : No Documentation Found
4. t_FieldSign (From Types) : No Documentation Found
5. t_Discrete (From Types) : No Documentation Found
6. t_Item (From Types) : No Documentation Found
7. t_Count (From Types) : No Documentation Found
8. t_Work_Item (From Types) : No Documentation Found
9. t_index (From Types) : No Documentation Found
10. t_indexes (From Types) : No Documentation Found
11. AnyField (From Types) : No Documentation Found
12. NumericField (From Types) : The NumericField layout defines a matrix of Real valued data-points
13. DiscreteField (From Types) : The Discrete Field layout defines a matrix of Integer valued data-points
14. Layout_Model2 (From Types) : Layout for Model dataset (version 2) Generic Layout describing the model 'learned' by a Machine Learning algorithm

15. Layout_Model (From Types) : No Documentation Found
16. Classify_Result (From Types) : No Documentation Found
17. l_result (From Types) : No Documentation Found
18. Class_Stats (From Types) : Class_Stats
19. Confusion_Detail (From Types) : Confusion_Detail
20. Classification_Accuracy (From Types) : Classification_Accuracy
21. Class_Accuracy (From Types) : Class_Accuracy Results layout for Analysis.Classification.AccuracyByClass See https://en.wikipedia.org/wiki/Precision_and_recall for a more detailed explanation
22. AUC_Result (From Types) : AUC_Result Result layout for Analysis.Classification.AUC
23. Regression_Accuracy (From Types) : Regression_Accuracy
24. Contingency_Table (From Types) : Contingency_Table Contains the contingency table for every combination of feature and classifier
25. Chi2_Result (From Types) : Chi2_Result Result layout for Analysis.FeatureSelection.Chi2 Contains chi2 value for every combination of feature and classifier per work item, and its corresponding p value
26. ARI_Result (From Types) : ARI_Result Result layout for Analysis.Clustering.ARI Contains the Adjusted Rand Index for each work item
27. SampleSilhouette_Result (From Types) : SampleSilhouette_Result Result layout for Analysis.Clustering.SampleSilhouetteScore Contains the silhouette score for each sample datapoint
28. Silhouette_Result (From Types) : Silhouette_Result Result layout for Analysis.Clustering.SilhouetteScore Contains the silhouette score for each work item
29. ClusterLabels (From Types) : ClusterLabels format defines the distance space where each cluster defined by a center and its closest samples
30. Data_Diagnostic (From Types) : No Documentation Found
31. Field_Mapping (From Types) : Field_Mapping is the format produced by ToField for field-name mapping
32. LUCI_Rec (From Types) : LUCI Record – A dataset of lines each containing a string This is the DATASET format in which ML algorithm export LUCI files
33. Classification_Scores (From Types) : Classification_Scores The probability or confidence, per class, that a sample belongs to that class

---

T_RECORDID t_RecordID

Types \

	t_RecordID

No Documentation Found

RETURN **UNSIGNED8** —

T_FIELDNUMBER t_FieldNumber

Types \

	t_FieldNumber

No Documentation Found

RETURN **UNSIGNED4** —

T_FIELDREAL t_FieldReal

Types \

	t_FieldReal

No Documentation Found

RETURN **REAL8** —

T_FIELDSIGN t_FieldSign

Types \

	t_FieldSign

No Documentation Found

RETURN **INTEGER1** —

T_DISCRETE t_Discrete

Types \

	t_Discrete

No Documentation Found

RETURN **INTEGER4** —

T_ITEM t_Item

Types \

	t_Item

No Documentation Found

RETURN **UNSIGNED4** —

T_COUNT t_Count

Types \

	t_Count

No Documentation Found

RETURN **UNSIGNED8** —

T_WORK_ITEM t_Work_Item

Types \

	t_Work_Item

No Documentation Found

RETURN **UNSIGNED2** —

T_INDEX t_index

Types \

	t_index

No Documentation Found

RETURN **UNSIGNED4** —

T_INDEXES t_indexes

Types \

	t_indexes

No Documentation Found

RETURN **SET (UNSIGNED4)** —

ANYFIELD AnyField

Types \

	AnyField

No Documentation Found

FIELD **wi** ||| UNSIGNED2 — No Doc

FIELD **id** ||| UNSIGNED8 — No Doc

FIELD **number** ||| UNSIGNED4 — No Doc

NUMERICFIELD NumericField

Types \

	NumericField

The NumericField layout defines a matrix of Real valued data-points. It acts as the primary Dataset layout for interacting with most ML Functions. Each record represents a single cell in a matrix. It is most often used to represent a set of data-samples or observations, with the 'id' field representing the data-sample or observation, and the 'number' field representing the various fields within the observation.

FIELD **wi** ||| UNSIGNED2 — The work-item id, supporting the Myriad style interface. This allows multiple independent matrixes to be contained within a single dataset, supporting independent ML activities to be processed in parallel.

FIELD **id** ||| UNSIGNED8 — This field represents the row-number of this cell of the matrix. It is also considered the record-id for observations / data-samples.

FIELD **number** ||| UNSIGNED4 — This field represents the matrix column number for this cell. It is also considered the field number of the observation

FIELD **value** ||| REAL8 — The value of this cell in the matrix.

DISCRETEFIELD DiscreteField

Types \

	DiscreteField

The Discrete Field layout defines a matrix of Integer valued data-points. It is similar to the NumericField layout above, except for only containing discrete (integer) values. It is typically used to convey the class-labels for classification algorithms.

FIELD **wi** ||| UNSIGNED2 — The work-item id, supporting the Myriad style interface. This allows multiple independent matrixes to be contained within a single dataset, supporting independent ML activities to be processed in parallel.

FIELD **id** ||| UNSIGNED8 — This field represents the row-number of this cell of the matrix. It is also considered the record-id for observations / data-samples.

FIELD **number** ||| UNSIGNED4 — This field represents the matrix column number for this cell. It is also considered the field number of the observation

FIELD **value** ||| INTEGER4 — The value of this cell in the matrix.

LAYOUT_MODEL2 Layout_Model2

Types \

	Layout_Model2

Layout for Model dataset (version 2) Generic Layout describing the model 'learned' by a Machine Learning algorithm. Models for all new ML bundles are stored in this format. Some older bundles may still use the Layout_Model (version 1) layout. Models are thought of as opaque data structures. They are not designed to be understandable except to the bundle that produced them. Most bundles contain mechanisms to extract useful information from the model. This version of the model is based on a Naming-Tree paradigm. This provides a flexible generic mechanism for storage and manipulation of models. For bundle developers (or the curious), the file modelOps2 provides a detailed description of the theory and usage of this model layout as well as a set of functions to manipulate models for use by bundle developers.

FIELD **wi** ||| UNSIGNED2 — The work-item-id

FIELD **value** ||| REAL8 — The value of the cell

FIELD **indexes** ||| SET (UNSIGNED4) — The identifier for the cell – a set of unsigned integers e.g., [1,2,1,3]

LAYOUT_MODEL Layout_Model

Types \

	Layout_Model

No Documentation Found

FIELD **wi** ||| UNSIGNED2 — No Doc

FIELD **id** ||| UNSIGNED8 — No Doc

FIELD **number** ||| UNSIGNED4 — No Doc

FIELD **value** ||| REAL8 — No Doc

CLASSIFY_RESULT Classify_Result

Types \

	Classify_Result

No Documentation Found

FIELD **wi** ||| UNSIGNED2 — No Doc

FIELD **id** ||| UNSIGNED8 — No Doc

FIELD **number** ||| UNSIGNED4 — No Doc

FIELD **value** ||| INTEGER4 — No Doc

FIELD **conf** ||| REAL8 — No Doc

L_RESULT l_result

Types \

	l__result

No Documentation Found

CLASS_STATS Class_Stats

Types \

	Class__Stats

Class_Stats Layout for data returned from Analysis.Regression.ClassStats

FIELD **wi** ||| UNSIGNED2 — Work-item identifier

FIELD **classifier** ||| UNSIGNED4 — The field number associated with this dependent variable, for multi-variate classification. Otherwise 1.

FIELD **class** ||| INTEGER4 — The class label associated with this record

FIELD **classCount** ||| INTEGER4 — The number of times the class was seen in the data

FIELD **classPct** ||| REAL8 — The percent of records with this class.

CONFUSION_DETAIL Confusion_Detail

Types \

	Confusion_Detail

Confusion_Detail Layout for storage of the confusion matrix for ML Classifiers Each row represents a pairing of a predicted class and an actual class

FIELD **wi** ||| UNSIGNED2 — Work item identifier

FIELD **classifier** ||| UNSIGNED4 — The field number associated with this dependent variable, for multi-variate. Otherwise 1.

FIELD **actual_class** ||| INTEGER4 — The target class number – the expected result.

FIELD **predict_class** ||| INTEGER4 — The class number predicted by the ML algorithm

FIELD **occurs** ||| UNSIGNED4 — The number of times this pairing of (actual / predicted) classes occurred

FIELD **correct** ||| BOOLEAN — Boolean indicating if this represents a correct prediction (i.e. predicted = actual)

FIELD **pctActual** ||| REAL8 — The percent of items that were actually of <actual_class> that were predicted as <predict_class>.</predict_class></actual_class>

FIELD **pctPred** ||| REAL8 — Indicates the percent of items that were predicted as <predict_class> that were actually of <actual_class>.</actual_class></predict_class>

CLASSIFICATION_ACCURACY Classification_Accuracy

Types \

	Classification_Accuracy

Classification_Accuracy Results layout for Analysis.Classification/Accuracy

FIELD **wi** ||| UNSIGNED2 — Work item identifier

FIELD **classifier** ||| UNSIGNED4 — The field number associated with this dependent variable, for multi-variate. Otherwise 1.

FIELD **errCnt** ||| UNSIGNED8 — The number of errors (i.e. predicted <> actual)

FIELD **recCnt** ||| UNSIGNED8 — The total number or records in the test set

FIELD **Raw_Accuracy** ||| REAL8 — The percentage of samples properly classified (0.0 - 1.0)

FIELD **PoD** ||| REAL8 — Power of Discrimination. Indicates how this classification performed relative to a random guess of class. Zero or negative indicates that the classification was no better than a random guess. 1.0 indicates a perfect classification. For example if there are two equi-probable classes, then a random guess would be right about 50% of the time. If this classification had a Raw Accuracy of 75%, then its PoD would be .5 (half way between a random guess and perfection).

FIELD **PoDE** ||| REAL8 — Power of Discrimination Extended. Indicates how this classification performed relative to guessing the most frequent class (i.e. the trivial solution). Zero or negative indicates that this classification is no better than the trivial solution. 1.0 indicates perfect classification. For example, if 95% of the samples were of class 1, then the trivial solution would be right 95% of the time. If this classification had a raw accuracy of 97.5%, its PoDE would be .5 (i.e. half way between trivial solution and perfection).

FIELD **Hamming_Loss** ||| REAL8 — Hamming loss. The percentage of records misclassified. Useful for multilabel classification. It is equal to 1 - Raw_Accuracy.

CLASS_ACCURACY Class_Accuracy

Types \

	Class_Accuracy

Class_Accuracy Results layout for Analysis.Classification.AccuracyByClass See https://en.wikipedia.org/wiki/Precision_and_recall for a more detailed explanation.

FIELD **wi** ||| UNSIGNED2 — Work item identifier

FIELD **classifier** ||| UNSIGNED4 — The field number associated with this dependent variable, for multi-variate. Otherwise 1.

FIELD **class** ||| INTEGER4 — The class to which the analytics apply

FIELD **precision** ||| REAL8 — The precision of the classification for this class (i.e. True Positives / (True Positives + FalsePositives)). What percentage of the items that we predicted as being in this class are actually of this class?

FIELD **recall** ||| REAL8 — The completeness of recall for this class (i.e. True Positives / (True Positives + False Negatives)) What percentage of the items that are actually in this class did we correctly predict as this class?

FIELD **FPR** ||| REAL8 — The false positive rate for this class (i.e. False Positives / (False Positives + True Negatives)) What percentage of the items not in this class did we falsely predict as this class?

FIELD **f_score** ||| REAL8 — The balanced F-score for this class (i.e. 2 * (precision * recall) / (precision + recall)) The harmonic mean of precision and recall. Higher values are better.

AUC_RESULT AUC_Result

Types \

	AUC_Result

AUC_Result Result layout for Analysis.Classification.AUC. Provides the area under the Receiver Operating Characteristic curve for the given given data. This area is a measure of the classifier's ability to distinguish between classes.

FIELD **wi** ||| UNSIGNED2 — Work item identifier

FIELD **classifier** ||| UNSIGNED4 — The field number associated with this dependent variable, for multi-variate. Otherwise 1.

FIELD **class** ||| INTEGER4 — The class to which the analytics apply.

FIELD **AUC** ||| REAL8 — The value of the Area Under the Receiver Operating Characteristic curve for this class. This value ranges between 0 and 1. A higher value is an indication of a better classifier.

REGRESSION_ACCURACY Regression_Accuracy

Types \

	Regression_Accuracy

Regression_Accuracy Results layout for Analysis.Regression.Accuracy

FIELD **wi** ||| UNSIGNED2 — Work item identifier

FIELD **regressor** ||| UNSIGNED4 — The field number associated with this dependent variable, for multi-variate. Otherwise 1.

FIELD **R2** ||| REAL8 — The R-Squared value (Coefficient of Determination) for the regression. R-squared of zero or negative indicates that the regression has no predictive value. R2 of 1 would indicate a perfect regression.

FIELD **MSE** ||| REAL8 — Mean Squared Error = SUM((predicted - actual)^2) / N (number of datapoints)

FIELD **RMSE** ||| REAL8 — Root Mean Squared Error = MSE^.5 (Square root of MSE)

CONTINGENCY_TABLE Contingency_Table

Types \

	Contingency_Table

Contingency_Table Contains the contingency table for every combination of feature and classifier. Result layout for Analysis.FeatureSelection.Contingency

FIELD **wi** ||| UNSIGNED2 — Work item identifier

FIELD **fnumber** ||| UNSIGNED4 — The feature number

FIELD **snumber** ||| UNSIGNED4 — The sample number or the classifier number

FIELD **fclass** ||| INTEGER4 — The feature label / class

FIELD **sclass** ||| INTEGER4 — The sample (classifier) label / class

FIELD **cnt** ||| INTEGER8 — The number of samples with feature label fclass and classifier label sclass Does not contain entries for combinations with no members.

CHI2_RESULT Chi2_Result

Types \

	Chi2_Result

Chi2_Result Result layout for Analysis.FeatureSelection.Chi2 Contains chi2 value for every combination of feature and classifier per work item, and its corresponding p value.

FIELD **wi** ||| UNSIGNED2 — Work item identifier

FIELD **fnumber** ||| UNSIGNED4 — Feature number

FIELD **snumber** ||| UNSIGNED4 — Sample number / number of classifier

FIELD **dof** ||| INTEGER8 — The number of degrees of freedom

FIELD **x2** ||| REAL8 — The chi2 value for this combination. Higher values indicate more closely related variables

FIELD **p** ||| REAL8 — The p-value, which is the area under the chi-square probability density function curve to the right of the specified x2 value. The probability that the variables are not closely related

---

ARI_RESULT ARI_Result

Types \

	ARI_Result

ARI_Result Result layout for Analysis.Clustering.ARI Contains the Adjusted Rand Index for each work item.

FIELD **wi** ||| UNSIGNED2 — Work item identifier

FIELD **value** ||| REAL8 — The ARI for the model

SAMPLESILHOUETTE_RESULT SampleSilhouette_Result

Types \

	SampleSilhouette_Result

SampleSilhouette_Result Result layout for Analysis.Clustering.SampleSilhouetteScore Contains the silhouette score for each sample datapoint.

FIELD **wi** ||| UNSIGNED2 — Work item identifier

FIELD **id** ||| UNSIGNED8 — Sample datapoint identifier

FIELD **value** ||| REAL8 — Silhouette score

SILHOUETTE_RESULT Silhouette_Result

Types \

	Silhouette_Result

Silhouette_Result Result layout for Analysis.Clustering.SilhouetteScore Contains the silhouette score for each work item.

FIELD **wi** ||| UNSIGNED2 — Work item identifier

FIELD **score** ||| REAL8 — Silhouette score

CLUSTERLABELS ClusterLabels

Types \

	ClusterLabels

ClusterLabels format defines the distance space where each cluster defined by a center and its closest samples. It is the same as KMeans.Types.KMeans_Model.Labels.

FIELD **wi** ||| UNSIGNED2 — The model identifier.

FIELD **id** ||| UNSIGNED8 — The sample identifier.

FIELD **label** ||| UNSIGNED8 — The identifier of the closest center to the sample.

DATA_DIAGNOSTIC Data_Diagnostic

Types \

	Data_Diagnostic

No Documentation Found

FIELD **wi** ||| UNSIGNED2 — No Doc

FIELD **valid** ||| BOOLEAN — No Doc

FIELD **message_text** ||| SET (VARSTRING) — No Doc

FIELD_MAPPING Field_Mapping

Types \

	Field_Mapping

Field_Mapping is the format produced by ToField for field-name mapping.

FIELD **orig_name** ||| STRING — The name of the field in the original layout

FIELD **assigned_name** ||| STRING — The integer field number used in the ML algorithm stored as a STRING

LUCI_REC LUCI_Rec

Types \

	LUCI_Rec

LUCI Record – A dataset of lines each containing a string This is the DATASET format in which ML algorithm export LUCI files.

FIELD **line** ||| STRING — A single line in the LUCI csv file

---

CLASSIFICATION_SCORES Classification_Scores

Types \

	Classification_Scores

Classification_Scores The probability or confidence, per class, that a sample belongs to that class.

FIELD **wi** ||| UNSIGNED2 — The work-item identifier.

FIELD **id** ||| UNSIGNED8 — The record-id of the sample.

FIELD **classifier** ||| UNSIGNED4 — The field number associated with this dependent variable, for multi-variate. Otherwise 1.

FIELD **class** ||| INTEGER4 — The class label.

FIELD **prob** ||| REAL8 — The percentage of trees that assigned this class label, which is a rough stand-in for the probability that the label is correct.

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ICLASSIFY IClassify

	IClassify

DEPRECATED Interface Definition for Classification Modules (version 1). This interface is being deprecated and should not be used for new bundles or bundles undergoing substantial revision. Please use IClassify2 going forward. Interface definition for Classification. Actual implementation modules will probably take parameters.

Children

1. GetModel (From IClassify) : Calculate the model to fit the observation data to the observed classes
2. Classify (From IClassify) : Classify the observations using a model
3. Report (From IClassify) : Report the confusion matrix for the classifier and training data

---

GETMODEL GetModel

IClassify \

DATASET(Types.Layout_Model)	**GetModel**
(DATASET(Types.NumericField) observations, DATASET(Types.DiscreteField) classifications)	

Calculate the model to fit the observation data to the observed classes.

PARAMETER **observations** ||| TABLE (NumericField) — the observed explanatory values.

PARAMETER **classifications** ||| TABLE (DiscreteField) — the observed classification used to build. the model

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value })** — the encoded model

---

CLASSIFY Classify

IClassify \

DATASET(Types.Classify_Result)	**Classify**
(DATASET(Types.Layout_Model) model, DATASET(Types.NumericField) new_observations)	

Classify the observations using a model.

PARAMETER **model** ||| TABLE (Layout_Model) — The model, which must be produced by a corresponding getModel function.

PARAMETER **new_observations** ||| TABLE (NumericField) — observations to be classified.

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , INTEGER4 value , REAL8 conf })** — Classification with a confidence value.

REPORT Report

IClassify \

DATASET(Types.Confusion_Detail)	**Report**
(DATASET(Types.Layout_Model) model, DATASET(Types.NumericField) observations, DATASET(Types.DiscreteField) classifications)	

Report the confusion matrix for the classifier and training data.

PARAMETER **model** ||| TABLE (Layout_Model) — the encoded model.

PARAMETER **observations** ||| TABLE (NumericField) — the explanatory values.

PARAMETER **classifications** ||| TABLE (DiscreteField) — the classifications associated with the observations.

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED4 classifier , INTEGER4 actual_class , INTEGER4 predict_class , UNSIGNED4 occurs , BOOLEAN correct , REAL8 pctActual , REAL8 pctPred })** — the confusion matrix showing correct and incorrect results.

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ICLASSIFY2 IClassify2

	IClassify2

Interface definition for Classification (Version 2). Classification learns a function that maps a set of input data to one or more output class-label (i.e. Discrete) variables. The resulting learned function is known as the model. That model can then be used repetitively to predict the class(es) for each sample when presented with new input data. Actual implementation modules will probably take configuration parameters to control the classification process. The Classification modules also expose attributes for assessing the effectiveness of the classification.

Children

1. GetModel (From IClassify2) : Calculate the model to fit the independent data to the observed classes (i.e
2. Classify (From IClassify2) : Classify the observations using a model
3. Accuracy (From IClassify2) : Return accuracy metrics for the given set of test data
   This is equivalent to calling Predict followed by Analysis.Classification.Accuracy(...)
4. AccuracyByClass (From IClassify2) : Return class-level accuracy by class metrics for the given set of test data

5. ConfusionMatrix (From IClassify2) : Return the confusion matrix for a set of test data

---

GETMODEL GetModel

IClassify2 \

DATASET(Layout_Model2)	**GetModel**
(DATASET(NumericField) independents, DATASET(DiscreteField) dependents)	

Calculate the model to fit the independent data to the observed classes (i.e. dependent data).

PARAMETER **indepenedents** ||| — The observed independent (explanatory) values.

PARAMETER **dependents** ||| TABLE (DiscreteField) — The observed dependent(class label) values.

PARAMETER **independents** ||| TABLE (NumericField) — No Doc

RETURN **TABLE ({ UNSIGNED2 wi , REAL8 value , SET (UNSIGNED4) indexes })** — The encoded model.

SEE Types.Layout_Model2

SEE Types.NumericField

SEE Types.DiscreteField

CLASSIFY Classify

IClassify2 \

DATASET(DiscreteField)	**Classify**
(DATASET(Layout_Model2) model, DATASET(NumericField) observations)	

Classify the observations using a model.

PARAMETER **model** ||| TABLE (Layout_Model2) — The model, which must be produced by a corresponding getModel function.

PARAMETER **observations** ||| TABLE (NumericField) — New observations (independent data) to be classified.

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , INTEGER4 value })** — Predicted class values.

ACCURACY Accuracy

IClassify2 \

DATASET(Classification_Accuracy)	**Accuracy**
(DATASET(Layout_Model2) model, DATASET(DiscreteField) actuals, DATASET(NumericField) observations)	

Return accuracy metrics for the given set of test data

This is equivalent to calling Predict followed by Analysis.Classification.Accuracy(. . .).

Provides accuracy statistics as follows:

- errCount – The number of misclassified samples.
- errPct – The percentage of samples that were misclasified (0.0 - 1.0).
- RawAccuracy – The percentage of samples properly classified (0.0 - 1.0).
- PoD – Power of Discrimination. Indicates how this classification performed relative to a random guess of class. Zero or negative indicates that the classification was no better than a random guess. 1.0 indicates a perfect classification. For example if there are two equiprobable classes, then a random guess would be right about 50% of the time. If this classification had a Raw Accuracy of 75%, then its PoD would be .5 (half way between a random guess and perfection).
- PoDE – Power of Discrimination Extended. Indicates how this classification performed relative to guessing the most frequent class (i.e. the trivial solution). Zero or negative indicates that this classification is no better than the trivial solution. 1.0 indicates perfect classification. For example, if 95% of the samples were of class 1, then the trivial solution would be right 95% of the time. If this classification had a raw accuracy of 97.5%, its PoDE would be .5 (i.e. half way between trivial solution and perfection).

  Normally, this should be called using data samples that were not included in the training set. In that case, these statistics are considered Out-of-Sample error statistics. If it is called with the X

and Y from the training set, it provides In-Sample error statistics, which should never be used to rate the classification model.

PARAMETER **model** ||| TABLE (Layout_Model2) — The encoded model as returned from GetModel.

PARAMETER **actuals** ||| TABLE (DiscreteField) — The actual class values associated with the observations.

PARAMETER **observations** ||| TABLE (NumericField) — The independent (explanatory) values on which to base the test.

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED4 classifier , UNSIGNED8 recCnt , UNSIGNED8 errCnt , REAL8 Raw_Accuracy , REAL8 PoD , REAL8 PoDE , REAL8 Hamming_Loss })** — DATSET(Classification_Accuracy), one record per work-item.

SEE Types.Classification_Accuracy

ACCURACYBYCLASS AccuracyByClass

IClassify2 \

DATASET(Class_Accuracy)	**AccuracyByClass**
(DATASET(Layout_Model2) model, DATASET(DiscreteField) actuals, DATASET(NumericField) observations)	

Return class-level accuracy by class metrics for the given set of test data.

This is equivalent to calling Predict followed by Analysis.Classification.AccuracyByClass(...).

PARAMETER **model** ||| TABLE (Layout_Model2) — The encoded model as returned from GetModel.

PARAMETER **actuals** ||| TABLE (DiscreteField) — The actual class values associated with the observations.

PARAMETER **observations** ||| TABLE (NumericField) — The independent (explanatory) values on which to base the test

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED4 classifier , INTEGER4 class , REAL8 precision , REAL8 recall , REAL8 FPR , REAL8 f_score })** — DATASET(Class_Accuracy), one record per work-item per class.

SEE Types.Class_Accuracy.

CONFUSIONMATRIX ConfusionMatrix

IClassify2 \

DATASET(Confusion_Detail)	**ConfusionMatrix**
(DATASET(Layout_Model2) model, DATASET(DiscreteField) actuals, DATASET(NumericField) observations)	

Return the confusion matrix for a set of test data. This is equivalent to calling Predict follwed by Analysis.Classification.ConfusionMatrix(...).

The confusion matrix indicates the number of datapoints that were classified correctly or incorrectly for each class label.

The matrix is provided as a matrix of size numClasses x numClasses with fields as follows:

- 'wi' – The work item id
- 'pred' – the predicted class label (from Classify).
- 'actual' – the actual (target) class label.
- 'samples' – the count of samples that were predicted as 'pred', but should have been 'actual'.
- 'totSamples' – the total number of samples that were predicted as 'pred'.
- 'pctSamples' – the percentage of all samples that were predicted as 'pred', that should have been 'actual' (i.e. samples / totSamples)

This is a useful tool for understanding how the algorithm achieved the overall accuracy. For example: were the common classes mostly correct, while less common classes often misclassified? Which classes were most often confused? This should be called with test data that is independent of the training data in order to understand the out-of-sample (i.e. generalization) performance.

PARAMETER **model** ||| TABLE (Layout_Model2) — The encoded model as returned from GetModel.

PARAMETER **actuals** ||| TABLE (DiscreteField) — The actual class values.

PARAMETER **observations** ||| TABLE (NumericField) — The independent (explanatory) values.

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED4 classifier , INTEGER4 actual_class , INTEGER4 predict_class , UNSIGNED4 occurs , BOOLEAN correct , REAL8 pctActual , REAL8 pctPred })** — DATASET(Confusion_Detail), one record per cell of the confusion matrix.

SEE Types.Confusion_Detail.

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IREGRESSION IRegression

/ EXPORT	**IRegression**
(DATASET(NumericField) X=empty_data, DATASET(NumericField) Y=empty_data)	

DEPRECATED Interface Definition for Regression Modules (version 1). This interface is being deprecated and should not be used for new bundles or bundles undergoing substantial revision. Please use IRegression2 going forward. Regression learns a function that maps a set of input data to one or more output variables. The resulting learned function is known as the model. That model can then be used repetitively to predict (i.e. estimate) the output value(s) based on new input data.

PARAMETER **X** ||| TABLE (NumericField) — The independent data in DATASET(NumericField) format. Each statistical unit (e.g. record) is identified by 'id', and each feature is identified by field number (i.e. 'number').

PARAMETER **Y** ||| TABLE (NumericField) — The dependent variable(s) in DATASET(NumericField) format. Each statistical unit (e.g. record) is identified by 'id', and each feature is identified by field number (i.e. 'number').

Children

1. GetModel (From IRegression) : Calculate and return the 'learned' model
2. Predict (From IRegression) : Predict the output variable(s) based on a previously learned model

---

GETMODEL GetModel

IRegression \

DATASET(Layout_Model)	**GetModel**

Calculate and return the 'learned' model. The model may be persisted and later used to make predictions using 'Predict' below.

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value })** — DATASET(LayoutModel) describing the learned model parameters.

PREDICT Predict

IRegression \

DATASET(NumericField)	**Predict**
(DATASET(NumericField) newX, DATASET(Layout_Model) model)	

Predict the output variable(s) based on a previously learned model.

PARAMETER **newX** ||| TABLE (NumericField) — DATASET(NumericField) containing the X values to b predicted.

PARAMETER **model** ||| TABLE (Layout_Model) — No Doc

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value })** — DATASET(NumericField) containing one entry per observation (i.e. id) in newX. This represents the predicted values for Y.

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IREGRESSION2 IRegression2

	IRegression2

Interface Definition for Regression Modules (Version 2). Regression learns a function that maps a set of input data to one or more continuous output variables. The resulting learned function is known as the model. That model can then be used repetitively to predict (i.e. estimate) the output value(s) based on new input data. Actual implementation modules will probably take configuration parameters to control the regression process. The regression modules also expose attributes for assessing the effectiveness of the regression.

Children

1. GetModel (From IRegression2) : Calculate and return the 'learned' model
2. Predict (From IRegression2) : Predict the output variable(s) based on a previously learned model
3. Accuracy (From IRegression2) : Assess the accuracy of a set of predictions

GETMODEL GetModel

IRegression2 \

DATASET(Layout_Model2)	GetModel
(DATASET(NumericField) independents, DATASET(NumericField) dependents)	

Calculate and return the 'learned' model.

The model may be persisted and later used to make predictions using 'Predict' below.

PARAMETER **independents** ||| TABLE (NumericField) — The independent data in DATASET(NumericField) format. Each statistical unit (e.g. record) is identified by 'id', and each feature is identified by field number (i.e. 'number').

PARAMETER **dependents** ||| TABLE (NumericField) — The dependent variable(s) in DATASET(NumericField) format. Each statistical unit (e.g. record) is identified by 'id', and each feature is identified by field number (i.e. 'number').

RETURN **TABLE ({ UNSIGNED2 wi , REAL8 value , SET (UNSIGNED4) indexes })** — The encoded model.

SEE Types.NumericField

SEE Types.Layout_Model2

PREDICT Predict

IRegression2 \

DATASET(NumericField)	Predict
(DATASET(Layout_Model2) model, DATASET(NumericField) observations)	

Predict the output variable(s) based on a previously learned model

PARAMETER **independents** ||| — the observations upon which to predict.

PARAMETER **model** ||| TABLE (Layout_Model2) — No Doc

PARAMETER **observations** ||| TABLE (NumericField) — No Doc

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value })** — one entry per observation (i.e. id) in observations. This represents the predicted values for the dependent variable(s).

ACCURACY Accuracy

IRegression2 \

DATASET(Regression_Accuracy)	**Accuracy**
(DATASET(Layout_Model2) model, DATASET(NumericField) actuals, DATASET(NumericField) observations)	

Assess the accuracy of a set of predictions. This is equivalent to calling predict and then Analysis.Regression.Accuracy.

PARAMETER **model** ||| TABLE (Layout_Model2) — The model as returned from GetModel

PARAMETER **actuals** ||| TABLE (NumericField) — The actual values of the dependent variable to compare with the predictions.

PARAMETER **observations** ||| TABLE (NumericField) — The independent data upon which the accuracy assessment is to be based.

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED4 regressor , REAL8 R2 , REAL8 MSE , REAL8 RMSE })** — Accuracy statistics (see Types.Regression_Accuracy for details)

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DESCRIPTIONS

BETA Beta

/ EXPORT	**Beta**
(REAL8 x, REAL8 y)	

Compute the beta value of two positive real numbers, x and y.

PARAMETER **x** ||| REAL8 — the value of the first number

PARAMETER **y** ||| REAL8 — the value of the second number

RETURN **REAL8** — the beta value

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Distributions

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DESCRIPTIONS

DISTRIBUTIONS Distributions

	Distributions

Compute PDF, CDF, and PPF values for various Probability Distributions.

The Probability Density Function(PDF(x)) of a distribution is the relative likelihood of a sample drawn from that distribution being of value x.

The Cumulative Distribution Function (CDF(x)) of a distribution is the probability of a sample drawn from that distribution to be less than or equal to x.

The Percentage Point Function (PPF(x)) of a distribution is the inverse of the CDF. Given a probability, it returns the value at which the probability of occurrence is less than or equal to the given probability.

Children

1. Normal_CDF (From Distributions) : Cumulative Distribution Function (CDF) of the standard normal distribution
2. Normal_PPF (From Distributions) : Percentage Point Function (PPF) for the Normal Distribution

3. T_CDF (From Distributions) : Cumulative Distribution Function (CDF) for Students t distribution
4. T_PPF (From Distributions) : Percentage point function (PPF) for the T distribution
5. Chi2_CDF (From Distributions) : The Cumulative Distribution Function (CDF) for the Chi Square distribution for the specified degrees of freedom
6. Chi2_PPF (From Distributions) : Probability Point Function (PPF) for the Chi Squared distribution

---

NORMAL_CDF Normal_CDF

Distributions \

REAL8	**Normal_CDF**
(REAL8 x)	

Cumulative Distribution Function (CDF) of the standard normal distribution. The probability that a normal random variable will be smaller than or equal to x standard deviations above or below the mean.

Taken from C/C++ Mathematical Algorithms for Scientists and Engineers, n. Shammas, McGraw-Hill, 1995.

PARAMETER **x** ||| REAL8 — the number of standard deviations.

RETURN **REAL8** — probability of exceeding x.

NORMAL_PPF Normal_PPF

Distributions \

REAL8	**Normal_PPF**
(REAL8 x)	

Percentage Point Function (PPF) for the Normal Distribution.

Translated from C/C++ Mathematical Algorithms for Scientists and Engineers, N. Shammas, McGraw-Hill, 1995.

PARAMETER **x** ||| REAL8 — probability.

RETURN **REAL8** — number of standard deviations from the mean.

T_CDF T_CDF

Distributions \

REAL8	**T_CDF**
(REAL8 x, REAL8 df)	

Cumulative Distribution Function (CDF) for Students t distribution.

The integral evaluated between negative infinity and x.

Translated from NIST SEL DATAPAC Fortran TCDF.f source.

PARAMETER **x** ||| REAL8 — value of the evaluation.

PARAMETER **df** ||| REAL8 — degrees of freedom.

RETURN **REAL8** — the probability that a value will be less than or equal to the specified value.

T_PPF T_PPF

Distributions \

REAL8	**T_PPF**
(REAL8 x, REAL8 df)	

Percentage point function (PPF) for the T distribution.

Translated from NIST SEL DATAPAC Fortran TPPF.f source.

PARAMETER **x** ||| REAL8 — the probability.

PARAMETER **df** ||| REAL8 — degrees of freedom of the distribution.

RETURN **REAL8** — the value with that probability.

CHI2_CDF Chi2_CDF

Distributions \

REAL8	**Chi2_CDF**
(REAL8 x, REAL8 df)	

The Cumulative Distribution Function (CDF) for the Chi Square distribution for the specified degrees of freedom.

Translated from the NIST SEL DATAPAC Fortran subroutine CHSCDF.

PARAMETER **x** ||| REAL8 — the value at which to compute.

PARAMETER **df** ||| REAL8 — the degrees of freedom of the distribution.

RETURN **REAL8** — the cumulative probability.

CHI2_PPF Chi2_PPF

Distributions \

REAL8	**Chi2_PPF**
(REAL8 x, REAL8 df)	

Probability Point Function (PPF) for the Chi Squared distribution.

Translated from the NIST SEL DATAPAC Fortran subroutine CHSPPF.

PARAMETER **x** ||| REAL8 — the probability value.

PARAMETER **df** ||| REAL8 — the degrees of freedom of the distribution.

RETURN **REAL8** — the value with that probability.

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DoubleFac

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DESCRIPTIONS

DOUBLEFAC DoubleFac

/ EXPORT REAL8	**DoubleFac**
(INTEGER2 i)	

Compute the double factorial. The double factorial is defined for odd n as the product of all the odd numbers up to and including that number.

For even numbers it is the product of the even numbers up to and including that number.

Thus DoubleFac(8) = 8*6*4*2.

IF i < 2, the value 1 is returned.

PARAMETER **i** ||| INTEGER2 — the input value.

RETURN **REAL8** — the numeric result.

Math/

Fac

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DESCRIPTIONS

FAC Fac

/ EXPORT REAL8	**Fac**
(UNSIGNED2 i)	

Factorial function, (i)(i-1)(i-2)...(2)

PARAMETER **i** ||| UNSIGNED2 — the input value.

RETURN **REAL8** — the factorial i!.

---

gamma

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DESCRIPTIONS

GAMMA gamma

/ EXPORT REAL8	**gamma**
(REAL8 x)	

Compute the value of gamma function of real number x.

This is a wrapper for the standard C tgamma function.

PARAMETER **x** ||| REAL8 — the input value.

RETURN **REAL8** — the value of GAMMA evaluated at x.

---

log_gamma

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DESCRIPTIONS

LOG_GAMMA log_gamma

/ EXPORT REAL8	log_gamma
(REAL8 x)	

Compute the value of the log gamma function of the absolute value of X.

This is wrapper for the standard C lgamma function. Avoids the race condition found on some platforms by taking the absolute value of the input argument.

PARAMETER **x** ||| REAL8 — the input x.

RETURN **REAL8** — the value of the log of the GAMMA evaluated at ABS(x).

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DESCRIPTIONS

LOWERGAMMA lowerGamma

/ EXPORT REAL8	**lowerGamma**
(REAL8 x, REAL8 y)	

Compute the lower incomplete gamma value of two real numbers, x and y.

PARAMETER **x** ||| REAL8 — the value of the first number.

PARAMETER **y** ||| REAL8 — the value of the second number.

RETURN **REAL8** — the lower incomplete gamma value.

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DESCRIPTIONS

NCK NCK

/ EXPORT REAL8	**NCK**
(INTEGER2 N, INTEGER2 K)	

N Choose K – finds the number of combinations of K elements out of a possible N.

PARAMETER **N** ||| INTEGER2 — the number of items in the population.

PARAMETER **K** ||| INTEGER2 — the number of items to choose.

RETURN **REAL8** — the number of combinations.

Poly

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DESCRIPTIONS

POLY Poly

/ EXPORT REAL8	**Poly**
(REAL8 x, SET OF REAL8 Coeffs)	

Evaluate a polynomial from a set of coefficients.

Coeffs 1 is assumed to be the HIGH order of the equation.

Thus for ax^2+bx+c - the set would need to be Coef := [a,b,c];

PARAMETER **x** ||| REAL8 — the value of x in the polynomial.

PARAMETER **Coeffs** ||| SET (REAL8) — a set of coefficients for the polynomial. The ALL set is considered to be all zero values.

RETURN **REAL8** — value of the polynomial at x.

Math/

StirlingFormula

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DESCRIPTIONS

STIRLINGFORMULA StirlingFormula

/ EXPORT	**StirlingFormula**
(REAL x)	

Stirling's formula.

PARAMETER **x** ||| REAL8 — the point of evaluation.

RETURN **REAL8** — evaluation result.

Math/

upperGamma

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DESCRIPTIONS

UPPERGAMMA upperGamma

/ EXPORT REAL8	**upperGamma**
(REAL8 x, REAL8 y)	

Compute the upper incomplete gamma value of two real numbers, x and y.

PARAMETER **x** ||| REAL8 — the value of the first number.

PARAMETER **y** ||| REAL8 — the value of the second number.

RETURN **REAL8** — the upper incomplete gamma value.

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DESCRIPTIONS

LABELENCODER LabelEncoder

	LabelEncoder

Allows to convert categorical values into numeric format. For example: use LabelEncoder to convert below raw data: raw := DATASET([{'apple'}, {'grape'}], {STRING fruit}); The result is as following: convertedDs := DATASET([{0}, {1}], {INTEGER fruit}); Curently does not support Myriad interface

Children

1. GetKey (From LabelEncoder) : Builds a mapping between feature names and categories
2. GetMapping (From LabelEncoder) : Builds a lookup table that maps each category of a feature to a unique number
3. Encode (From LabelEncoder) : Replaces each categorical value in the data with its index in the key
4. Decode (From LabelEncoder) : Converts back the categorical values into their original labels

---

GETKEY GetKey

LabelEncoder \

	GetKey
`(dataForUndefinedCategories, partialKey)`	

Builds a mapping between feature names and categories.

PARAMETER **dataForUndefinedCategories:** ||| INTEGER8 — any record-oriented dataset. The data from which the categories are extracted if not predefined in the list of categorical features.

PARAMETER **partialKey:** ||| INTEGER8 — same record structure as the key (see below). Mapping between feature names and categories. Some names are mapped to empty categories such that their categories could be extracted from dataForUndefinedCategories.

RETURN **BOOLEAN** — key: DATASET(KeyLayout) The full mapping between categorical feature names and their categories. Its record structure has the following format: <pre><name of="" categorical="" feature="">; SET OF STRING <name of="" categorical="" feature="">; ... SET OF STRING <name of="" categorical="" feature="" n="">; END; </name></name></name>
 KeyLayout := RECORD
 SET OF STRING </pre>

GETMAPPING GetMapping

LabelEncoder \

	GetMapping
(key)	

Builds a lookup table that maps each category of a feature to a unique number. Each category is assigned its index in the category set.

PARAMETER **key:** ||| INTEGER8 — DATASET(KeyLayout). Mapping between feature names and categories.

RETURN **BOOLEAN** — categoriesMapping: DATASET(MappingLayout). A table with each feature name mapped to its categories and each category mapped to its value. <pre>
 //record mapping a category to its value.
 Category := RECORD
 STRING categoryName;
 INTEGER value;
 END;

 //record mapping feature names to their categories.
 MappingLayout := RECORD
 STRING featureName;
 DATASET(Category) categories;
 END;
 </pre>

ENCODE Encode

LabelEncoder \

	Encode
	`(dataToEncode, key)`

Replaces each categorical value in the data with its index in the key. Every unknown category (not in the key) is replaced by -1.

PARAMETER **dataToEncode:** ||| INTEGER8 — any dataset. The data to encode.

PARAMETER **key:** ||| INTEGER8 — DATASET(KeyLayout). Mapping between feature names and their categories.

RETURN **BOOLEAN** — encodedData: same record structure as dataToEncode with the datatype of all categorical features changed to INTEGER. Data with categorical values replaced by numbers.

DECODE Decode

LabelEncoder \

	Decode
	`(dataToDecode, encoderKey)`

Converts back the categorical values into their original labels. Every -1 is replaced by an empty string.

PARAMETER **dataToDecode:** ||| INTEGER8 — any dataset. The data to decode.

PARAMETER **key:** ||| — DATASET(KeyLayout). Mapping between feature names and their categories.

PARAMETER **encoderkey** ||| INTEGER8 — No Doc

RETURN **BOOLEAN** — decodedData: same record structure as dataToDecode with the datatype of all categorical features changed to STRING. Data with categorical values replaced by their original labels.

Preprocessing/

MinMaxScaler

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DESCRIPTIONS

MINMAXSCALER MinMaxScaler

/ EXPORT	MinMaxScaler
(DATASET(NumericField) baseData = DATASET([], NumericField), t_FieldReal lowBound = 0.0, t_FieldReal highBound = 1.0, DATASET(KeyLayout) key = DATASET([], KeyLayout))	

Scale the input data to a defined range [Min, Max]. Curently does not support Myriad interface

PARAMETER **baseData:** ||| TABLE (NumericField) — DATASET(NumericField), Default = DATASET([], NumericField). The data from which the minimums and maximums are determined.

PARAMETER **low:** ||| — t_FieldReal, Default = 0.0 The minimum value of the normalized data.

PARAMETER **high:** ||| — t_FieldReal, Default = 1.0 The maximum value of the normalized data.

PARAMETER **key:** ||| TABLE (KeyLayout) — DATASET(KeyLayout), default = DATASET([], KeyRec). The key to be reused for scaling/unscaling.

PARAMETER **lowbound** ||| REAL8 — No Doc

PARAMETER **highbound** ||| REAL8 — No Doc

SEE StandardScaler

Children

1. GetKey (From MinMaxScaler) : Computes the key or reuses it if already given
2. Scale (From MinMaxScaler) : scales the data using the following formula:
3. unscale (From MinMaxScaler) : unscales the data using the following formula

---

GETKEY GetKey

MinMaxScaler \

	GetKey
()	

Computes the key or reuses it if already given.

RETURN **TABLE ({ REAL8 lowBound , REAL8 highBound , TABLE (FeatureMinMax) minsMaxs })** — the key: DATASET(KeyLayout).

SCALE Scale

MinMaxScaler \

	Scale
(DATASET(NumericField) dataToScale)	

scales the data using the following formula: x' = min + ([(x - x_min)(max - min)]/(x_max - x_min))

PARAMETER **dataToScale:** ||| TABLE (NumericField) — DATASET(NumericField). The data to scale.

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value })** — the scaled data: DATASET(NumericField)

UNSCALE unscale

MinMaxScaler \

	unscale
(DATASET(NumericField) dataToUnscale)	

unscales the data using the following formula x = x_min + ((x' - min)(x_max - x_min))/(max-min)

PARAMETER **dataToUnscale:** ||| TABLE (NumericField) — DATASET(NumericField) The data to unscale.

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value })** — the unscaled data: DATASET(NumericField).

Preprocessing/

Normalizer

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DESCRIPTIONS

NORMALIZER Normalizer

	Normalizer
(DATASET(MTypes.NumericField) dataToNormalize, STRING3 norm = '12')	

Normalizer Normalizes each sample to its unit norm (row-wise normalization) with below options L1 norm.

Given a set of values, the L1 norm is the sum of absolute values. L2 norm.

Given a set of values, the L2 norm is the square root of the sum of squares. L-Infinty norm.

Given a set of values the l-infinty norm is the value with highest absolute value.

PARAMETER **dataToNormalize:** ||| TABLE (NumericField) — DATASET(Types.NumericField) The data to normalize.

PARAMETER **norm:** ||| STRING3 — STRING3, Default = '12'. The norm based on which the data will be normalized. valid values: '11', '12', 'inf'.

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8**

value }) — the normalizedData: DATASET(NumericField). Curently does not support Myriad interface.

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OneHotEncoder

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DESCRIPTIONS

ONEHOTENCODER OneHotEncoder

/ EXPORT	**OneHotEncoder**
(DATASET(NumericField) ds = DATASET([], NumericField), DATASET(l_cFeatures) categoricalFeatures = DATASET([], l_cFeatures))	

OneHotEncoder OneHotEncode is used to convert each of the designated categorical features to a binary (absent/present) value (i.e.oneHot) for use by algorithms that don't directly support categorical values. Also can convert back from oneHot encoding to numerical category. Each categorical field will produce additional features according to its cardinality. For example, if there are four possible categories, then the original feature will be replaced by four binary features. Supports Myriad Interface.

PARAMETER **ds** ||| TABLE (NumericField) — dataset to be encoded.

PARAMETER **categoricalFeatures** ||| TABLE (l_cFeatures) — categorical feature IDs for each work item. e.g. to encoded field number 3 for work item 1, below categoricalFeatures can be used: DATASET([{1, 3}], l_cFeatures)

Children

1. isValidInput (From OneHotEncoder) : Validates input

2. getMappings (From OneHotEncoder) : No Documentation Found
3. encode (From OneHotEncoder) : No Documentation Found
4. decode (From OneHotEncoder) : Revert the encoded data to its original form

---

ISVALIDINPUT isValidInput

OneHotEncoder \

	isValidInput
()	

Validates input.

RETURN **BOOLEAN** — True when input is valid, False otherwise.

GETMAPPINGS getMappings

OneHotEncoder \

	getMappings

No Documentation Found

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED4 number , REAL8 value , UNSIGNED4 newNum })** —

ENCODE encode

OneHotEncoder \

	encode

No Documentation Found

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value })** —

DECODE decode

OneHotEncoder \

	decode
	`(DATASET(NumericField) encodedDS)`

Revert the encoded data to its original form

PARAMETER **encodedDS** ||| TABLE (NumericField) — encoded data

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value })** — decoded decoded data

---

Preprocessing/

Split

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DESCRIPTIONS

SPLIT Split

	Split
	`(DATASET(NumericField) dataToSplit, REAL4 splitRatio = 0.0, BOOLEAN shuffle = FALSE)`

Split input data into training and test sets based on the split ratio. It requires the data has sequential id starting with 1. Curently does not support Myriad interface

PARAMETER **dataToSplit:** ||| TABLE (NumericField) — DATASET(Types.NumericField). The data to split.

PARAMETER **splitRatio:** ||| REAL4 — REAL4, DEFAULT = 0.5. The percentage of input data split as training data.

PARAMETER **shuffle:** ||| BOOLEAN — Boolean, DEFAULT = false. if true, the data is shuffled before splitting.

RETURN — training and test data Note: currently not support Myraid interface.

Children

1. trainData (From Split) : No Documentation Found
2. testData (From Split) : No Documentation Found

TRAINDATA trainData

Split \

	trainData

No Documentation Found

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value }) —**

TESTDATA testData

Split \

	testData

No Documentation Found

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value }) —**

Preprocessing/

StandardScaler

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DESCRIPTIONS

STANDARDSCALER StandardScaler

/ EXPORT	StandardScaler
(DATASET(NumericField) baseData = DATASET([], NumericField), DATASET(KeyLayout) key = DATASET([], KeyLayout))	

Standardize the data by mapping to zero mean and standard deviation of 1.0. Curently does not support Myriad interface

PARAMETER **baseData:** ||| TABLE (NumericField) — DATASET(NumericField), default = DATASET([], Types.NumericField) The data from which the means and standard deviations are determined for each feature.

PARAMETER **key:** ||| TABLE (KeyLayout) — DATASET(KeyLayout), default = DATASET([], KeyRec) The key to be reused for scaling/unscaling.

Children

1. GetKey (From StandardScaler) : Compute the mean and standard deviation per feature or reuses the key if provided
2. Scale (From StandardScaler) : scale the data using the following formula
3. unscale (From StandardScaler) : unscale the data using the following formula:

GETKEY GetKey

StandardScaler \

	GetKey
	()

Compute the mean and standard deviation per feature or reuses the key if provided.

RETURN **TABLE ({ UNSIGNED4 featureId , REAL8 avg , REAL8 stdev })** — key: DATASET(KeyLayout).

SCALE Scale

StandardScaler \

	Scale
	(DATASET(NumericField) dataToScale)

scale the data using the following formula x' = (x - mean)/stdev

PARAMETER **dataToScale:** ||| TABLE (NumericField) — DATASET(NumericField). The data to scale

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value })** — the scaled data: DATASET(NumericField)

UNSCALE unscale

StandardScaler \

	unscale
	(DATASET(NumericField) dataToUnscale)

unscale the data using the following formula: x = (x' * stdev) + mean

PARAMETER **dataToUnscale:** ||| TABLE (NumericField) — DATASET(NumericField). The data to unscale.

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value })** — the unscaled data: DATASET(NumericField).

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DESCRIPTIONS

STRATIFIEDSPLIT StratifiedSplit

/ EXPORT	StratifiedSplit
(DATASET(NumericField) ds, REAL4 trainSize = 0, REAL4 testSize = 0, UNSIGNED labelId = 0, BOOLEAN shuffle = FALSE)	

Split input data into training and test sets based on the split ratio. The result preservees the percentage of the samples for the specific feature or class. It requires the data has sequential id starting with 1. Curently does not support Myriad interface.

PARAMETER **ds:** ||| TABLE (NumericField) — DATASET(NumericField). The data to split.

PARAMETER **trainSize:** ||| REAL4 — REAL4, Default = 0.0 The training size.

PARAMETER **testSize:** ||| REAL4 — REAL4, Default = 0.0 The test size.

PARAMETER **labelId:** ||| UNSIGNED8 — UNSIGNED, Default = 0. The number of the field whose proportions has to be maintained.

PARAMETER **shuffle** ||| BOOLEAN — No Doc

RETURN — the training data, test data as DATASET(NumericField).

Children

1. trainData (From StratifiedSplit) : No Documentation Found
2. testData (From StratifiedSplit) : No Documentation Found

TRAINDATA trainData

StratifiedSplit \

	trainData

No Documentation Found

RETURN TABLE ({ UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value }) —

TESTDATA testData

StratifiedSplit \

	testData

No Documentation Found

RETURN TABLE ({ UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value }) —

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	Types

Record structures for Preprocessing modules.

Children

1. valueLayout (From Types) : No Documentation Found
2. numberLayout (From Types) : No Documentation Found
3. idLayout (From Types) : No Documentation Found
4. OneHotEncoder (From Types) : record structures for OneHotEncoder
5. StandardScaler (From Types) : record structures for StandardScaler
6. MinMaxScaler (From Types) : record structures for MinMaxScaler
7. Normaliz (From Types) : record structures for normalize function

---

VALUELAYOUT valueLayout

Types \

	valueLayout

No Documentation Found

FIELD **value** ||| REAL8 — No Doc

NUMBERLAYOUT numberLayout

Types \

	numberLayout

No Documentation Found

FIELD **number** ||| UNSIGNED4 — No Doc

IDLAYOUT idLayout

Types \

	idLayout

No Documentation Found

FIELD **id** ||| UNSIGNED8 — No Doc

ONEHOTENCODER OneHotEncoder

Types \

	OneHotEncoder

record structures for OneHotEncoder.

Children

1. cFeatures (From OneHotEncoder) : No Documentation Found

CFEATURES cFeatures

Types \ OneHotEncoder \

	cFeatures

No Documentation Found

FIELD **wi** ||| UNSIGNED8 — No Doc

FIELD **number** ||| UNSIGNED8 — No Doc

STANDARDSCALER StandardScaler

Types \

	StandardScaler

record structures for StandardScaler.

Children

1. KeyLayout (From StandardScaler) : No Documentation Found

KEYLAYOUT KeyLayout

Types \ StandardScaler \

	KeyLayout

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FIELD **featureid** ||| UNSIGNED4 — No Doc

FIELD **avg** ||| REAL8 — No Doc

FIELD **stdev** ||| REAL8 — No Doc

MINMAXSCALER MinMaxScaler

Types \

	MinMaxScaler

record structures for MinMaxScaler.

Children

1. FeatureMinMax (From MinMaxScaler) : No Documentation Found
2. KeyLayout (From MinMaxScaler) : No Documentation Found

FEATUREMINMAX FeatureMinMax

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	FeatureMinMax

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FIELD **featureid** ||| UNSIGNED4 — No Doc

FIELD **minvalue** ||| REAL8 — No Doc

FIELD **maxvalue** ||| REAL8 — No Doc

KEYLAYOUT KeyLayout

Types \ MinMaxScaler \

	KeyLayout

No Documentation Found

FIELD **lowbound** ||| REAL8 — No Doc

FIELD **highbound** ||| REAL8 — No Doc

FIELD **minsmaxs** ||| TABLE (FeatureMinMax) — No Doc

NORMALIZ Normaliz

Types \

	Normaliz

record structures for normalize function.

Children

1. normsLayout (From Normaliz) : No Documentation Found

NORMSLAYOUT normsLayout

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	normsLayout

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FIELD **id** ||| UNSIGNED8 — No Doc

FIELD **value** ||| REAL8 — No Doc

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Data and Record structures used by TestLabelEncoder Modules

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1. KeyLayout (From TestDataAndTypes) : No Documentation Found
2. key (From TestDataAndTypes) : No Documentation Found
3. sampleDataLayout (From TestDataAndTypes) : No Documentation Found
4. sampleData (From TestDataAndTypes) : No Documentation Found
5. sampleData2 (From TestDataAndTypes) : No Documentation Found
6. EncodedLayout (From TestDataAndTypes) : No Documentation Found
7. encodedData1 (From TestDataAndTypes) : No Documentation Found
8. encodedData2 (From TestDataAndTypes) : No Documentation Found
9. DecodedLayout (From TestDataAndTypes) : No Documentation Found
10. decodedData1 (From TestDataAndTypes) : No Documentation Found
11. decodedData2 (From TestDataAndTypes) : No Documentation Found

KEYLAYOUT KeyLayout

TestDataAndTypes \

	KeyLayout

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FIELD **f1** ||| SET (STRING) — No Doc

FIELD **f3** ||| SET (STRING) — No Doc

FIELD **f4** ||| SET (STRING) — No Doc

KEY key

TestDataAndTypes \

	key

No Documentation Found

RETURN **ROW (KeyLayout)** —

SAMPLEDATALAYOUT sampleDataLayout

TestDataAndTypes \

	sampleDataLayout

No Documentation Found

FIELD **id** ||| UNSIGNED8 — No Doc

FIELD **f1** ||| STRING — No Doc

FIELD **f2** ||| UNSIGNED8 — No Doc

FIELD **f3** ||| UNSIGNED8 — No Doc

FIELD **f4** ||| STRING — No Doc

SAMPLEDATA sampleData

TestDataAndTypes \

	sampleData

No Documentation Found

RETURN **TABLE (sampleDataLayout)** —

SAMPLEDATA2 sampleData2

TestDataAndTypes \

	sampleData2

No Documentation Found

RETURN **TABLE (sampleDataLayout)** —

ENCODEDLAYOUT EncodedLayout

TestDataAndTypes \

	EncodedLayout

No Documentation Found

FIELD **id** ||| UNSIGNED8 — No Doc

FIELD **f1** ||| INTEGER8 — No Doc

FIELD **f2** ||| UNSIGNED8 — No Doc

FIELD **f3** ||| INTEGER8 — No Doc

FIELD **f4** ||| INTEGER8 — No Doc

ENCODEDDATA1 encodedData1

TestDataAndTypes \

	encodedData1

No Documentation Found

RETURN **TABLE (EncodedLayout)** —

ENCODEDDATA2 encodedData2

TestDataAndTypes \

	encodedData2

No Documentation Found

RETURN **TABLE (EncodedLayout)** —

DECODEDLAYOUT DecodedLayout

TestDataAndTypes \

	DecodedLayout

No Documentation Found

FIELD **id** ||| UNSIGNED8 — No Doc

FIELD **f1** ||| STRING — No Doc

FIELD **f2** ||| UNSIGNED8 — No Doc

FIELD **f3** ||| STRING — No Doc

FIELD **f4** ||| STRING — No Doc

DECODEDDATA1 decodedData1

TestDataAndTypes \

	decodedData1

No Documentation Found

RETURN **TABLE (DecodedLayout)** —

DECODEDDATA2 decodedData2

TestDataAndTypes \

	decodedData2

No Documentation Found

RETURN **TABLE (DecodedLayout) —**

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TESTDATA TestData

	TestData

Test data for testing standardScaler module

Children

1. sampleData (From TestData) : No Documentation Found
2. key1 (From TestData) : No Documentation Found
3. key2 (From TestData) : No Documentation Found
4. scaledData1 (From TestData) : No Documentation Found
5. scaledData2 (From TestData) : No Documentation Found

SAMPLEDATA sampleData

TestData \

	sampleData

No Documentation Found

RETURN **TABLE (NumericField) —**

KEY1 key1

TestData \

	key1

No Documentation Found

RETURN **TABLE (KeyLayout) —**

KEY2 key2

TestData \

	key2

No Documentation Found

RETURN **TABLE (KeyLayout) —**

SCALEDDATA1 scaledData1

TestData \

	scaledData1

No Documentation Found

RETURN **TABLE (NumericField) —**

SCALEDDATA2 scaledData2

TestData \

	scaledData2

No Documentation Found

RETURN **TABLE (NumericField) —**

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DESCRIPTIONS

TESTDATA testData

	testData

Test data for testing the Normaliz function

Children

1. sampleData (From testData) : No Documentation Found
2. l1NormResult (From testData) : No Documentation Found
3. l2NormResult (From testData) : No Documentation Found
4. lInfNormResult (From testData) : No Documentation Found

SAMPLEDATA sampleData

testData \

	sampleData

No Documentation Found

RETURN **TABLE (NumericField)** —

L1NORMRESULT l1NormResult

testData \

	l1NormResult

No Documentation Found

RETURN **TABLE (NumericField)** —

L2NORMRESULT l2NormResult

testData \

	l2NormResult

No Documentation Found

RETURN **TABLE (NumericField)** —

LINFNORMRESULT lInfNormResult

testData \

	lInfNormResult

No Documentation Found

RETURN **TABLE (NumericField) —**

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TESTDATA TestData

	TestData

Test Data for Testing OneHotEncoder

Children

1. validFeatureIds (From TestData) : No Documentation Found
2. invalidFeatureIds (From TestData) : No Documentation Found
3. key (From TestData) : No Documentation Found
4. sample1 (From TestData) : No Documentation Found
5. sample2 (From TestData) : No Documentation Found
6. encodedSample1 (From TestData) : No Documentation Found
7. encodedSample2 (From TestData) : No Documentation Found

VALIDFEATUREIDS validFeatureIds

TestData \

	validFeatureIds

No Documentation Found

RETURN **SET (INTEGER8) —**

INVALIDFEATUREIDS invalidFeatureIds

TestData \

	invalidFeatureIds

No Documentation Found

RETURN **SET (INTEGER8) —**

KEY key

TestData \

	key

No Documentation Found

RETURN **TABLE (cFeatures) —**

SAMPLE1 sample1

TestData \

	sample1

No Documentation Found

RETURN **TABLE (NumericField)** —

SAMPLE2 sample2

TestData \

	sample2

No Documentation Found

RETURN **TABLE (NumericField)** —

ENCODEDSAMPLE1 encodedSample1

TestData \

	encodedSample1

No Documentation Found

RETURN **TABLE (NumericField)** —

ENCODEDSAMPLE2 encodedSample2

TestData \

	encodedSample2

No Documentation Found

RETURN **TABLE (NumericField) —**

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DESCRIPTIONS

TESTDATA testData

	testData

Test data for testing split function

Children

1. sampleData (From testData) : No Documentation Found
2. trainData (From testData) : No Documentation Found
3. testData (From testData) : No Documentation Found

SAMPLEDATA sampleData

testData \

	sampleData

No Documentation Found

RETURN **TABLE (NumericField) —**

TRAINDATA trainData

testData \

	trainData

No Documentation Found

RETURN **TABLE (NumericField) —**

TESTDATA testData

testData \

	testData

No Documentation Found

RETURN **TABLE (NumericField) —**

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DESCRIPTIONS

TESTDATA TestData

	TestData

Test data for testing standardScaler module

Children

1. key (From TestData) : No Documentation Found
2. sampleData (From TestData) : No Documentation Found
3. scaledData (From TestData) : No Documentation Found

KEY key

TestData \

	key

No Documentation Found

RETURN **TABLE (KeyLayout) —**

SAMPLEDATA sampleData

TestData \

	sampleData

No Documentation Found

RETURN **TABLE (NumericField) —**

SCALEDDATA scaledData

TestData \

	scaledData

No Documentation Found

RETURN **TABLE (NumericField) —**

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TESTDATA TestData

	TestData

No Documentation Found

Children

1. Layout (From TestData) : No Documentation Found
2. ds (From TestData) : No Documentation Found
3. ds4 (From TestData) : No Documentation Found
4. expTrainData (From TestData) : No Documentation Found
5. expTrainData4 (From TestData) : No Documentation Found
6. expTestData (From TestData) : No Documentation Found
7. expTestData3 (From TestData) : No Documentation Found
8. expTestData4 (From TestData) : No Documentation Found

LAYOUT Layout

TestData \

	Layout

No Documentation Found

FIELD **id** ||| UNSIGNED8 — No Doc

FIELD **f1** ||| UNSIGNED8 — No Doc

FIELD **f2** ||| UNSIGNED8 — No Doc

FIELD **f3** ||| UNSIGNED8 — No Doc

FIELD **f4** ||| UNSIGNED8 — No Doc

DS ds

TestData \

	ds

No Documentation Found

RETURN **TABLE (Layout)** —

DS4 ds4

TestData \

	ds4

No Documentation Found

RETURN **TABLE (Layout) —**

EXPTRAINDATA expTrainData

TestData \

	expTrainData

No Documentation Found

RETURN **TABLE (NumericField) —**

EXPTRAINDATA4 expTrainData4

TestData \

	expTrainData4

No Documentation Found

RETURN **TABLE (NumericField) —**

EXPTESTDATA expTestData

TestData \

	expTestData

No Documentation Found

RETURN **TABLE (NumericField) —**

EXPTESTDATA3 expTestData3

TestData \

	expTestData3

No Documentation Found

RETURN **TABLE (NumericField) —**

EXPTESTDATA4 expTestData4

TestData \

	expTestData4

No Documentation Found

RETURN **TABLE (NumericField) —**

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DESCRIPTIONS

FILES Files

	Files

No Documentation Found

Children

1. pathPrefix (From Files) : No Documentation Found
2. RawDataRec (From Files) : No Documentation Found
3. rawDataPath (From Files) : No Documentation Found
4. rawData (From Files) : No Documentation Found
5. CleanDataRec (From Files) : No Documentation Found
6. cleanDataPath (From Files) : No Documentation Found
7. cleanData (From Files) : No Documentation Found
8. labelEncodedDataRec (From Files) : No Documentation Found
9. labelEncodedDataPath (From Files) : No Documentation Found
10. labelEncodedData (From Files) : No Documentation Found
11. MLDataPath (From Files) : No Documentation Found

12. MLData (From Files) : No Documentation Found
13. xTrainPath (From Files) : No Documentation Found
14. xTrain (From Files) : No Documentation Found
15. yTrainPath (From Files) : No Documentation Found
16. yTrain (From Files) : No Documentation Found
17. xTestPath (From Files) : No Documentation Found
18. xTest (From Files) : No Documentation Found
19. yTestPath (From Files) : No Documentation Found
20. yTest (From Files) : No Documentation Found
21. cleanXTrainPath (From Files) : No Documentation Found
22. cleanXTrain (From Files) : No Documentation Found
23. cleanXTestPath (From Files) : No Documentation Found
24. cleanXTest (From Files) : No Documentation Found
25. PredictionsPath (From Files) : No Documentation Found

PATHPREFIX pathPrefix

Files \

	pathPrefix

No Documentation Found

RETURN STRING37 —

RAWDATAREC RawDataRec

Files \

	RawDataRec

No Documentation Found

FIELD **longitude** ||| STRING — No Doc

FIELD **latitude** ||| STRING — No Doc

FIELD **housingmedianage** ||| STRING — No Doc

FIELD **totalrooms** ||| STRING — No Doc

FIELD **totalbedrooms** ||| STRING — No Doc

FIELD **population** ||| STRING — No Doc

FIELD **households** ||| STRING — No Doc

FIELD **medianincome** ||| STRING — No Doc

FIELD **medianhousevalue** ||| STRING — No Doc

FIELD **oceanproximity** ||| STRING — No Doc

RAWDATAPATH rawDataPath

Files \

	rawDataPath

No Documentation Found

RETURN **STRING44** —

RAWDATA rawData

Files \

	rawData

No Documentation Found

RETURN **TABLE (RawDataRec)** —

CLEANDATAREC CleanDataRec

Files \

	CleanDataRec

No Documentation Found

FIELD **id** ||| UNSIGNED8 — No Doc

FIELD **longitude** ||| REAL4 — No Doc

FIELD **latitude** ||| REAL4 — No Doc

FIELD **housingmedianage** ||| REAL4 — No Doc

FIELD **totalrooms** ||| REAL4 — No Doc

FIELD **totalbedrooms** ||| REAL4 — No Doc

FIELD **population** ||| REAL4 — No Doc

FIELD **households** ||| REAL4 — No Doc

FIELD **medianincome** ||| REAL4 — No Doc

FIELD **medianhousevalue** ||| REAL8 — No Doc

FIELD **oceanproximity** ||| STRING10 — No Doc

CLEANDATAPATH cleanDataPath

Files \

	cleanDataPath

No Documentation Found

RETURN **STRING46** —

CLEANDATA cleanData

Files \

	cleanData

No Documentation Found

RETURN **TABLE (CleanDataRec)** —

LABELENCODEDDATAREC labelEncodedDataRec

Files \

	labelEncodedDataRec

No Documentation Found

FIELD **id** ||| UNSIGNED8 — No Doc

FIELD **longitude** ||| REAL4 — No Doc

FIELD **latitude** ||| REAL4 — No Doc

FIELD **housingmedianage** ||| REAL4 — No Doc

FIELD **totalrooms** ||| REAL4 — No Doc

FIELD **totalbedrooms** ||| REAL4 — No Doc

FIELD **population** ||| REAL4 — No Doc

FIELD **households** ||| REAL4 — No Doc

FIELD **medianincome** ||| REAL4 — No Doc

FIELD **medianhousevalue** ||| REAL8 — No Doc

FIELD **oceanproximity** ||| INTEGER8 — No Doc

LABELENCODEDDATAPATH labelEncodedDataPath

Files \

	labelEncodedDataPath

No Documentation Found

RETURN **STRING53** —

LABELENCODEDDATA labelEncodedData

Files \

	labelEncodedData

No Documentation Found

RETURN **TABLE (labelEncodedDataRec)** —

MLDATAPATH MLDataPath

Files \

	MLDataPath

No Documentation Found

RETURN **STRING43** —

MLDATA MLData

Files \

	MLData

No Documentation Found

RETURN **TABLE (NumericField)** —

XTRAINPATH xTrainPath

Files \

	xTrainPath

No Documentation Found

RETURN **STRING43** —

XTRAIN xTrain

Files \

	xTrain

No Documentation Found

RETURN **TABLE (NumericField)** —

YTRAINPATH yTrainPath

Files \

	yTrainPath

No Documentation Found

RETURN **STRING43** —

YTRAIN yTrain

Files \

	yTrain

No Documentation Found

RETURN **TABLE (NumericField)** —

XTESTPATH xTestPath

Files \

	xTestPath

No Documentation Found

RETURN **STRING42** —

XTEST xTest

Files \

	xTest

No Documentation Found

RETURN **TABLE (NumericField)** —

YTESTPATH yTestPath

Files \

	yTestPath

No Documentation Found

RETURN **STRING42** —

YTEST yTest

Files \

	yTest

No Documentation Found

RETURN TABLE (NumericField) —

CLEANXTRAINPATH cleanXTrainPath

Files \

	cleanXTrainPath

No Documentation Found

RETURN STRING48 —

CLEANXTRAIN cleanXTrain

Files \

	cleanXTrain

No Documentation Found

RETURN TABLE (NumericField) —

CLEANXTESTPATH cleanXTestPath

Files \

	cleanXTestPath

No Documentation Found

RETURN **STRING47** —

CLEANXTEST cleanXTest

Files \

	cleanXTest

No Documentation Found

RETURN **TABLE (NumericField)** —

PREDICTIONSPATH PredictionsPath

Files \

	PredictionsPath

No Documentation Found

RETURN **STRING48** —

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AppendNF

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DESCRIPTIONS

APPENDNF AppendNF

	AppendNF
	(DATASET(NumericField) ds1, DATASET(NumericField) ds2)

Merge two NumericField datasets ds1 and ds2 by appending ds2 to ds1. For example, merge ds1 and ds2 as following: ds1 := DATASET({[1, 1, 1, 0.5]}, NumericField); ds2 := DATASET({[1, 2, 1, 2.0]}, NumericField); The result after merging is as below: mergedDs := DATASET({[1, 1, 1, 0.5], [1, 2, 2, 2.0]}, NumericField);

PARAMETER **ds1:** ||| TABLE (NumericField) — DATASET(NumericField) The dataset to append to

PARAMETER **ds2:** ||| TABLE (NumericField) — DATASET(NumericField) The dataset to be appended

RETURN **TABLE (NumericField)** — the merged dataset with ds2 following ds1

GetCategories

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DESCRIPTIONS

GETCATEGORIES GetCategories

	GetCategories
(source, featureName)	

Allows to extract all the categories of a feature from a given dataset.

PARAMETER **source:** ||| INTEGER8 — ANY. the dataset from which to extract the categories.

PARAMETER **featureName:** ||| INTEGER8 — STRING. the name of the feature for which to extract the categories.

RETURN **BOOLEAN** — categories: SET OF STRING. the feature's categories.

GetFeatureNames

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DESCRIPTIONS

GETFEATURENAMES GetFeatureNames

	GetFeatureNames
(dta)	

Extracts the feature names from some dataset.

Note: complex record structures with child datasets are not handled.

PARAMETER **dta:** ||| INTEGER8 — any dataset. Dataset from which to extract the feature names

RETURN **BOOLEAN** — featureNames: SET OF STRING A set of string holding the feature names.

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DESCRIPTIONS

RESETID ResetID

/ EXPORT	ResetID
(DATASET(NumericField) ds)	

resets the id sequence so it starts from 1.

PARAMETER **ds:** ||| TABLE (NumericField) — DATASET(NumericField). The dataset with unordered ids.

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value })** — dataset with ordered ids.

Shuffle

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IMPORTS

DESCRIPTIONS

SHUFFLE shuffle

/ EXPORT	**shuffle**
(DATASET(NumericField) dataToShuffle)	

shuffles a numericField dataset.

PARAMETER **dataToShuffle:** ||| TABLE (NumericField) — DATASET(NumericField). the data to shuffle.

RETURN **TABLE (NumericField)** — shuffled data: DATASET(NumericField).

ValidateSplitInput

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DESCRIPTIONS

VALIDATESPLITINPUT validateSplitInput

/ EXPORT	validateSplitInput
(DATASET(NumericField) dataToSplit, REAL4 trainSize, REAL4 testSize)	

validates input for split function.

input is valid if data is not empty, train and test sizes are not both zero, sizes are within [0.0, 1.0) with one of them being different from 0 and their sum does not exceed 1.0.

PARAMETER **dataToSplit:** ||| TABLE (NumericField) — DATASET(Types.NumericField). The data to split.

PARAMETER **trainSize:** ||| REAL4 — REAL4. The training size.

PARAMETER **testSize:** ||| REAL4 — REAL4. The test size.

RETURN **STRING** — 'Data is empty' if dataToSplit is empty, 'Train size and test sizes are both 0.0' if the sizes are equal to zero, 'Invalid size! valid range = [0.0, 1.0)' if one of the sizes is out of range and 'Sizes are too large! trainSize + testSize > 1.0' if the sum of sizes exceeds 1.0.

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MAPAFEATURECATEGORIES MapAFeatureCategories

	MapAFeatureCategories
(STRING featureName, SET OF STRING unmappedCategories)	

Builds a lookup table that maps each category to a unique number. Each category is assigned its index in the category set.

PARAMETER **featureName:** ||| STRING — STRING. The name of the feature.

PARAMETER **unmappedCategories:** ||| SET (STRING) — SET OF STRING. The feature's unmapped categories.

RETURN **TABLE (mappingLayout)** — categoriesMapping: ROW(MappingLayout). A row the feature name mapped to its categories and each category mapped to its value.

MapCategoriesToValues

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DESCRIPTIONS

MAPCATEGORIESTOVALUES MapCategoriesToValues

	MapCategoriesToValues
(key)	

Builds a lookup table that maps each category of a feature to a unique number. Each category is assigned its index in the category set.

PARAMETER **key:** ||| INTEGER8 — DATASET(KeyLayout). Mapping between feature names and categories.

RETURN **BOOLEAN** — categoriesMapping: DATASET(MappingLayout). A table with each feature name mapped to its categories and each category mapped to its value. <pre>
 //record mapping a category to its value.
 Category := RECORD
 STRING categoryName;
 INTEGER value;
 END;

 //record mapping feature names to their categories.
 MappingLayout := RECORD
 STRING featureName;
 DATASET(Category) categories;
 END;
 </pre>

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TYPES Types

	Types

Utility Record Structures for LabelEncoder Module

Children

1. Category (From Types) : No Documentation Found
2. MappingLayout (From Types) : No Documentation Found
3. LabelLayout (From Types) : No Documentation Found

CATEGORY Category

Types \

	Category

No Documentation Found

FIELD **categoryname** ||| STRING — No Doc

FIELD **value** ||| INTEGER8 — No Doc

MAPPINGLAYOUT MappingLayout

Types \

	MappingLayout

No Documentation Found

FIELD **featurename** ||| STRING — No Doc

FIELD **categories** ||| TABLE (Category) — No Doc

LABELLAYOUT LabelLayout

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	LabelLayout

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FIELD **label** ||| STRING — No Doc

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FIELD_AGGREGATES field_aggregates

	field_aggregates

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RETURN —

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GENERATE generate

	generate

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RETURN —

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TEST_APPENDS test_appends

	test_appends

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RETURN —

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TEST_DISCRETE test_discrete

; EXPORT	test_discrete

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RETURN —

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	to_from

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RETURN —

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DESCRIPTIONS

FAT Fat

/ EXPORT DATASET(Types.NumericField)	**Fat**
(DATASET(Types.NumericField) d0, Types.t_FieldReal v=0)	

Make a sparse NumericField dataset dense by filling in missing values. All empty cells are set to the designated value.

PARAMETER **d0** ||| TABLE (NumericField) — They NumericField dataset to be filled.

PARAMETER **v** ||| REAL8 — The value to assign missing records.

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , REAL8 value })** — A full NumericField dataset with every field populated.

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DESCRIPTIONS

FATD FatD

/ EXPORT DATASET(Types.DiscreteField)	**FatD**
(DATASET(Types.DiscreteField) d0, Types.t_Discrete v=0)	

Make a sparse DiscreteField dataset dense by filling in missing values. All empty cells are set to the designated value.

PARAMETER **d0** ||| TABLE (DiscreteField) — The DiscreteField dataset to be filled.

PARAMETER **v** ||| INTEGER4 — The value to assign missing records.

RETURN **TABLE ({ UNSIGNED2 wi , UNSIGNED8 id , UNSIGNED4 number , INTEGER4 value })** — A full DiscreteField dataset with every field populated.

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Gini

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DESCRIPTIONS

GINI Gini

/ EXPORT	Gini
(infile, pivot, target, wi_name='wi')	

Create a file of pivot/target pairs with a Gini impurity value.

PARAMETER **infile** ||| INTEGER8 — the input file, any type with a work item field.

PARAMETER **pivot** ||| INTEGER8 — the name of the pivot field.

PARAMETER **target** ||| INTEGER8 — the name of the field used as the target.

PARAMETER **wi_name** ||| INTEGER8 — the name of the work item field, default is "wi".

RETURN **BOOLEAN** — A table by Work Item and Pivot value giving count and Gini impurity value.

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SequenceInField

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DESCRIPTIONS

SEQUENCEINFIELD SequenceInField

/ EXPORT	**SequenceInField**
(infile,infield,seq,wi_name='wi')	

Assign sequence numbers within groups for a dataset. Given a file (dataset) which is sorted by the work item identifier and INFIELD (and possibly other values), add sequence numbers within the range of each infield. Slighly elaborate code is to avoid having to partition the data to one value of infield per node and to work with very large numbers of records where a global count project would be inappropriate. This is useful for assigning rank positions with the groupings.

PARAMETER **infile** ||| INTEGER8 — the input file, any type.

PARAMETER **infield** ||| INTEGER8 — field name of grouping field.

PARAMETER **seq** ||| INTEGER8 — name of the field to receive the sequence number.

PARAMETER **wi_name** ||| INTEGER8 — work item field name, default is wi.

RETURN **BOOLEAN** — a file of the same type with sequence numbers applied.
