



AutoML Vs Fully Automatic: Comparisons between H2O-3 and Driverless AI

Tuesday, December 10, 6 PM - 8 PM
New York

Thomas Ott - Solutions Engineer

meetup

H2O.ai Overview

Company	Founded in Silicon Valley in 2012 Funded: \$147.5M Investors: Wells Fargo, NVIDIA, Nexus Ventures, Paxion Ventures, CapitalOne and most recently \$72.5M led by Goldman Sachs
Products	<ul style="list-style-type: none">• H2O Open Source Machine Learning (18,000 organizations)• H2O Driverless AI – Automatic Machine Learning
Team	200+ AI experts (Expert data scientists, Kaggle Grandmasters, Distributed Computing, Visualization)
Global	Mountain View, NYC, Toronto, London, Prague, India



Global Customers

H₂O.ai



INEOS

MITSUBISHI ELECTRIC

Stanley Black & Decker

swisscom
T-Mobile®

airvantage

CISCO

COMCAST

infutor

NEUROMETRICS
consultores en analitica cognitiva

PropertyGuru

G₅
RESEARCH

DIRECT MAILERS

Integral
Ad Science

Nielsen
Catalina
SOLUTIONS

rc

Dillard's
SUN BASKET

H-E-B

Travelport

Walgreens

eBay

Booking.com

macy's

VISION Banco
CREDIT SUISSE

deserve
yapstone

Bank of America
Merrill Lynch

ING

CITI
WELLS FARGO

VISA

DECISION LOGIC

EQUIFAX

MarketAxess®

DISCOVER

experian™

CapitalOne

PACIFIC LIFE

Nationwide

underwrite.ai

XCEEDANCE

AEGON

TRANSAMERICA®

PROGRESSIVE®

opta

ZURICH

SAIC

beeline®

HappyMoney®

Mindtree

dun & bradstreet

[AI ACADEMY]

Australian Government

IP Australia

ADP

pwc

Allergan

KAIER PERMANENTE

CHANGE HEALTHCARE

ArmadaHealth®

aetna®

Global
Industrial/
Agriculture

Telcos

Media and
Marketing

Retail

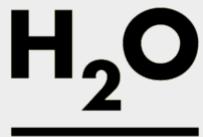
Financial

Insurance

Advisory,
Accounting
and Government

Healthcare

Open Source



In-memory, distributed
machine learning algorithms
with H2O Flow GUI



H2O AI open source engine
integration with Spark



Lightning fast machine
learning on GPUs

- 100% open source – Apache V2 licensed
- Built for data scientists – interface using R, Python on H2O Flow (interactive notebook interface)
- Enterprise support subscriptions

DRIVERLESSAI

Automatic feature engineering,
machine learning and interpretability

- Enterprise software
- Built for domain users, analysts and data scientists – GUI-based interface for end-to-end data science
- Fully automated machine learning from ingest to deployment
- User licenses on a per seat basis (annual subscription)

Open Source



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machine learning algorithms
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H2O-3's AutoML

What's in the AutoML box?

- Works with Python / R / Java / H2O Flow
- Horizontally Scalable* and Time Based
- Hyperparameter Tuning (Random Grid)
- Algorithms:
 - XGBoostGBM
 - GBM
 - Deep Learning
 - Distributed Random Forests
 - GLM
 - Stacked Ensemble

* XGBoostGBM is turned off by default for multi-node

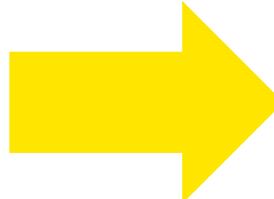
What's in the AutoML box?

- Works with Python / R / Java / **H2O Flow << Demo Tonight**
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MOJO

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What's in the AutoML box?

H2O's AutoML can also be a helpful tool for the advanced user, by providing a simple wrapper function that performs a large number of modeling-related tasks that would typically require many lines of code, and by freeing up their time to focus on other aspects of the data science pipeline tasks such as data-preprocessing, feature engineering and model deployment.

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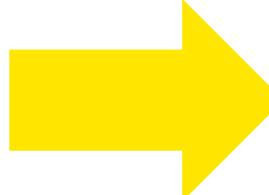
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Driverless AI

What's in the Driverless AI box?

- GUI based / Python & R Clients
- Vertically Scaling / CPU & GPU based
- Hyperparameter Tuning (Evolutionary as part of GA)
- Feature Engineering / AutoDoc / Machine Learning Interpretability (Shapley / LIME)
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 - XGBoostGBM / GBM
 - LightGBM
 - GLM
 - TensorFlow (CNN)
 - FTRL
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What's in the Driverless AI box?

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- 
- Python
MOJO Java
MOJO C++
1 Click Deploy



Kaggle Dataset

Loan Loss Default

Variable	Description
Id	A unique identifier associated with an application.
F1	Numerical features
...	
F778	Numerical features
Loss	Target (numerical) / Optimize for M.A.E.

Reference: <https://www.kaggle.com/c/loan-default-prediction>



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Driverless Experiments

Driverless Experiments

- Generate 2 Experiments
 - Experiment #1: 6/6/4 Settings
 - Experiment #2: 6/6/4 Settings + BYOR
- Run on 1 GPU / Approximately 30 minutes to 1.5 hours
- Compare Features Side by Side

Driverless Experiments

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EXPERIMENTS

COMPARE 0 ITEMS

UNLINK 0 ITEMS

+ LINK EXPERIMENT

NEW EXPERIMENT

1. SELECT SCORING DATASET

1. Select Scoring Dataset

2. SELECT EXPERIMENTS

filterItemsSelected

3. SCORE DATASET ON EXPERIMENTS

SCORE 0 ITEMS

SELECT SCORER FOR TEST SCORE

Select Scorer

<input type="checkbox"/>	Name	A	T	I	Scorer	Status	Train Time	Val. Score	Test Score	Test Time	<input type="checkbox"/>
<input type="checkbox"/>	2. DAI + FE	6	6	4	MAE	Completed	00:38:08	0.7968	NA	N/A	<input type="checkbox"/>
<input type="checkbox"/>	3. DAI + FE + Z...	6	6	4	MAE	Completed	01:32:03	0.7997	NA	N/A	<input type="checkbox"/>

Driverless Experiments

EXPERIMENTS

1. SELECT SCORING DATASET
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2. SELECT EXPERIMENTS
filterItemsSelected

3. SCORE DATASET ON EXPERIMENTS
SCORE 0 ITEMS

COMPARE 0 ITEMS UNLINK 0 ITEMS + LINK EXPERIMENT NEW EXPERIMENT

SELECT SCORER FOR TEST SCORE
Select Scorer

Name	A	T	I	Scorer	Status	Train Time	Val. Score	Test Score	Test Time
2. DAI + FE	6	6	4	MAE	Completed	00:38:08	0.7968	NA	N/A
3. DAI + FE + Z..	6	6	4	MAE	Completed	01:32:03	0.7997	NA	N/A

Driverless Experiments - Variable Importance

VARIABLE IMPORTANCE

783_ClusterDist50:f170:f517:f766.5	1.00
789_NumToCatTE:f471:f630.0	0.61
783_ClusterDist50:f170:f517:f766.4	0.56
783_ClusterDist50:f170:f517:f766.7	0.53
783_ClusterDist50:f170:f517:f766.6	0.52
783_ClusterDist50:f170:f517:f766.12	0.43
783_ClusterDist50:f170:f517:f766.10	0.27
380_f46	0.24
783_ClusterDist50:f170:f517:f766.14	0.22
407_f493	0.16
783_ClusterDist50:f170:f517:f766.9	0.13
783_ClusterDist50:f170:f517:f766.15	0.06
306_f39	0.03

VARIABLE IMPORTANCE

689_f766	1.00
388_f471	0.93
594_f674	0.88
321_f404	0.85
590_f670	0.84
589_f67	0.82
727_CVTE:f137.0	0.75
731_CVTE:f276.0	0.72
107_f2	0.71
453_f536	0.68
732_CVTE:f277.0	0.67
547_f630	0.65
238_f322	0.64
32_f13	0.63
0_f1	0.62



H2O-3 AutoML Experiment

H2O-3 AutoML – 4 Hour Training

▼ MODELS

models sorted in order of mean_residual_deviance, best first

	model_id	mean_residual_deviance	rmse	mse	mae
0	StackedEnsemble_AllModels_AutoML_20191205_134903	18.457724565363122	4.296245403298457	18.457724565363122	1.4360225136135123
1	StackedEnsemble_BestOfFamily_AutoML_20191205_134903	18.488463419168774	4.2998213240981045	18.488463419168774	1.4398850252912432
2	XGBoost_grid_1_AutoML_20191205_134903_model_6	18.524848729415798	4.304050270316995	18.524848729415798	1.4084007958468263
3	XGBoost_grid_1_AutoML_20191205_134903_model_20	18.531881298735822	4.304867163889709	18.531881298735822	1.3932624527912796
4	XGBoost_grid_1_AutoML_20191205_134903_model_11	18.532076903555605	4.304889882860606	18.532076903555605	1.3443163254323498
5	XGBoost_grid_1_AutoML_20191205_134903_model_21	18.533253687333488	4.305026560583975	18.533253687333488	1.414472436842969
6	GBM_grid_1_AutoML_20191205_134903_model_3	18.55352115412073	4.3073798479029834	18.55352115412073	1.4391232532568006
7	XGBoost_grid_1_AutoML_20191205_134903_model_2	18.577092294616232	4.310115113847452	18.577092294616232	1.4232732504339223

H2O-3 AutoML – 4 Hour Training

▼ MODELS

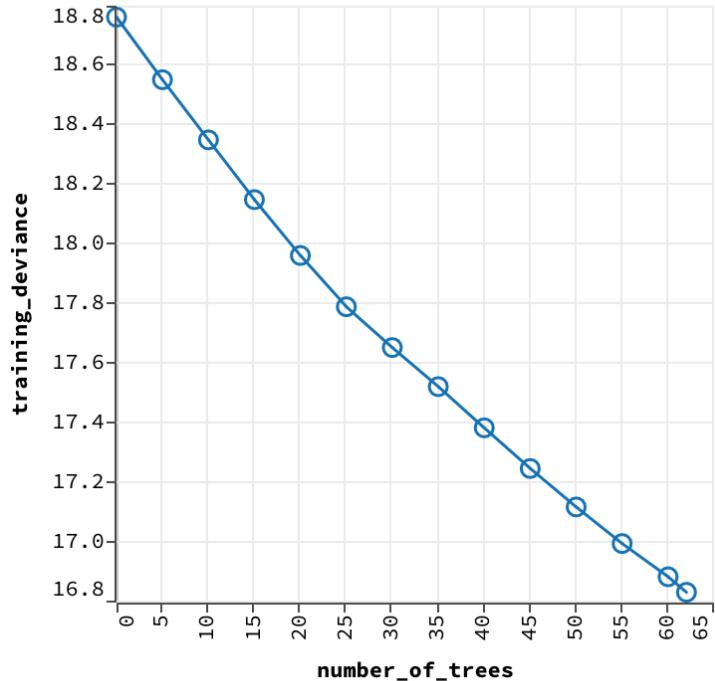
models sorted in order of mean_residual_deviance, best first

	model_id	mean_residual_deviance	rmse	mse	mae
0	StackedEnsemble_AllModels_AutoML_20191205_134903	18.457724565363122	4.296245403298457	18.457724565363122	1.4360225136135123
1	StackedEnsemble_BestOfFamily_AutoML_20191205_134903	18.488463419168774	4.2998213240981045	18.488463419168774	1.4398850252912432
2	XGBoost_grid_1_AutoML_20191205_134903_model_6	18.524848729415798	4.304050270316995	18.524848729415798	1.4084007958468263
3	XGBoost_grid_1_AutoML_20191205_134903_model_20	18.531881298735822	4.304867163889709	18.531881298735822	1.3932624527912796
4	XGBoost_grid_1_AutoML_20191205_134903_model_11	18.532076903555605	4.304889882860606	18.532076903555605	1.3443163254323498
5	XGBoost_grid_1_AutoML_20191205_134903_model_21	18.533253687333488	4.305026560583975	18.533253687333488	1.414472436842969
6	GBM_grid_1_AutoML_20191205_134903_model_3	18.55352115412073	4.3073798479029834	18.55352115412073	1.4391232532568006
7	XGBoost_grid_1_AutoML_20191205_134903_model_2	18.577092294616232	4.310115113847452	18.577092294616232	1.4232732504339223

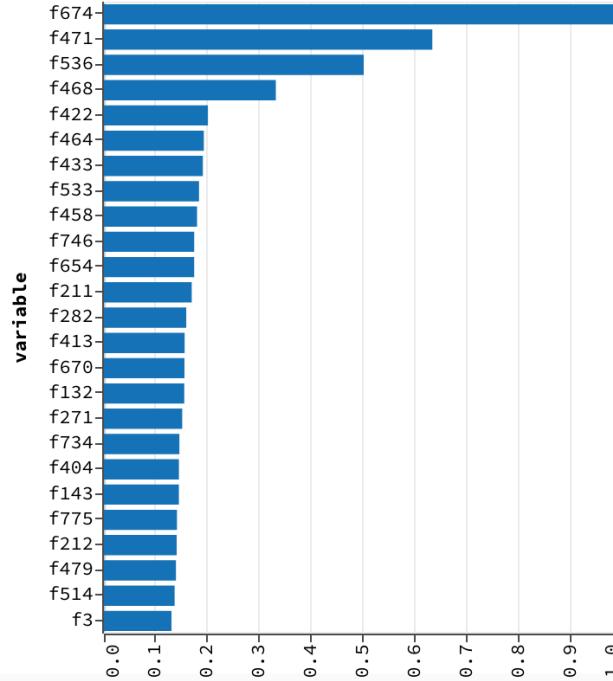
MAE = 1.34 using XGBoost model #11

H2O-3 AutoML – Features

▼ SCORING HISTORY - DEVIANCE



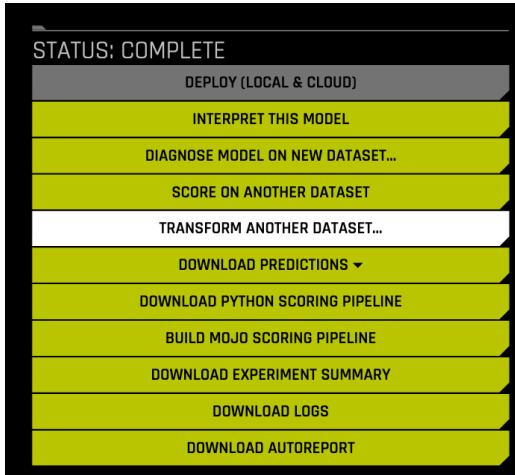
▼ VARIABLE IMPORTANCES





Using Driverless AI Features in AutoML

Transform Dataset into Transformed Features



	A	B	C	D	E	F	G	H	I
1	306_f39	380_f46	407_f493	783_ClusterDist50:f170:f517:f766.5	783_ClusterDist50:f170:f517:f766.6	783_ClusterDist50:f170:f517:f766.7	783_ClusterDist50:f170:f517:f766.9	783_ClusterDist50:f170:f517:f766.10	loss
2	0.65705	0.70127	19.72		4.1890683	3.468733	4.046106	3.430209	0 0
3	0.7471	0.80819	124		3.0490234		2.2169568	3.531153	2.4769564 0
4	0.77405	0.8207	903		5.2391896	3.156621	1.0810538	5.9418473	4.172575 0
5	0.78385	0.86382	130.94		4.650567	2.7428029	1.2893546	5.1386466	3.2553873 0
6	0.79085	0.82485	399		1.9060979	4.804308	3.0140483	2.7850735	2.9816196 0
7	0.7269	0.89431	836.75		3.711679	3.1023474	2.0080702	4.0702352	2.6610246 1
8	0.76075	0.92268	252.92		2.8794038	4.3365793	2.0285404	3.8632266	3.372635 0
9	0.7995	0.88271	82		4.058473	3.7201104	1.4652498	4.8899136	3.8527265 0
10	0.7868	0.84464	82.5		4.264527	2.3753636	2.4006875	4.2668266	2.2144604 0

Load into AutoML and Run for 1 Hour

▼ MODELS

models sorted in order of mean_residual_deviance, best first

32	GBM_4_AutoML_20191205_170249	19.53685310518864	4.420051255945867	19.53685310518864	1.452662850257629	NaN
33	GBM_1_AutoML_20191205_170249	19.53887942185216	4.420280468686593	19.53887942185216	1.4491605755184283	NaN
34	XGBoost_grid_1_AutoML_20191205_170249_model_1	19.550453470904767	4.421589473357377	19.550453470904767	1.435419096811673	NaN
35	GBM_grid_1_AutoML_20191205_170249_model_11	19.560374134017135	4.422711174609657	19.560374134017135	1.4618233503803184	0.73
36	XGBoost_grid_1_AutoML_20191205_170249_model_19	19.574376138075163	4.424293857563618	19.574376138075163	1.4323884281055193	0.73
37	XGBoost_grid_1_AutoML_20191205_170249_model_17	19.574499892978885	4.424307843378316	19.574499892978885	1.4434372742349393	0.74
38	XGBoost_grid_1_AutoML_20191205_170249_model_12	19.582265382649492	4.425185350089812	19.582265382649492	1.443978908677506	NaN
39	XGBoost_grid_1_AutoML_20191205_170249_model_15	19.63858313079829	4.431544102318997	19.63858313079829	1.447825694990862	NaN
40	DeepLearning_grid_1_AutoML_20191205_170249_model_6	19.669011907915188	4.434975976024582	19.669011907915188	1.047967422168763	0.63
41	DeepLearning_grid_1_AutoML_20191205_170249_model_5	19.701332086128847	4.4386182631680375	19.701332086128847	1.2262382861044774	NaN
42	GBM_grid_1_AutoML_20191205_170249_model_10	19.72759121230986	4.441575307513074	19.72759121230986	1.4504047077809836	NaN

AutoML Results

▼ MODELS

models sorted in order of mean_residual_deviance, best first

32	GBM_4_AutoML_20191205_170249	19.53685310518864	4.420051255945867	19.53685310518864	1.452662850257629	NaN
33	GBM_1_AutoML_20191205_170249	19.53887942185216	4.420280468686593	19.53887942185216	1.4491605755184283	NaN
34	XGBoost_grid_1_AutoML_20191205_170249_model_1	19.550453470904767	4.421589473357377	19.550453470904767	1.435419096811673	NaN
35	GBM_grid_1_AutoML_20191205_170249_model_11	19.560374134017135	4.422711174609657	19.560374134017135	1.4618233503803184	0.73
36	XGBoost_grid_1_AutoML_20191205_170249_model_19	19.574376138075163	4.424293857563618	19.574376138075163	1.4323884281055193	0.73
37	XGBoost_grid_1_AutoML_20191205_170249_model_17	19.574499892978885	4.424307843378316	19.574499892978885	1.4434372742349393	0.74
38	XGBoost_grid_1_AutoML_20191205_170249_model_12	19.582265382649492	4.425185350089812	19.582265382649492	1.443978908677506	NaN
39	XGBoost_grid_1_AutoML_20191205_170249_model_15	19.63858313079829	4.431544102318997	19.63858313079829	1.447825694990862	NaN
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41	DeepLearning_grid_1_AutoML_20191205_170249_model_5	19.701332086128847	4.4386182631680375	19.701332086128847	1.2262382861044774	NaN
42	GBM_grid_1_AutoML_20191205_170249_model_10	19.72759121230986	4.441575307513074	19.72759121230986	1.4504047077809836	NaN

MAE = 1.04 using DL model_6



H₂O.ai

Reasons to Use

Reasons to use H2O-3 AutoML

H₂O.ai

H₂O.ai

In-Memory, Distributed
Machine Learning Algorithms
with H2O Flow GUI

- Open Source
- High Degree of User Control
- In Memory & Distributed
- Web UI, Python Client, R Client
- Autogenerated Java Scoring Pipeline

Reasons to use Driverless AI

H₂O.ai

- Commercial license
- High degree of automation
- Optimized for GPU's
- Web UI, Python Client, R Client
- Feature Engineering + BYOR
- Autogenerated Java/Python/C++ Scoring Pipelines
- MLI + MLI Scoring Pipeline
- AutoDoc

DRIVERLESSAI

Automatic feature
engineering, machine
learning and interpretability



Thank You

Thomas Ott

Github: <https://github.com/tomott12345/>