GIGABYTE™

DNN Training Appliance

GIGABYTE's DNN Training Appliance is a well-integrated software and hardware package that combines powerful computing performance together with a user-friendly GUI, providing DNN developers an easy to use environment to conduct dataset management, training jobs management, real time system environment monitoring and model analysis. The appliance includes powerful hardware and software optimizations that can improve the performance and reduce the time required for DNN training.

GIGABYTE's DNN Training Appliance provides developers and data scientists with the following benefits:

Reduces the Complexity & Cost of DNN Training Environment Setup

To generate a production grade DNN model, a developer will need to go through many difficult and time consuming steps, including dataset collection, dataset cleansing, dataset labeling, dataset augmentation, dataset format conversion, DNN model selection, model design, hyperparameters tuning, model training, model evaluation, and model format conversion. Each step requires different tools and configurations that require time and effort for preparation.

GIGABYTE's DNN Training Appliance aims to reduce this complexity by providing a complete training and management platform, incorporating all these processes into a single appliance enabled with a web-browser based GUI. Users can import, convert and manage their dataset; design, train and evaluate different DNN models; and test inferencing of their trained models. Built on GIGA-BYTE's G481-HA1 server, the Appliance is fully optimized to use the bare metal resources available to deliver maximum training performance on cost efficient hardware.

Reduces the Time and Improves the Accuracy for Each DNN Training Job

DNN models need to be trained on a large dataset to achieve an acceptable level of accuracy. Depending on the dataset size, this training could take days or even weeks. And in order to adapt to the latest business circumstances or situations (such as new products, new regulations, etc.), the DNN model needs to be periodically retrained through the latest datasets. If running a DNN training job takes too long, it will have a serious impact on an organization's operations, resource management and competiveness.

GIGABYTE's DNN Training Appliance helps to reduce training time by incorporating many different optimization features, such as GPU memory optimization to allow larger size of training input or fit larger DNN models into GPU memory, automatic hyperparameters tuning during a training job to achieve higher accuracy, and dataset cleaning features to reduce the training time by removing by mislabeled or duplicate training data.
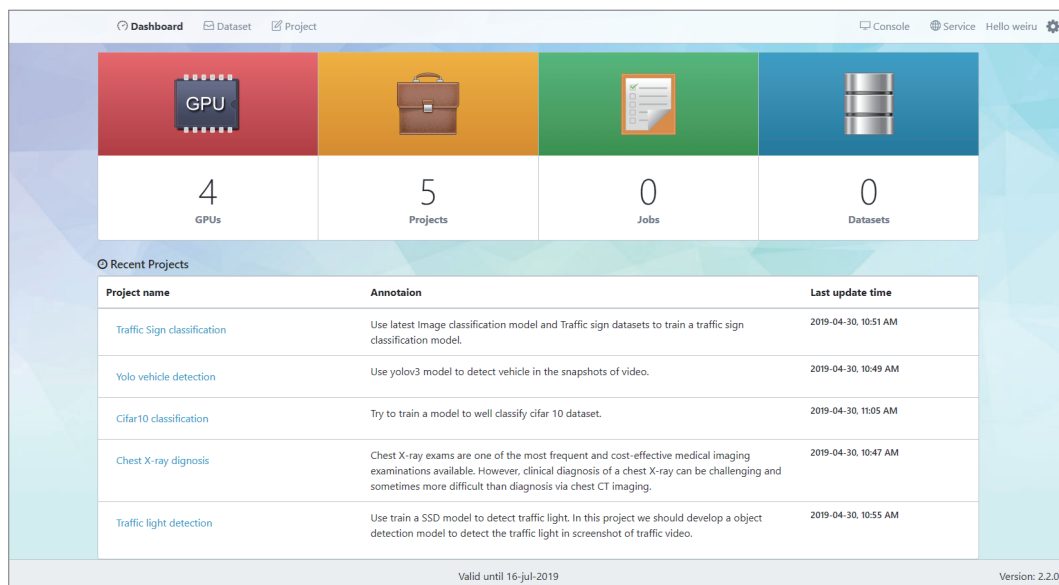
DNN Training Appliance Dashboard

G481-HA1 GPU Server

SUMMARY OF DNN TRAINING APPLIANCE BENEFITS

Saves Time

- All in one package eliminates the painful process of setting up your own hardware & software environment
- Effective dataset management features to "clean" your dataset, making it more accurate
- Powerful optimization features shortens DNN training job time while maintaining accuracy
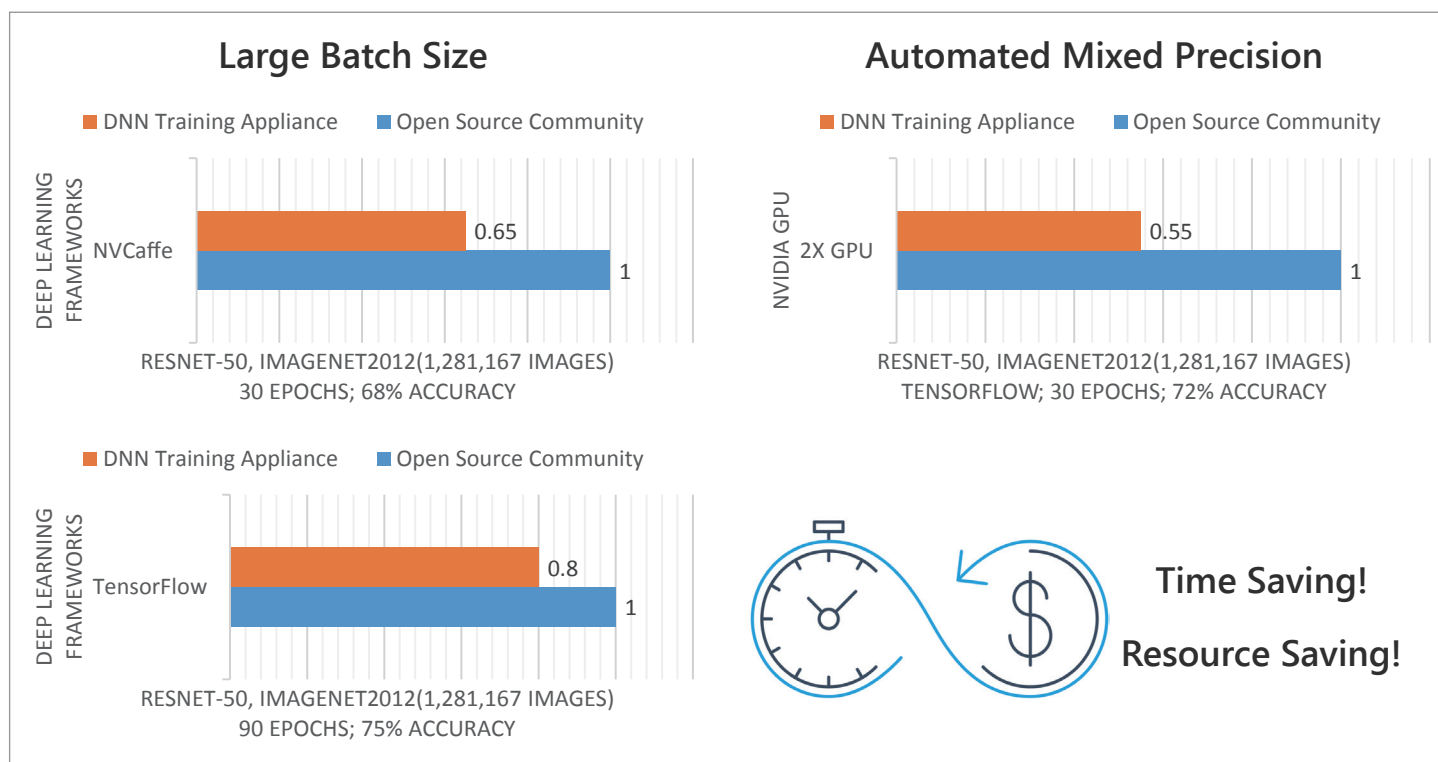
Saves Money

- A highly flexible solution that allows users to choose the most suitable combination of hardware (GPUs, CPUs, networking, memory, storage etc.) and software to meet the actual needs and budget of different development schedules
- Achieves maximum utilization of your hardware investment with powerful optimization features

Ease of Use

- Easy to use GUI shortens the learning curve for developers unfamiliar with setting up and running a DNN training environment; spend less time and resources on employee training

Flexible Choice of Standard or Customized Solutions

- The standard version of GIGABYTE's DNN Training Appliance is enabled for image classification and object detection, or talk to us about a customized solution for your DNN model / application type and business domain (e.g. automotive, medical, manufacturing etc.)

Large Batch Size

DNN Training Appliance   Open Source Community

DEEP LEARNING FRAMEWORKS

NVCaffe — 0.65 / 1

RESNET-50, IMAGENET2012(1,281,167 IMAGES)
30 EPOCHS; 68% ACCURACY

DNN Training Appliance   Open Source Community

DEEP LEARNING FRAMEWORKS

TensorFlow — 0.8 / 1

RESNET-50, IMAGENET2012(1,281,167 IMAGES)
90 EPOCHS; 75% ACCURACY

Automated Mixed Precision

DNN Training Appliance   Open Source Community

NVIDIA GPU

2X GPU — 0.55 / 1

RESNET-50, IMAGENET2012(1,281,167 IMAGES)
TENSORFLOW; 30 EPOCHS; 72% ACCURACY

Time Saving!

Resource Saving!

Faster Deep Learning Training Time

# EFFORTLESS TRAINING MANAGEMENT AND MONITORING

Project-Based Training Management

GIGABYTE's DNN Training Appliance manages the training process by project grouping. Create a new project to import datasets and run training jobs via the web portal GUI. Within each project, quickly and easily keep track of your model training history, including hyperparameter modification, each training job result and the trained model from each job.
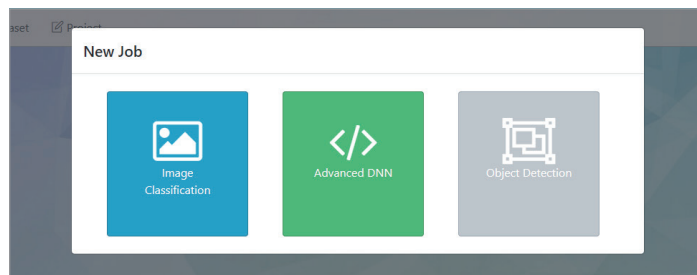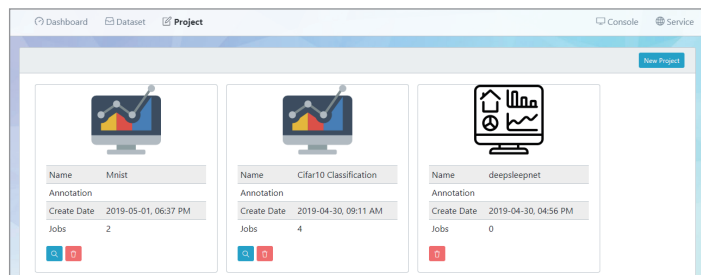

Training Wizard & Automatic Optimization

GIGABYTE's DNN Training Appliance features a step by step wizard, guiding the user on how to train different types of models (for image classification, object detection etc.). This wizard provides different datasets, DNN models and network and hyperparameter settings according to the DNN application type. The Appliance also includes many powerful optimization features (such as memory optimization, automatic hyperparameters tuning and mixed precision training) that are "one-click" enabled.

Step1. Select Dataset

Step2. Select Network

Step4. Configure Hyperparameters

Step3. Select GPU
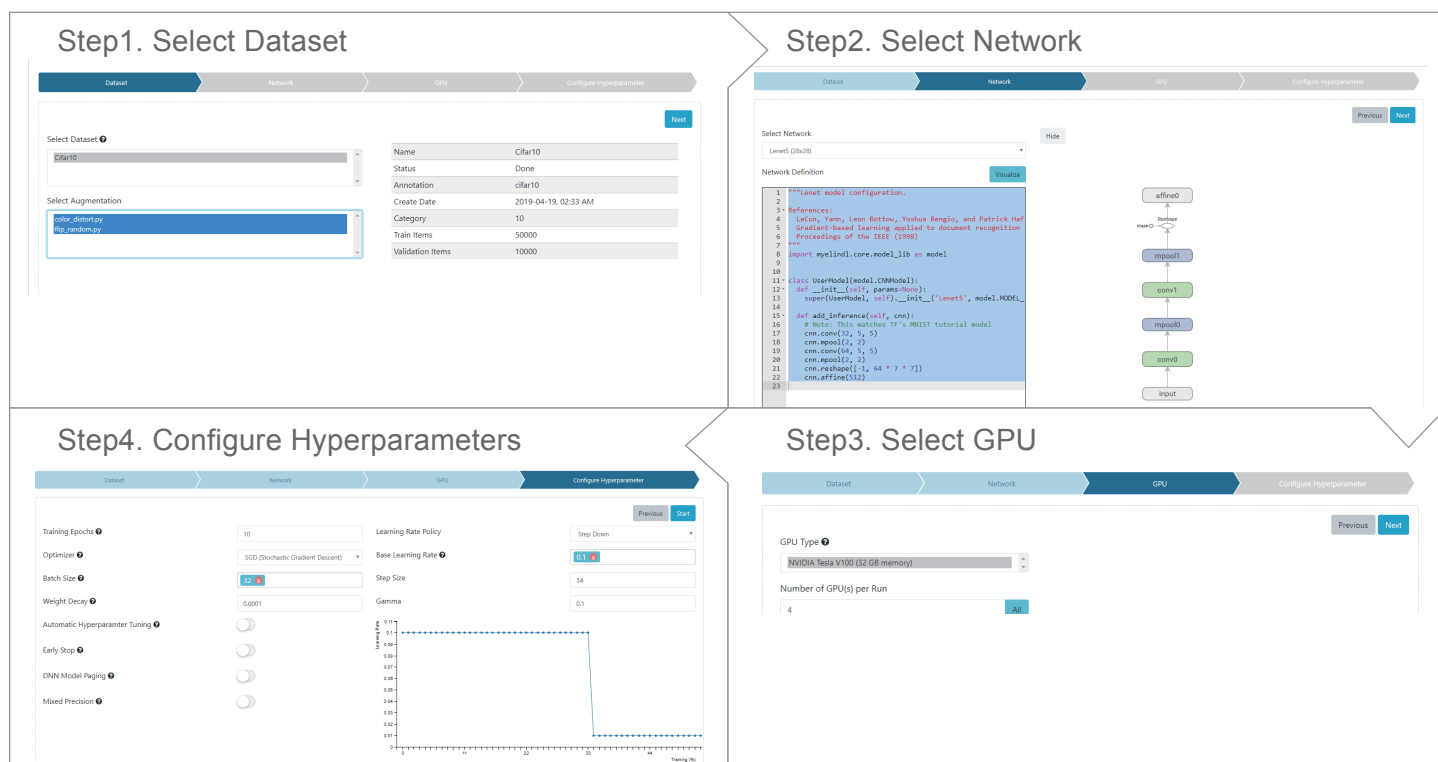
Real-Time Monitoring & Quick Result Verification

Once training starts, keep track of training progress in real-time via the training monitoring interface. And after each training job is completed, quickly verify your DNN model with the inferencing validation feature.
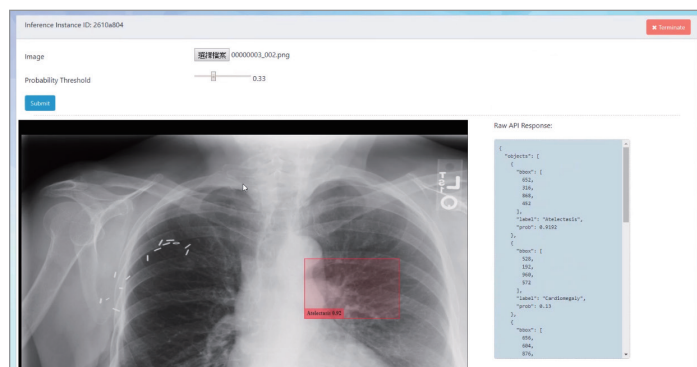
Intuitive Editor & Setting Interface

The user can easily create a new training job based on the result output of the previous job, by editing hyperparameters, editing the DNN model architecture, changing the dataset or adjusting the number of GPUs utilized for the training job.
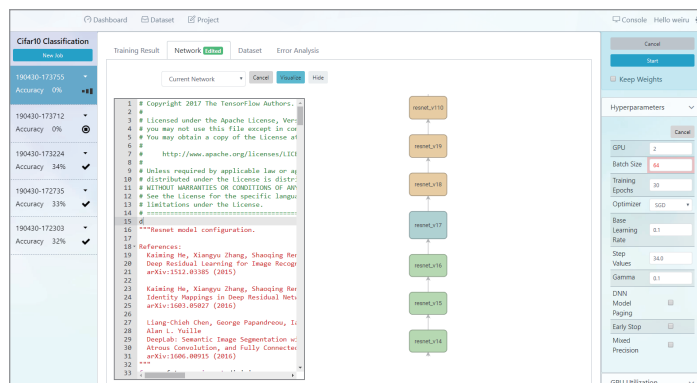
# EFFECTIVE DATASET MANAGEMENT TOOLS

Dataset Augmentation

A common problem for DNN training is the lack of good quality datasets or an uneven balance of dataset classifications. The Dataset Augmentation function provides a way to overcome these problems by enhancing your existing datasets, supporting standard or custom augmentations like randomly flipping images left or right, or randomly distorting the color of images to generate more variations of a certain image.
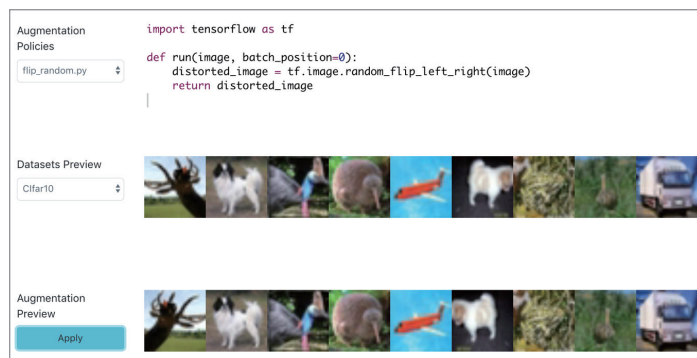

Dataset Import and Conversion

The platform supports multiple dataset formats (such as Cifar10, KITTI, COCO, ChestXray, etc.), and automatically converts the raw data into the dataset format of the deep learning framework that will be used.
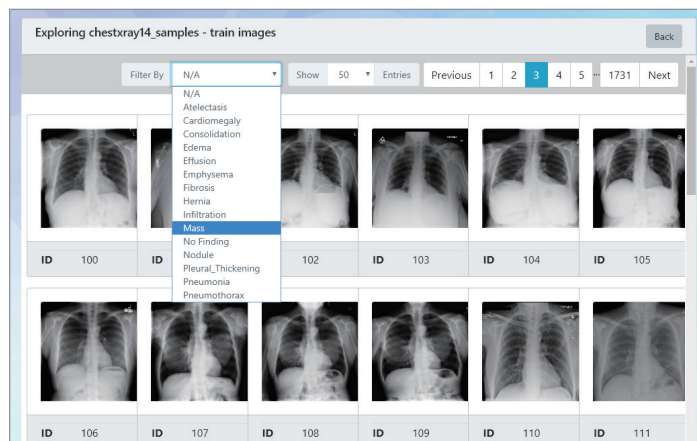

Dataset Error Detection & Cleaning

By using model analysis features like the confusion matrix, the user can find suspect data in their dataset. The GUI can then be used for data re-labelling, deletion or duplication accordingly. The easy to use interface saves users time when cleaning up their data, and allows datasets to be managed quickly and easily.
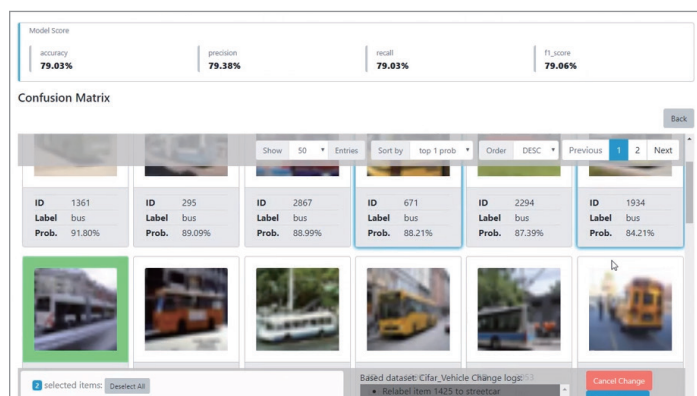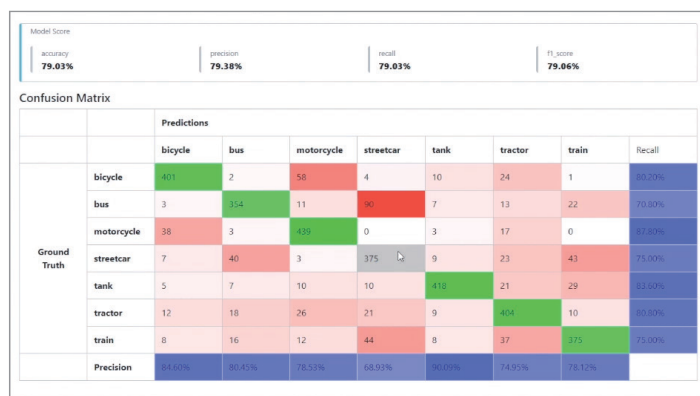
POWERFUL OPTIMIZATION FEATURES

GPU Memory Optimization

The GPU memory optimization feature enhances GPU memory utilization performance during DNN training. This optimization allows for larger image batch sizes to be used during image classification training, reducing the total training time required based on a certain size dataset. This feature can be of particular benefit when larger DNN model sizes or GPUs with smaller memory capacities are used, and reduces the occurrence of GPU OOM (Out of Memory) errors.
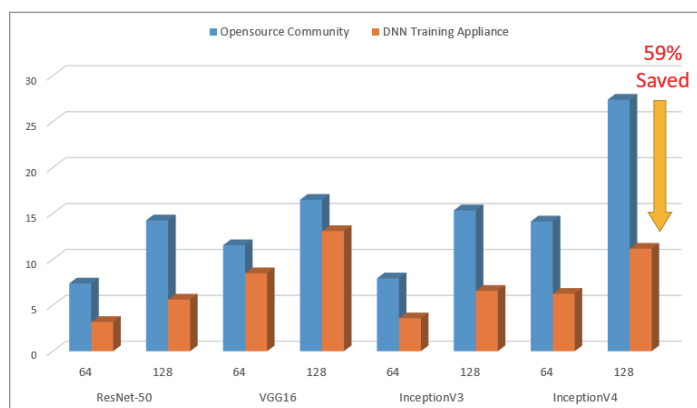
GPU Memory Utilization Optimization

Automatic Hyperparameters Tuning

It takes a lot of time and effort to test and find a proper set of hyperparameters which can optimize the training accuracy of a DNN model. GIGABYTE's DNN Training Appliance includes a tool that can automatically discover optimal hyperparameters settings (such as batch size, learning rate, learning rate gamma, learning rate step) during a training job to achieve the most efficient time / accuracy ratio.
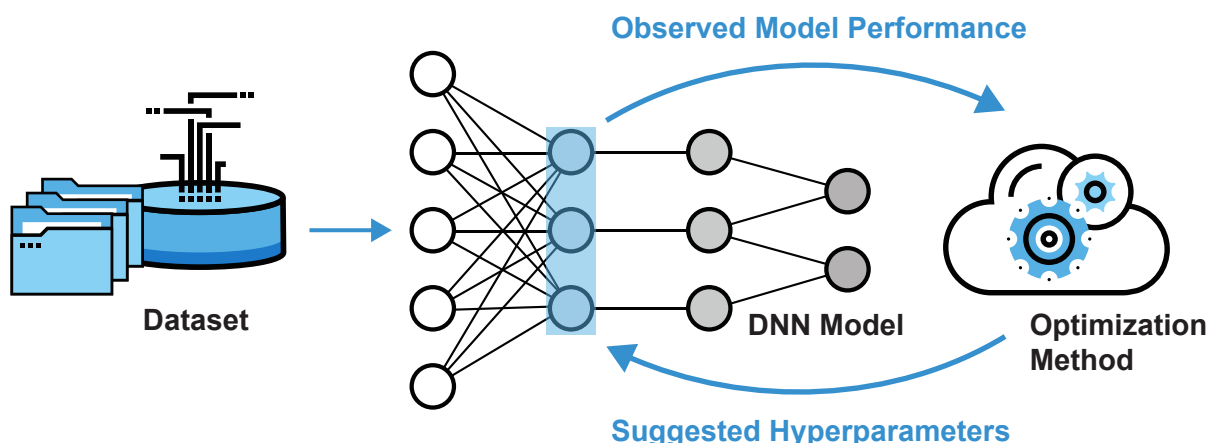
INTELLIGENT ENVIRONMENT MONITORING

GPU Thermal Aware Management

GIGABYTE's DNN Training Appliance features a real-time GPU monitoring feature (for GPU utilization, memory usage and temperature), including a protection mechanism that will automatically adjust a training job in process when the temperature of a GPU rises over a certain threshold.
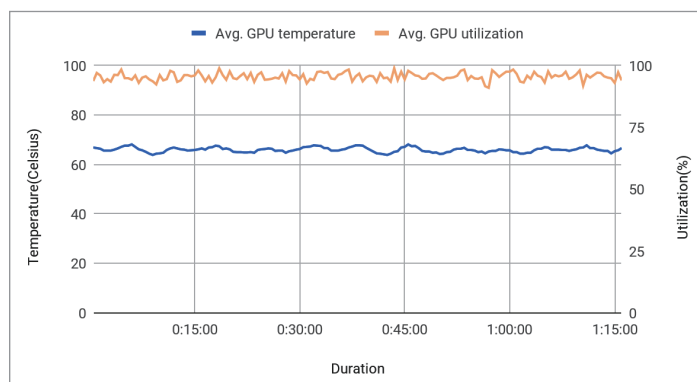

GPU Temperature Under Intensive GPU Training

OPTIMIZED HARDWARE PLATFORM

Single-Root GPU Server

GIGABYTE's DNN Training Appliance is built with G481-HA1, a server optimized for a single cluster DNN training appliance by employing a single root GPU system architecture. Since DNN training requires frequent communication between each GPU in the system, utilizing a single-root architecture (all GPUs can communicate via the same CPU root) helps reduce GPU to GPU latency and decrease DNN training job time.
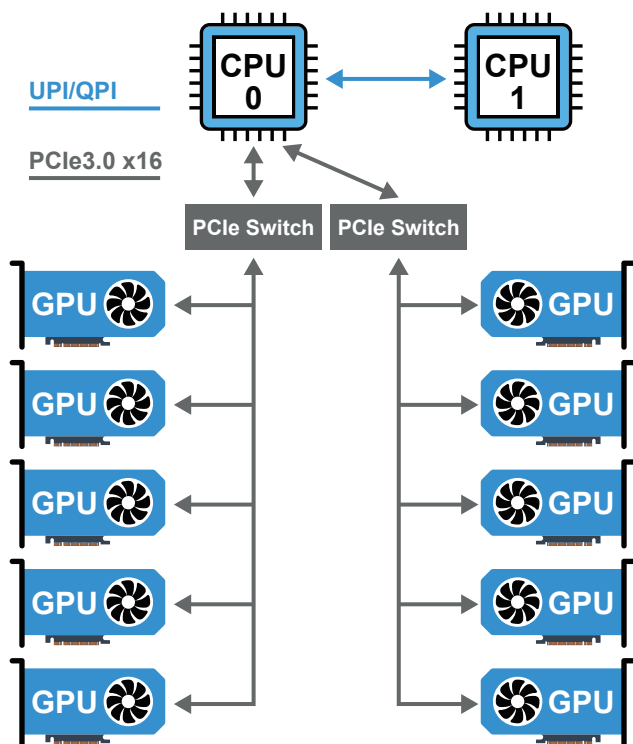
Single-Root Configuration
Minimize GPU to GPU latency for small scale deployments
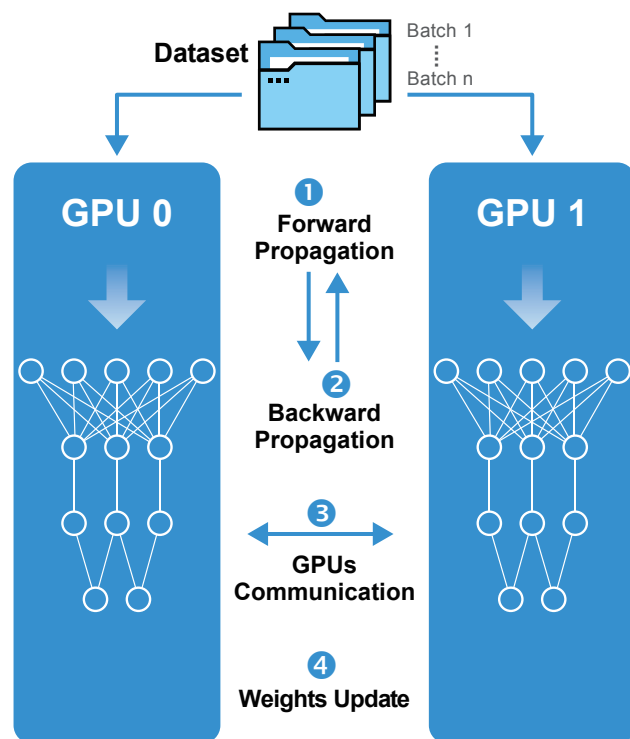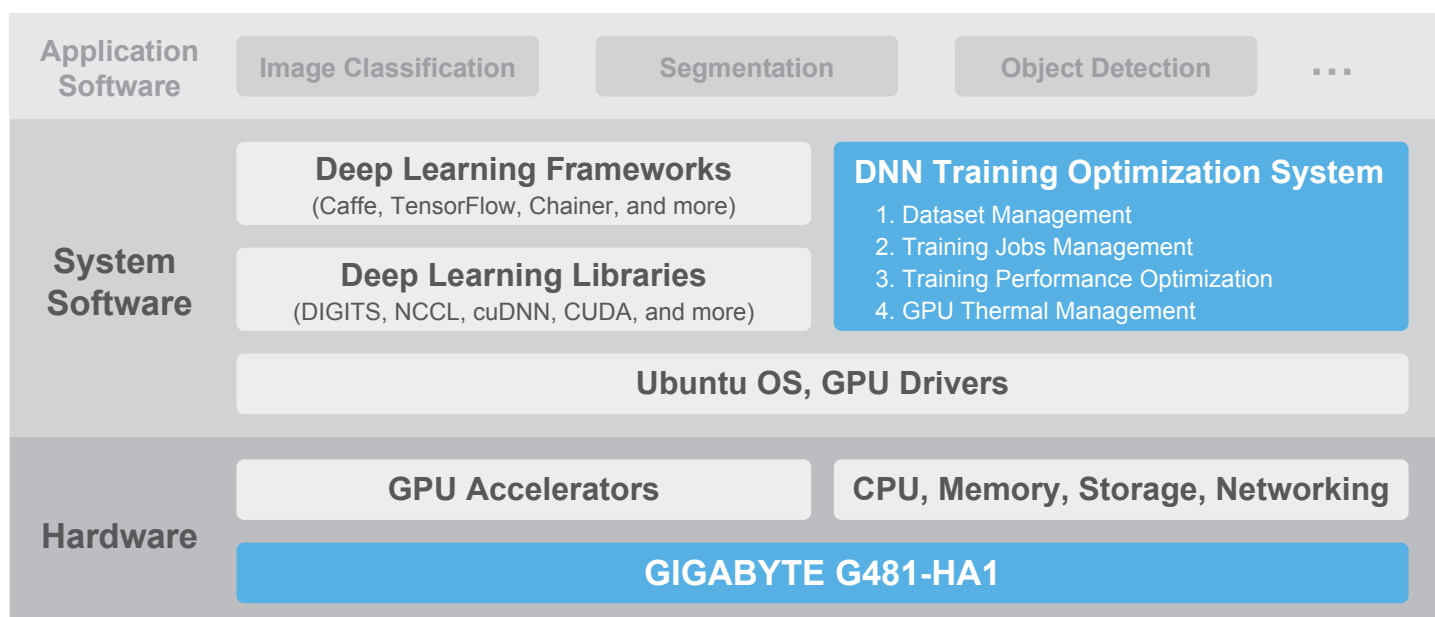

DNN Model Training Method
GPU to GPU synchronization is an important feature of DNN model training

G481-HA1 Specifications:

CPU	Dual 2nd Generation Intel Xeon Scalable Processors, TDP up to 205W
Memory	6-Channel DDR4 memory, 24 x DIMMS Intel Optane DC Persistent Memory Ready
Networking	2 x 10GbE BASE-T LAN ports 2 x 1GbE BASE-T LAN ports (Optional: 4 x Omni-Path QSFP28 LAN ports)
Storage	8 x 2.5" NVMe + 2 x 2.5" SATA / SAS hot-swap SSD 12 x 3.5" SATA / SAS hot-swap HDD
Expansion Slots	10 x PCIe x16 (3.0 x16) for GPUs 1 x PCIe 3.0 x16, LPHL 1 x PCIe 3.0 x16, LPHL (occupied by RAID card)
Power	3 x 2200W 80 PLUS Platinum redundant PSUs
Management	1 x Dedicated management port Aspeed AST2500 management controller GIGABYTE Server Management remote management platform

GIGABYTE DNN TRAINING APPLIANCE

Application Software	Image Classification	Segmentation	Object Detection	...

System Software	Deep Learning Frameworks (Caffe, TensorFlow, Chainer, and more)	DNN Training Optimization System 1. Dataset Management 2. Training Jobs Management 3. Training Performance Optimization 4. GPU Thermal Management
	Deep Learning Libraries (DIGITS, NCCL, cuDNN, CUDA, and more)	
	Ubuntu OS, GPU Drivers	

Hardware	GPU Accelerators	CPU, Memory, Storage, Networking
	GIGABYTE G481-HA1	

Dataset Management

- Multi-format dataset support for image classification, object detection
- Automatic conversion feature of dataset into format required by deep learning framework
- Easy to use GUI to quickly browse dataset content, edit dataset tags, and delete, copy, retag, etc.

Training Management

- Guided training wizard for image classification and object detection
- Easy to use GUI for system management, DNN model editing and visualization, hyperparameters setting & real-time model training performance monitoring
- Support for multiple deep learning frameworks
- Multiple training job scheduling support with containers
- Web console: browser-based CLI (Command Line Interface) feature for developers to perform specific data preprocssing or other tasks
- Remote CLI (Command Line Interface) feature for managing resources and running training jobs remotely
- Model Version Control feature

Training Optimization

- One-click enabled optimization features, including mixed precision training, automatic hyperparameters tuning, GPU memory usage optimization
- Confusion matrix feature for advanced analysis of image classification training results
- Simultaneously run a training job with different hyperparameters combinations
- Multiple GPU training (scalable from 1 ~ 8 GPUs per appliance)
- Single-root system architecture for reduced latency of GPU to GPU synchronization during training job

Environment Monitoring

- System monitoring interface, displaying information such as usage rate of system resources required for model training
- GPU thermal aware management prevents GPU being damaged due to excessive temperature

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