



# H2O4GPU

H2O4GPU Platform Powered by GPUs for Lightning-Fast Model Building

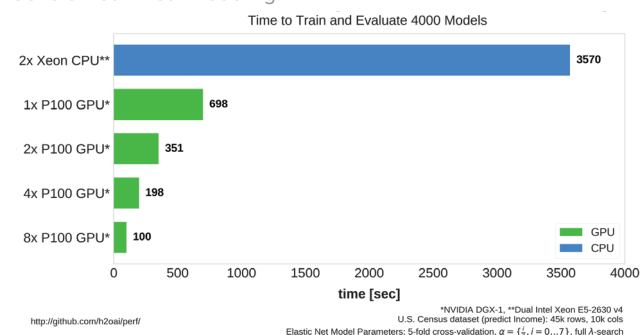
H2O4GPU is an open-source collection of GPU solvers created by H2O.ai. It builds on the easy-to-use scikit-learn API and its well-tested CPU-based algorithms. It can be used as a drop-in replacement for scikit-learn with support for GPUs on selected (and ever-growing) algorithms. H2O4GPU inherits all the existing scikit-learn algorithms and falls back to CPU algorithms when the GPU algorithm does not support an important existing scikit-learn class option.

Today, select algorithms are GPU-enabled. These include Gradient Boosting Machines (GBM's), Generalized Linear Models (GLM's), and K-Means Clustering.

## Gradient Linear Model (GLM)

- Framework utilizes Proximal Graph Solver (POGS)
- Solvers include Lasso, Ridge Regression, Logistic Regression, and Elastic Net Regularization

### Generalized Linear Modeling



## SPECIFICATIONS

### Software

- PC with Ubuntu 16.04+
- Install CUDA with bundled display drivers CUDA 8 or CUDA 9

### Hardware

- Nvidia GPU with Compute Capability  $\geq 3.5$

## H2O4GPU ROAD MAP

### Currently available

- GLM (POGS)
- Python API for scoring and training
- GBM
- Inference on GPU (GLM)
- Random Forest
- Inference on GPU (GBM)
- k-Means clustering
- Scikit learn API for compatibility
- PCA
- R API for training and scoring
- SVD

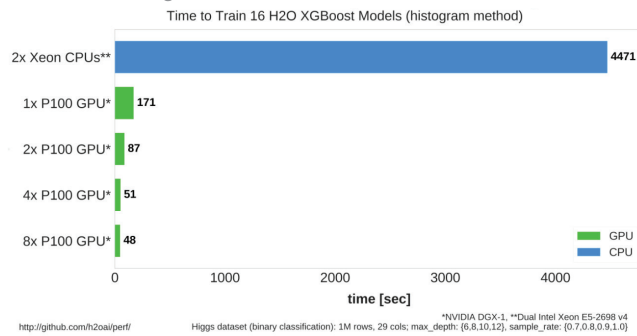
### Coming Q2 2018

- k-Nearest Neighbors
- Matrix Factorization
- Factorization Machines
- Quantiles
- Kalman Filters
- Sort
- Aggregator
- API Support:
  - GOAI API support
  - Data.table
- Performance & Scalability:
  - Multi machine

### Q4 2018

- Kernel Methods
- Recommendation Engines - Non-Negative Matrix Factorization
- Recommendation Engines - Bayesian Neural Nets
- MCMC Solver
- Time Series
- SVM
- Text Analysis-TF-IDF
- Text Analysis - Word2Vec
- Text Analysis -Ooc2Vec
- Automatic K for K-means
- H2O GLM - Lasso
- Simulation Techniques
- Sampling Techniques
- Domain Specific Algorithms:
  - Life Sciences
  - Financial Services Underwriting
  - Sampling Techniques

## Gradient Boosting Machines



### Improvements to original implementation of POGS:

- Full alpha search
- Cross Validation
- Early Stopping
- Added scikit-learn-like API
- Supports multiple GPU's

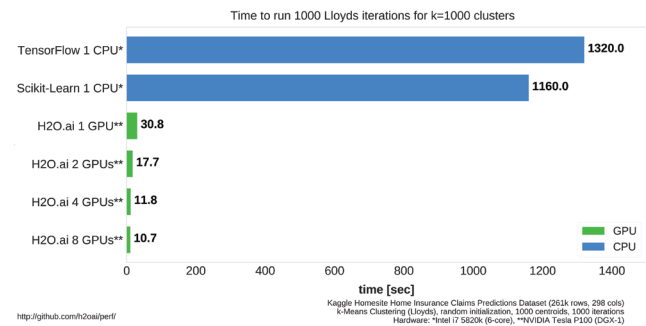
## Gradient Boosting Machines

- Based on XGBoost
- Raw floating point data — binned into quantiles
- Quantiles are stored as compressed instead of floats
- Compressed quantiles are efficiently transferred to GPU
- Sparsity is handled directly with high GPU efficiency
- Multi-GPU enabled by sharing rows using NVIDIA NCCL AllReduce

## k-Means Clustering

- Based on NVIDIA prototype of k-Means algorithm in CUDA
- Improvements to original implementation:
  - Significantly faster than scikit-learn implementation (50x) and other GPU implementations (5-10x)
  - Supports multiple GPU's

## k-Means Clustering



## RESOURCES

- **Github:** <https://github.com/h2oai/h2o4gpu>
- **FAQ:** <https://github.com/h2oai/h2o4gpu/blob/master/FAQ.md>

H2O.ai is the open source leader in AI and automatic machine learning with a mission to democratize AI for everyone. H2O.ai is transforming the use of AI to empower every company to be an AI company in financial services, insurance, healthcare, telco, retail, pharmaceuticals and marketing. H2O.ai is driving an open AI movement with H2O, which is used by more than 18,000 companies and hundreds of thousands of data scientists. H2O Driverless AI, an award winning and industry leading automatic machine learning platform for the enterprise, is helping data scientists across the world in every industry be more productive and deploy models in a faster, easier and cheaper way. H2O.ai partners with leading technology companies such as NVIDIA, IBM, AWS, Intel, Microsoft Azure and Google Cloud Platform and is proud of its growing customer base which includes Capital One, Nationwide Insurance, Walgreens and MarketAxess. H2O.ai believes in AI4Good with support for wildlife conservation and AI for academics. Learn more at [www.H2O.ai](http://www.H2O.ai)