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-enabed. These include Gradient Boosting Machines (GBM's), Generalized Linear Models (GLM's), and K-Means Clustering.

SPECIFICATIONS

Software

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

Hardware

- Nvidia GPU with Compute Capability>=3.5

H2O GPU Edition in phases:

Phase I (Single GPU) — Completed

- Generalized Linear Model
- Gradient Boosting Method
- k-Means Clustering
- Python API and .whl installation file
- Connectors to GPU Open AI Data Frames

Phase II (Multi GPU) — Completed

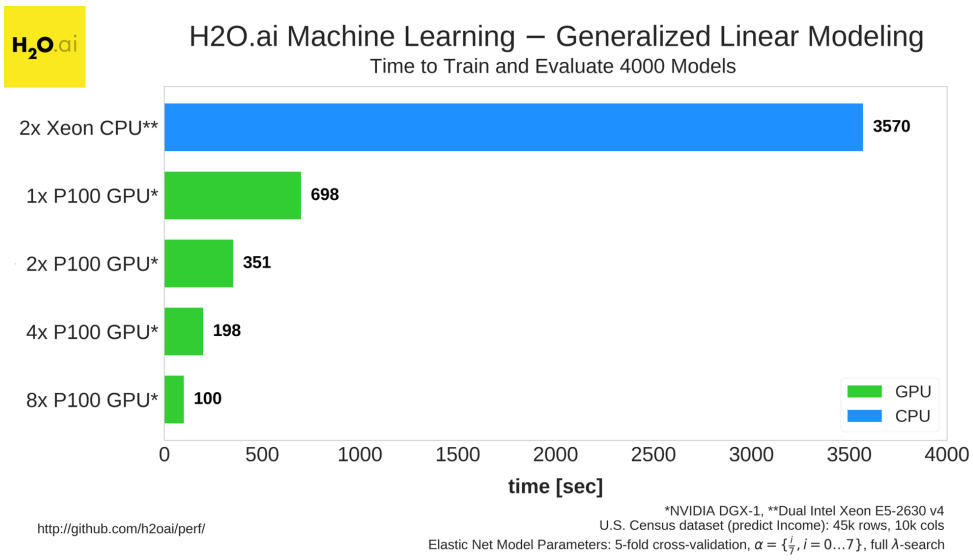
- Generalized Linear Model (multiple models in parallel and multi-GPU, single model)
- Gradient Boosting Method (multiple models in parallel and multi-GPU, single model)
- Random Forest (multi-GPU, single model)

Phase III

- Singular Value Decomposition
- Truncated Singular Value Decomposition
- k-Nearest Neighbors - Single GPU
- Principal Component Analysis

Phase IV

- Kalman Filters
- Sort, Quantiles (Single GPU)
- Sort, Quantiles (Multi-GPU)
- Support Vector Machine (Single GPU)



http://github.com/h2oai/perf/

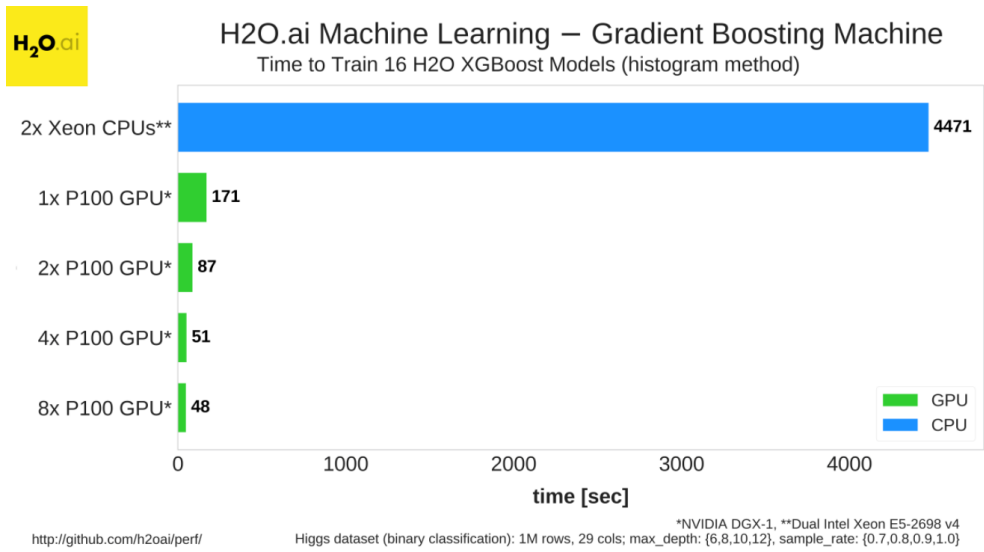
*NVIDIA DGX-1, **Dual Intel Xeon E5-2630 v4
U.S. Census dataset (predict Income): 45k rows, 10k cols
Elastic Net Model Parameters: 5-fold cross-validation, $\alpha = \{\frac{i}{7}, i = 0 \ldots 7\}$, full λ-search

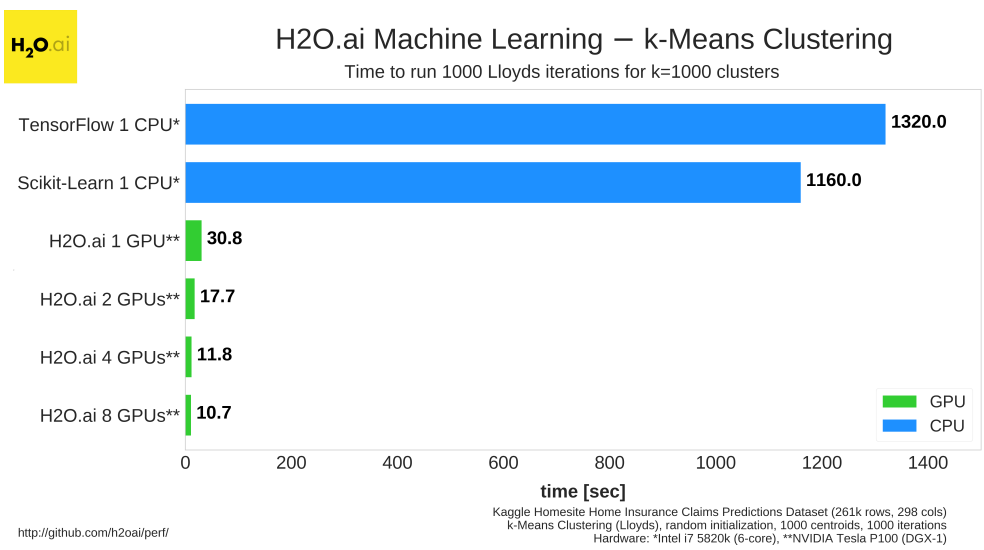
Gradient Linear Model (GLM)

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

RESOURCES

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

About H2O.ai

H2O.ai is focused on bringing AI to businesses through software. Its flagship product is H2O, the leading open source platform that makes it easy for financial services, insurance and healthcare companies to deploy machine learning and predictive analytics to solve complex problems. More than 10,000 organizations and 100,000+ data scientists depend on H2O for critical applications like predictive maintenance and operational intelligence. The company accelerates business transformation for 169 Fortune 500 enterprises, 8 of the world's 12 largest banks, 7 of the 10 largest auto insurance companies and all 5 major telecommunications providers. Follow us on Twitter @h2oai. To learn more about H2O customer use cases, please visit http://www.h2o.ai/customers/. Join the Movement.