DIGITS- Interactive Deep Learning GPU Training System

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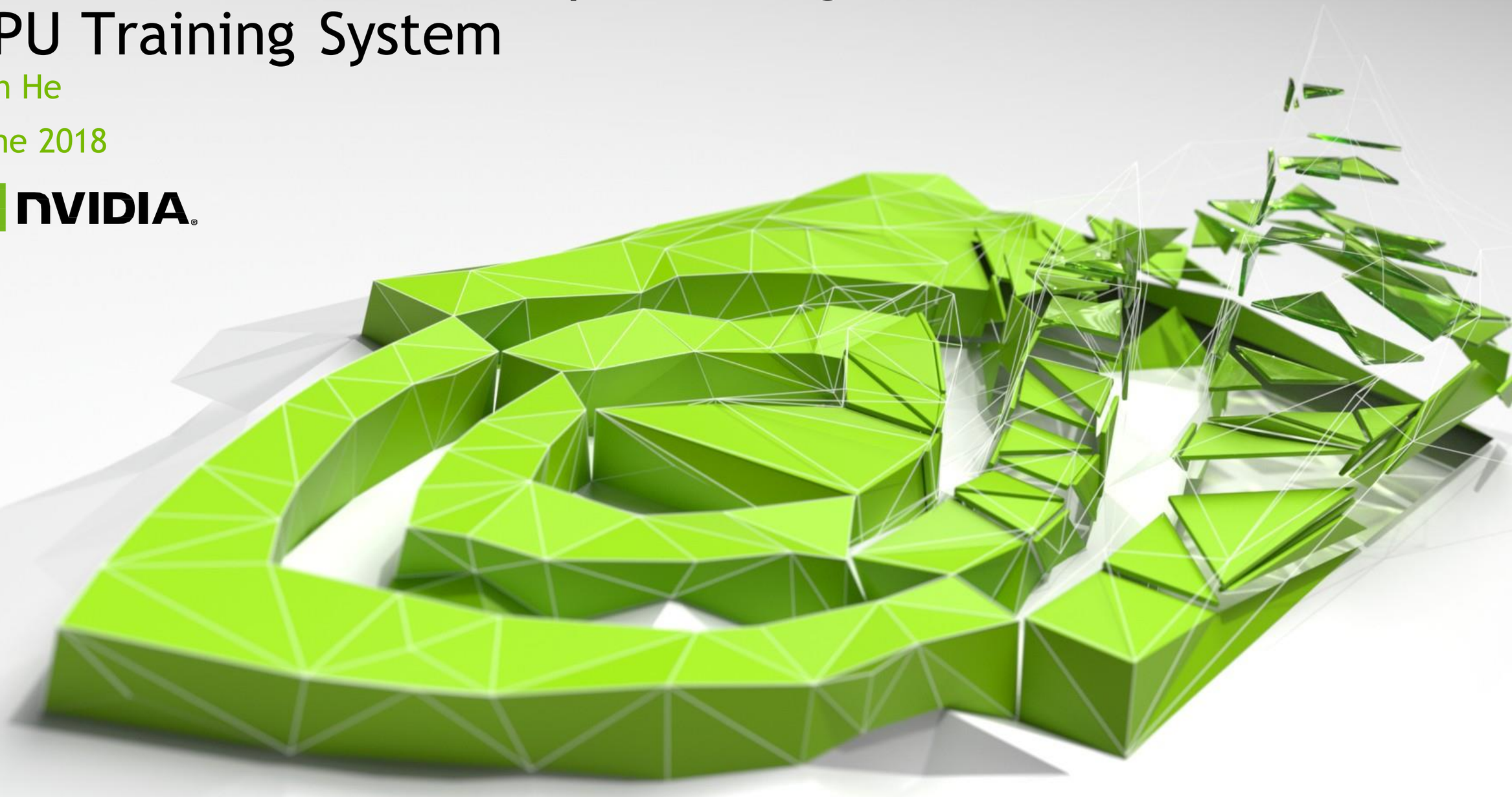


Agenda

- Introduction to DIGITS
- CREATING DATASETS
- TRAIN A NETWORK
- References

“DIGITS makes it way easier to design the best network for the job. The DIGITS interface makes it super easy to track key diagnostics during training. The field will definitely benefit from having tools like this for configuration and introspection”

— Simon Osindero, AI Architect at Flickr

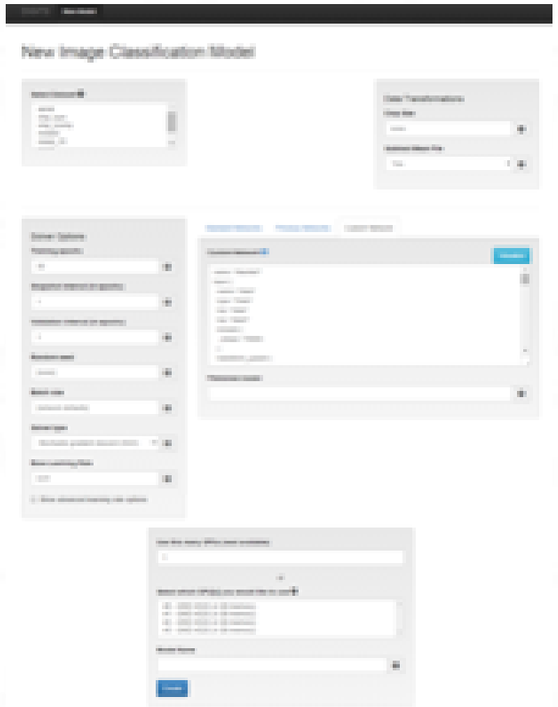
INTRODUCTION TO DIGITS

NVIDIA DIGITS

Interactive Deep Learning GPU Training System

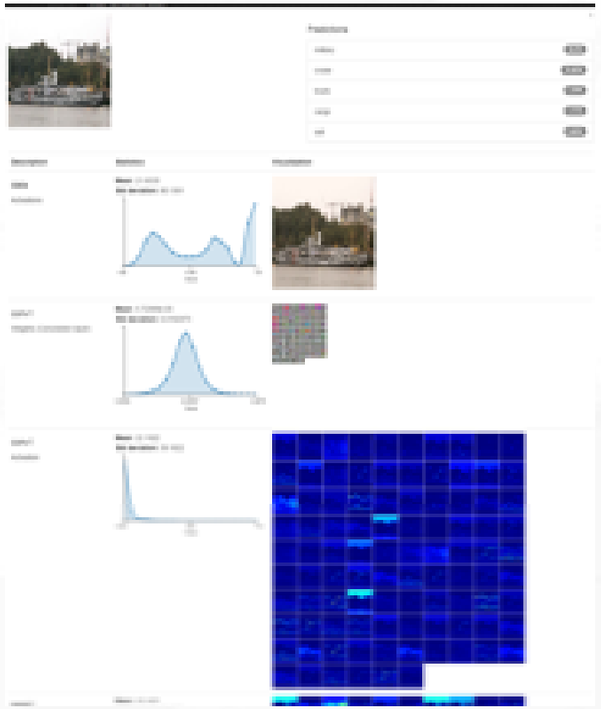
Process Data

Configure DNN



Monitor Progress

Visualization



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Who is DIGITS for?

Data Scientists & Researchers:

- Quickly design the best deep neural network (DNN) for your data
- Monitor DNN training quality in real-time
- Manage training of many DNNs in parallel on multi-GPU systems, and multi-GPU training

DIGITS

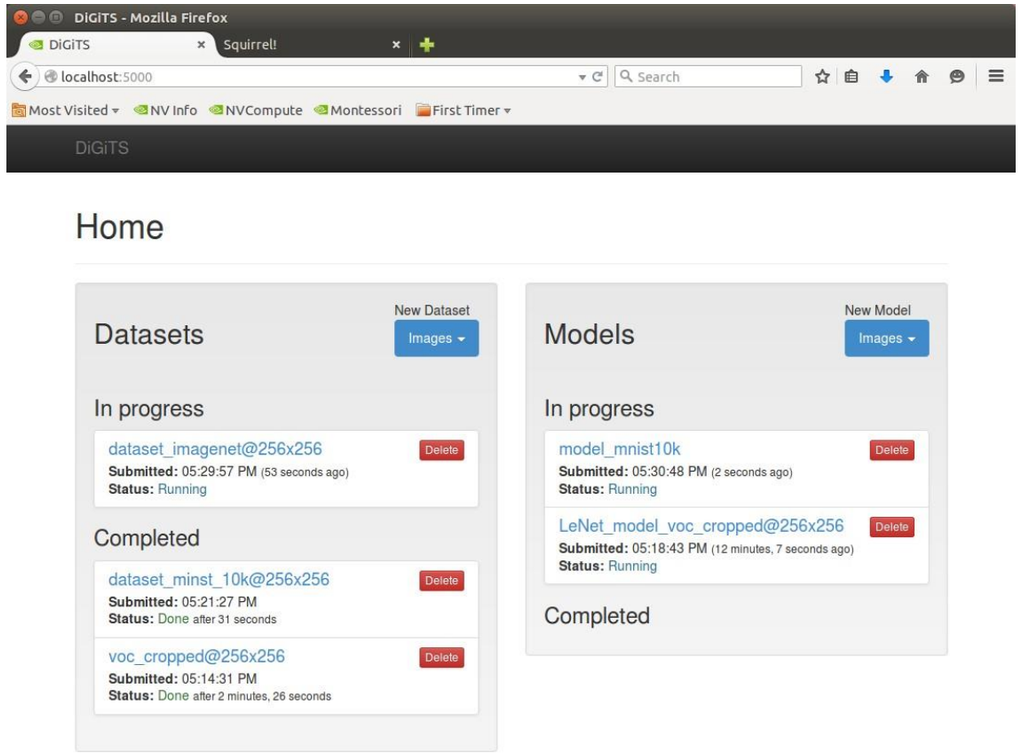
Deep Learning GPU Training System

Available at http://developer.nvidia.com/digits

Free to use, Source Code available at Github, latest branch v3.0
https://github.com/NVIDIA/DIGITS

Current release supports classification on images

Future versions: More problem types and data formats (video, speech)



DIGITS

Key Features

Visualize DNN topology and how training data activates your network

Manage training of many DNNs in parallel on multi-GPU systems

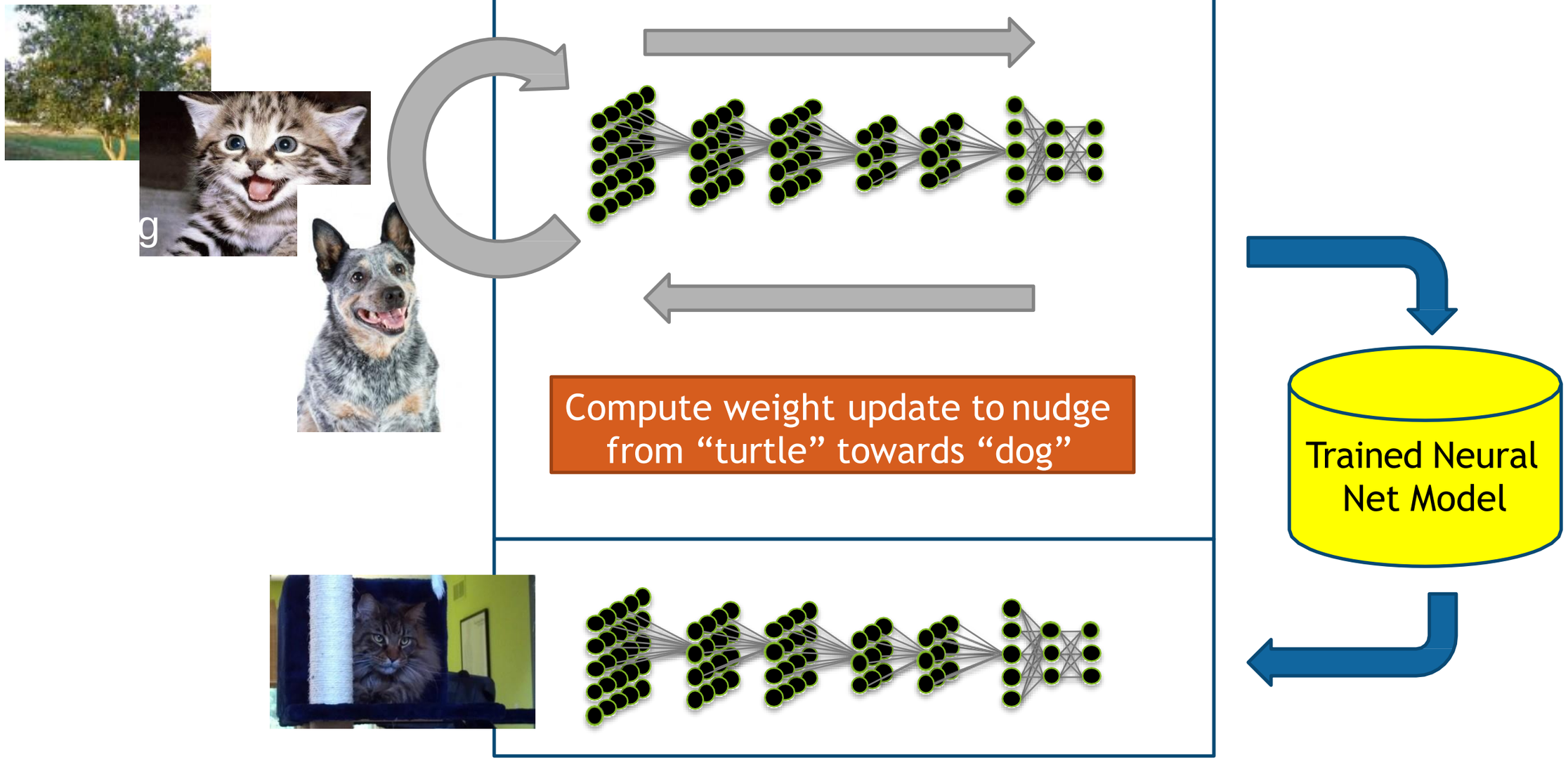
Simple setup and launch

Import a wide variety of image formats and sources

Monitor network training in real-time

Open source, so DIGITS can be customized and extended as needed

What is Deep Learning Software?



Deep Learning

Steps with DIGITS

Creating a Dataset

Define the Network or use existing

- Choose a given Framework
- Selecting a preconfigured (“standard”) network – LeNet, AlexNet, GoogleNet
- Previous network
- Custom network

Training a Model

Classification

CREATING DATASETS

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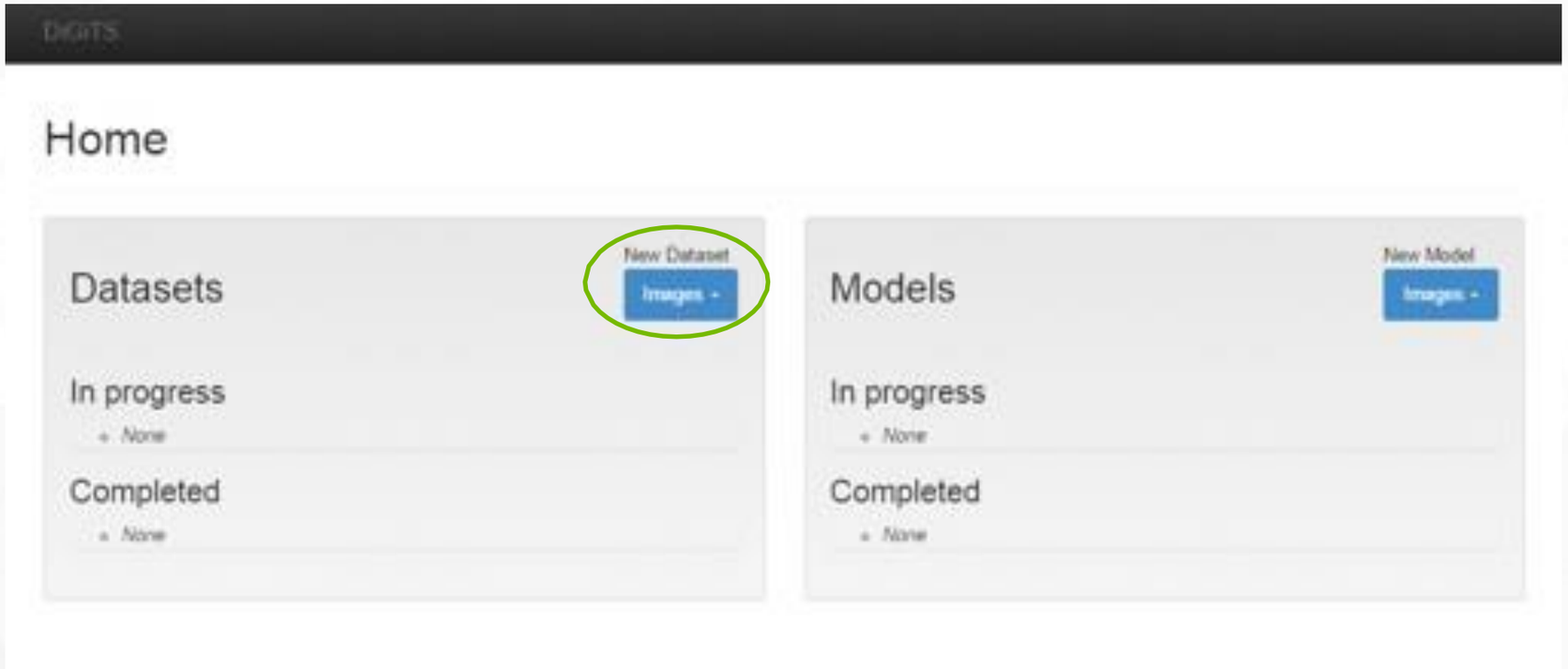
Creating your Dataset

Main Console



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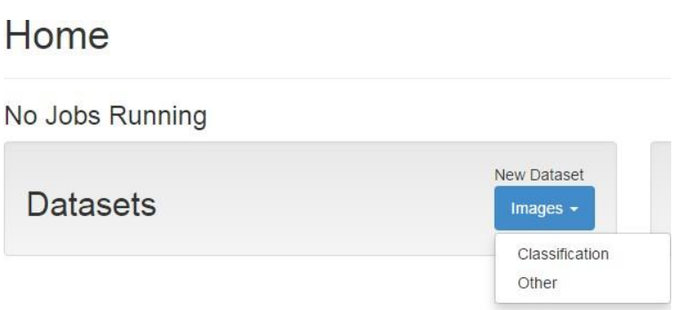
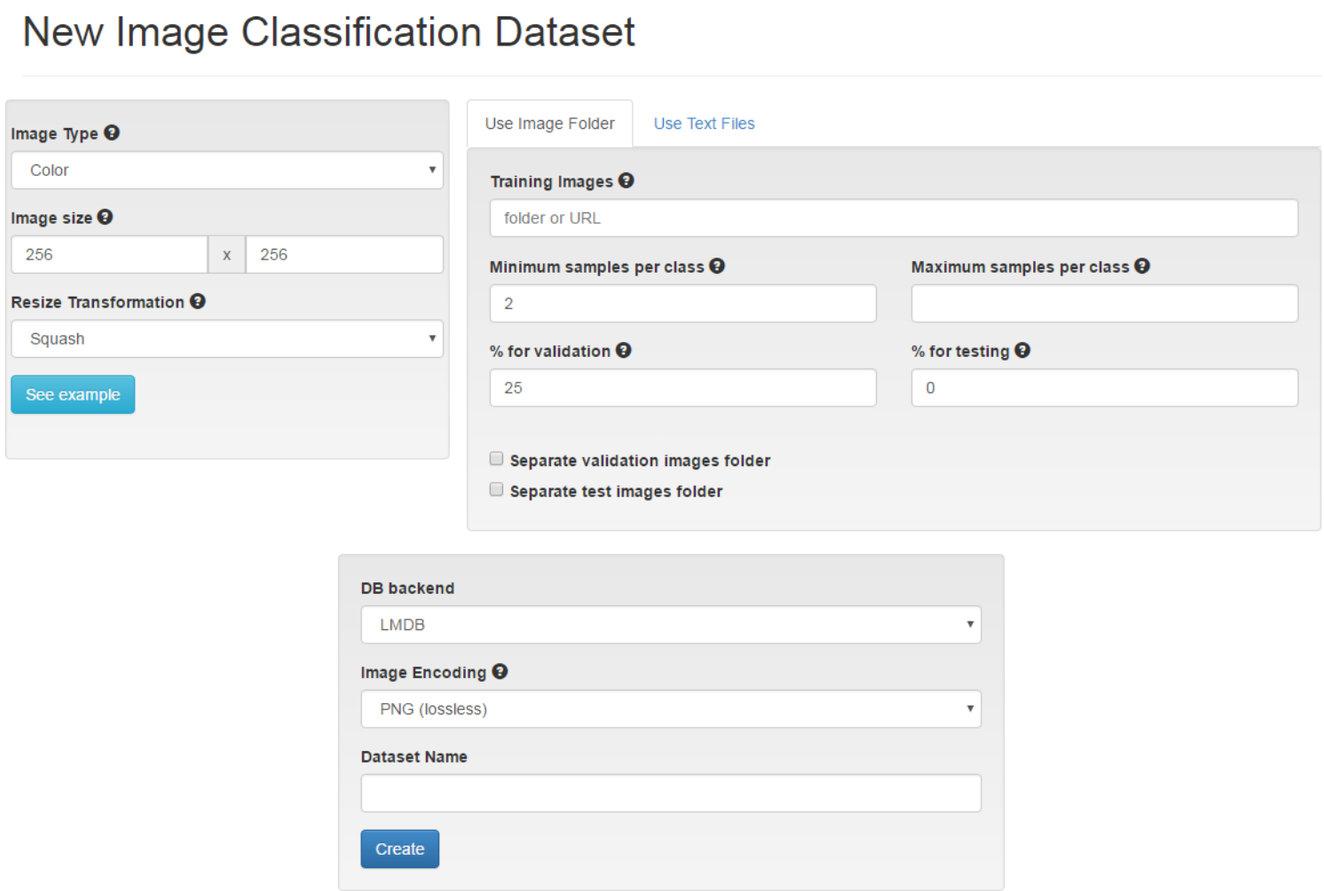
Creating your Dataset

Main Console





In the Datasets section on the left side of the page, click on the blue Images button and select Classification which will take you to the "New Image Classification Dataset" page

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Download MNIST dataset

Use the following command to download the MNIST dataset (for Deb package installations, the script is at/usr/share/digits/tools/download_data/main.py):

$ tools/download_data/main.py mnist ~/mnist

```
Downloading url=http://yann.lecun.com/exdb/mnist/train-images-idx3-ubyte.gz ...
Downloading url=http://yann.lecun.com/exdb/mnist/train-labels-idx1-ubyte.gz ...
Downloading url=http://yann.lecun.com/exdb/mnist/t10k-images-idx3-ubyte.gz ...
Downloading url=http://yann.lecun.com/exdb/mnist/t10k-labels-idx1-ubyte.gz ...
Uncompressing file=train-images-idx3-ubyte.gz ...
Uncompressing file=train-labels-idx1-ubyte.gz ...
Uncompressing file=t10k-images-idx3-ubyte.gz ...
Uncompressing file=t10k-labels-idx1-ubyte.gz ...
Reading labels from /home/username/mnist/train-labels.bin ...
Reading images from /home/username/mnist/train-images.bin ...
Reading labels from /home/username/mnist/test-labels.bin ...
Reading images from /home/username/mnist/test-images.bin ...
Dataset directory is created successfully at '/home/username/mnist'
Done after 16.722807169 seconds.
```

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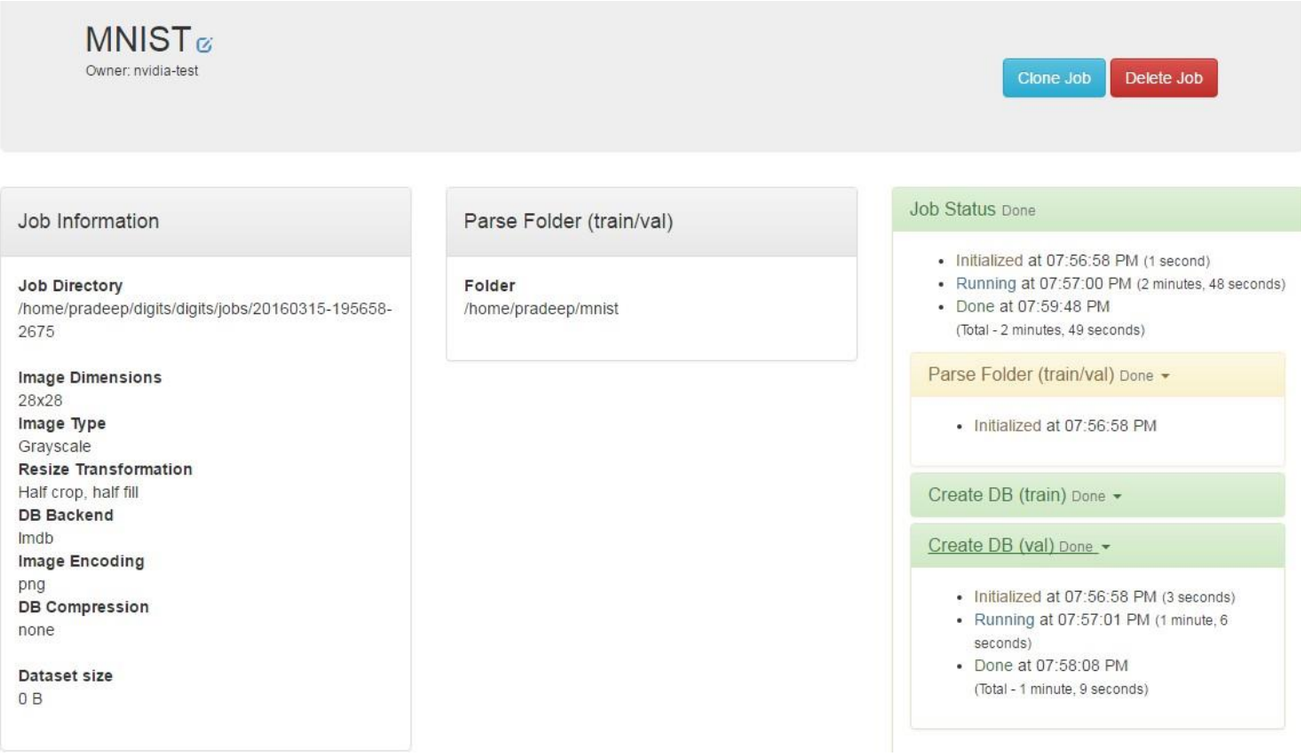
Creating your Dataset

While the model creation job is running, you should see the expected completion time on the right side

When Model creation is done, you can also see completion time and duration

Users may download a copy of .txt files for reference



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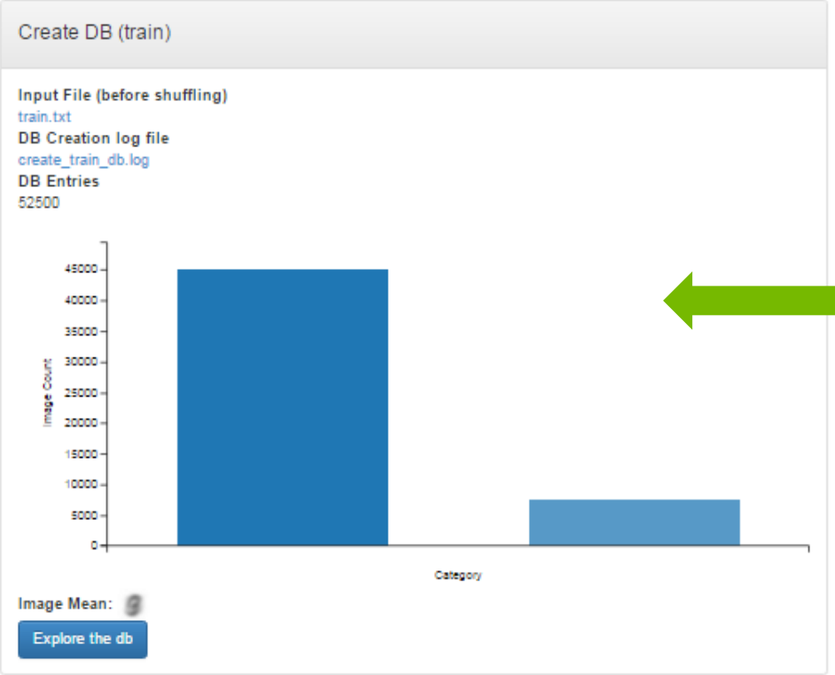
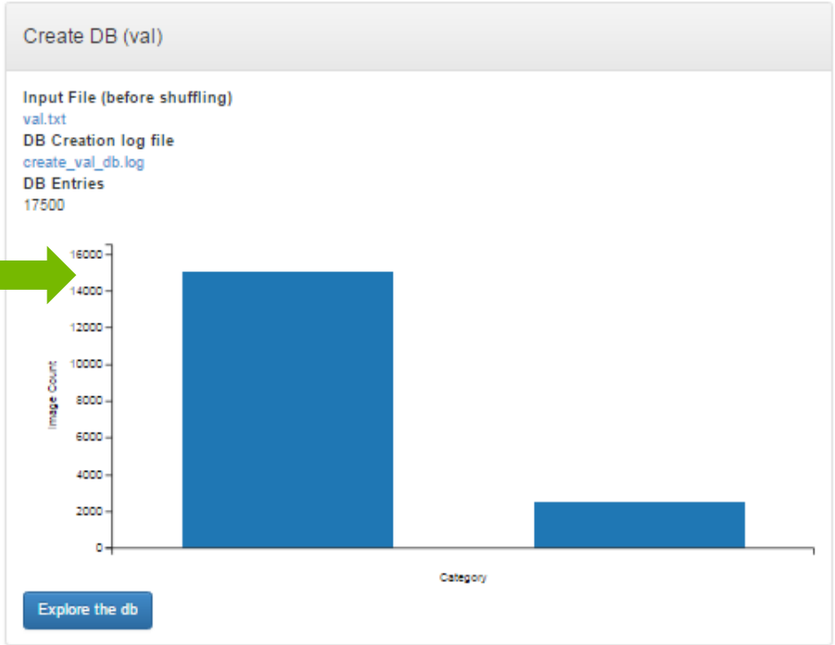
Database results



- Training data is used to train our neural network.
- Teaches the network to classify object categories
- Training Data Set, Current example uses 52500 Images for training

- Validation data tests the performance of the network
  - This data is only used for testing the generalization ability of the network
  - Not used to teach/train network
  - Prevents use of and identifies when network is overfit.
  - In current example 17500 images used for validation.



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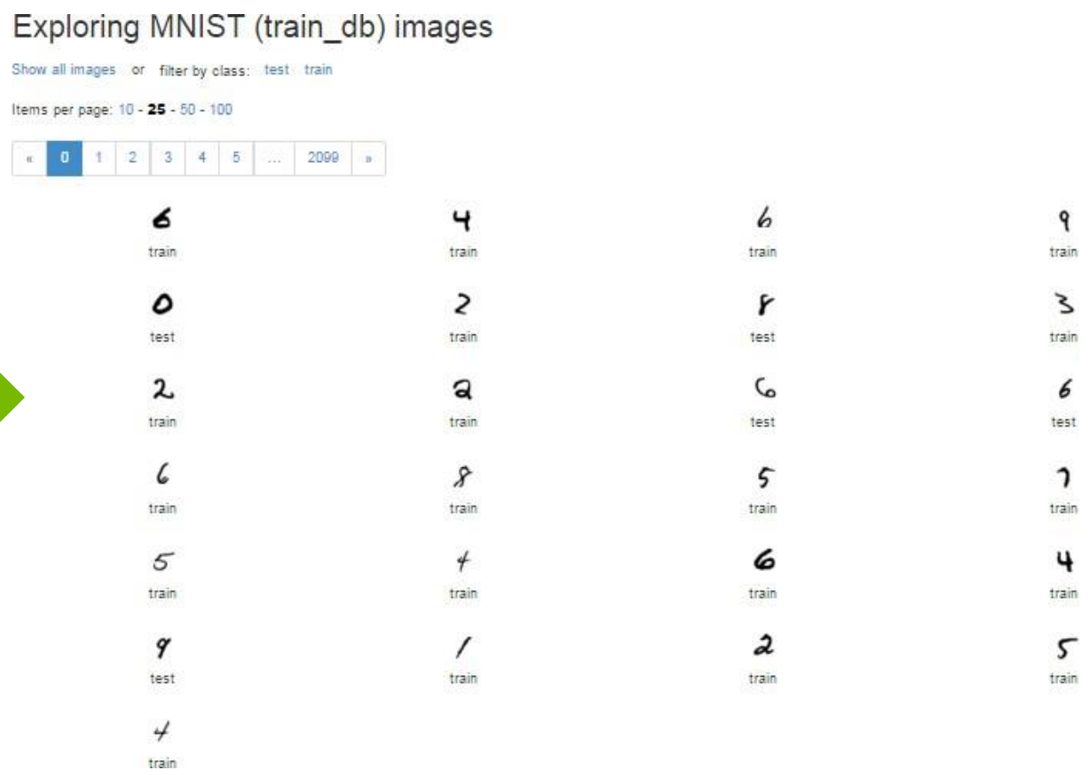
Database Results

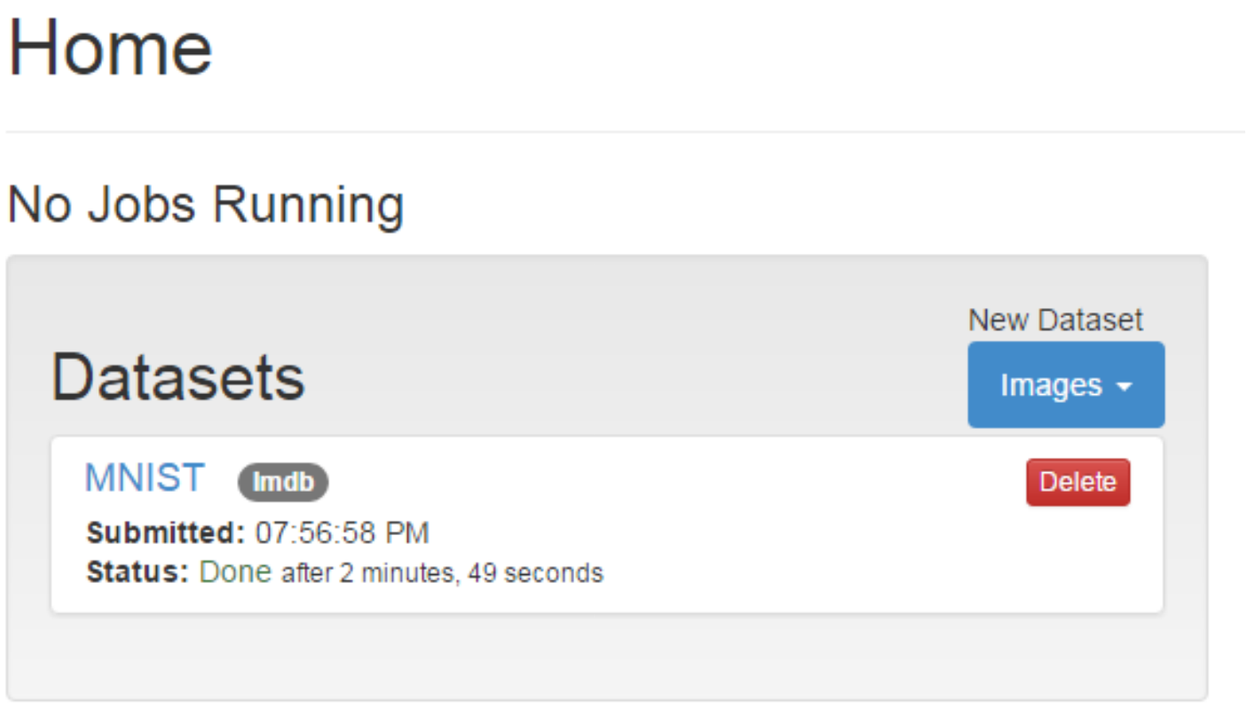
Database of Images can be explored via Exploring "Explore DB" tab and you can see test images used for training/validation



DIGITS DEMO

Creating your Dataset

A new database is Created as visible on Home Page of DIGITS



TRAIN A NETWORK

TRAINING

Choose Framework

With DIGITS 6.0, three frameworks are integrated into DIGITS

- Caffe
- Torch
- TensorFlow

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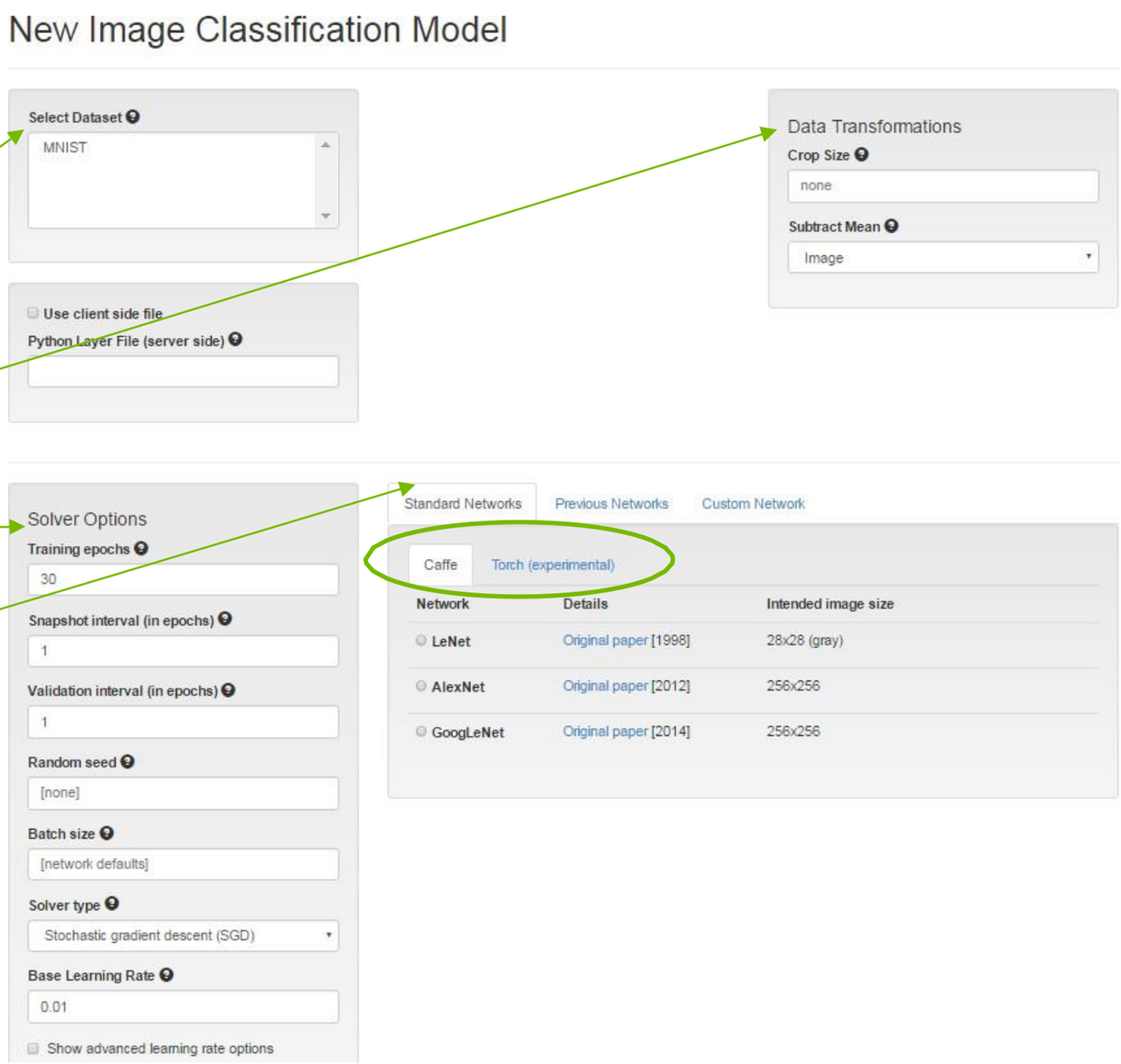
Train A network

Training a network interface, please note

- Database selection
- Data Transformations
- Solver Options
- Different Network configurations
  - Caffe
  - Torch(experimental)



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Train a Network

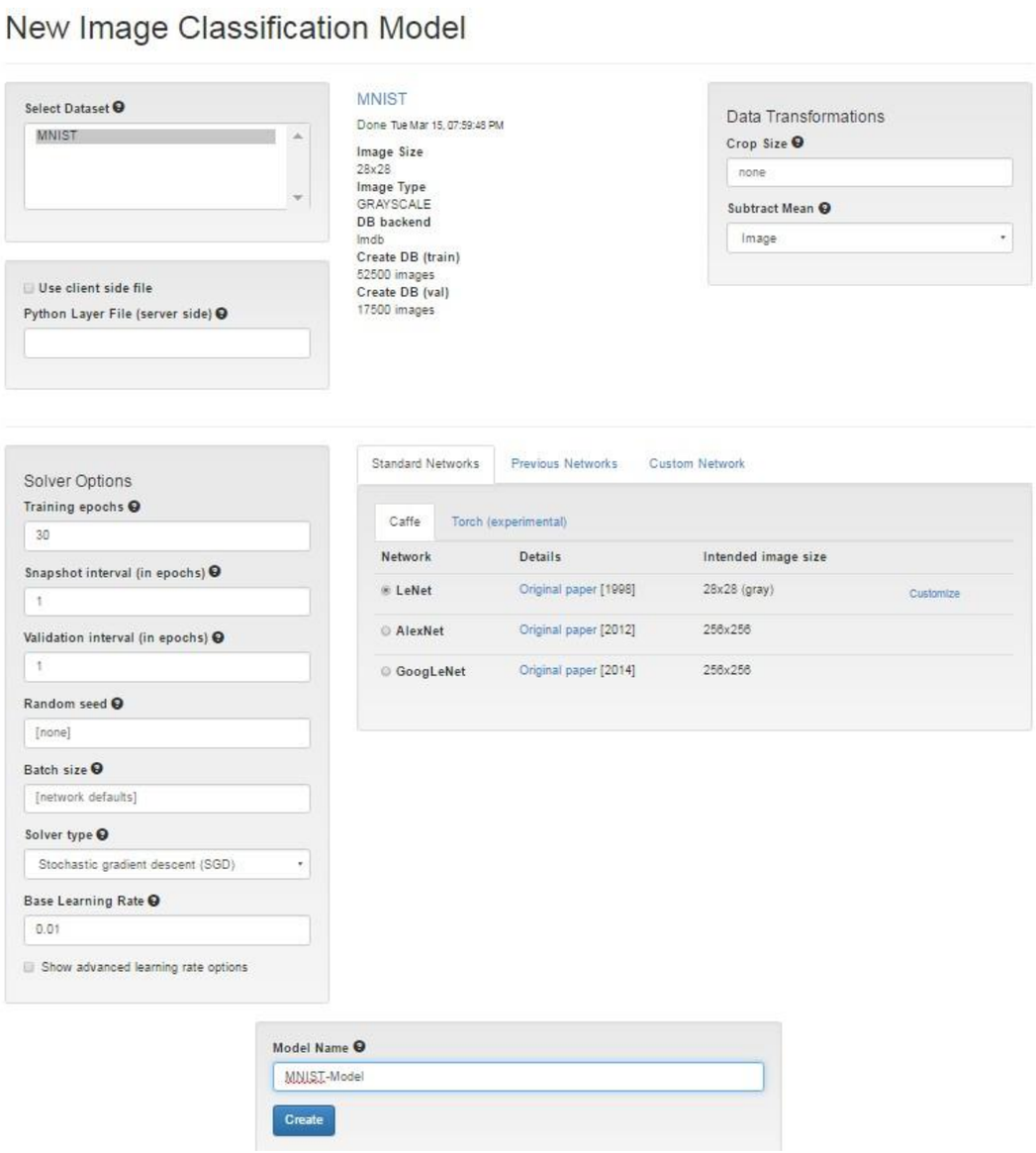
Select the Database

Provide a Model Name

Do any changes in Solver options

Start with a default Network like LeNet (Framework can be anyone Caffe/Torch)

Click on Create Button



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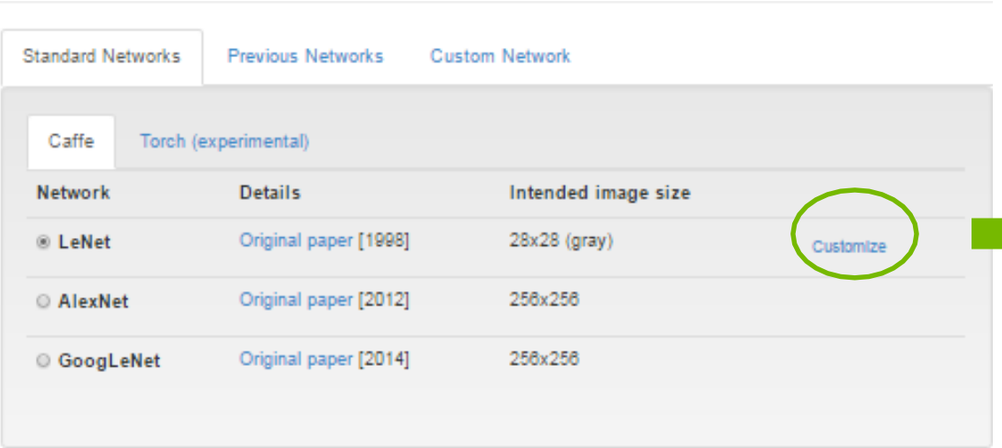
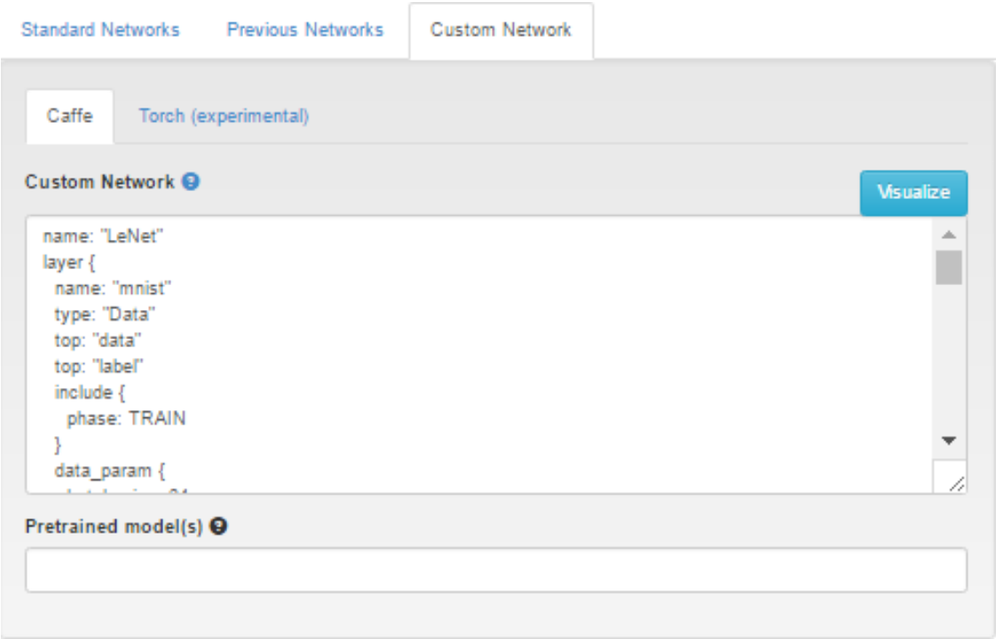
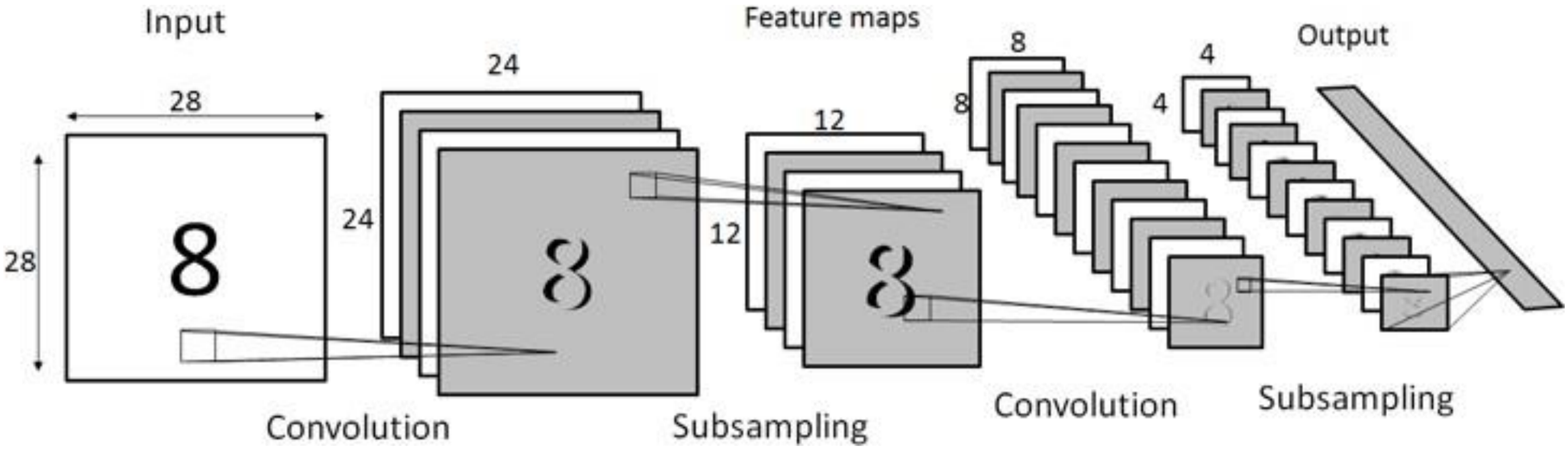
Train a Network-Advance Options





LENET

Network Configuration



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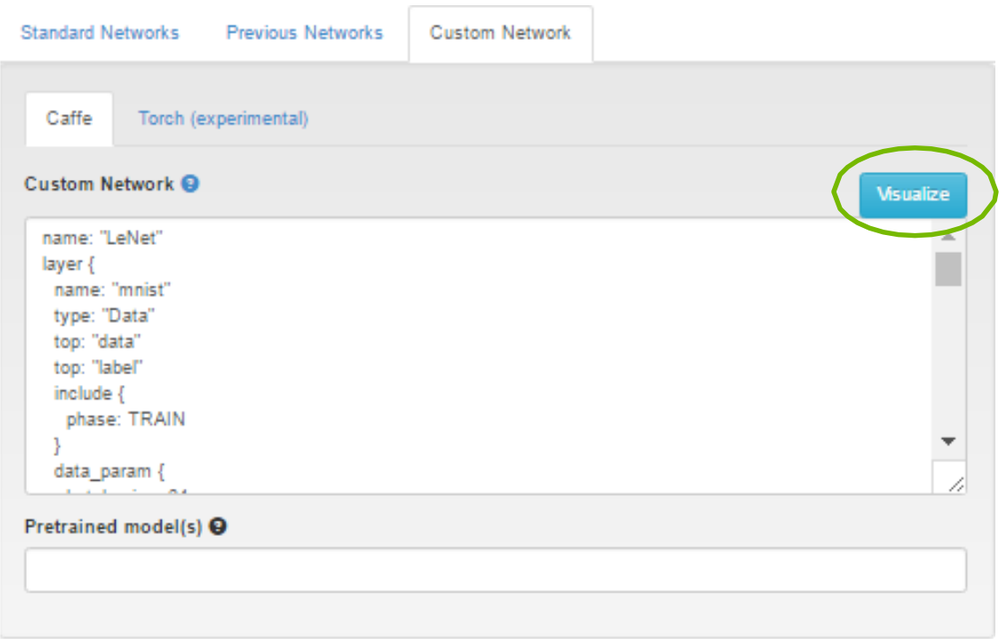
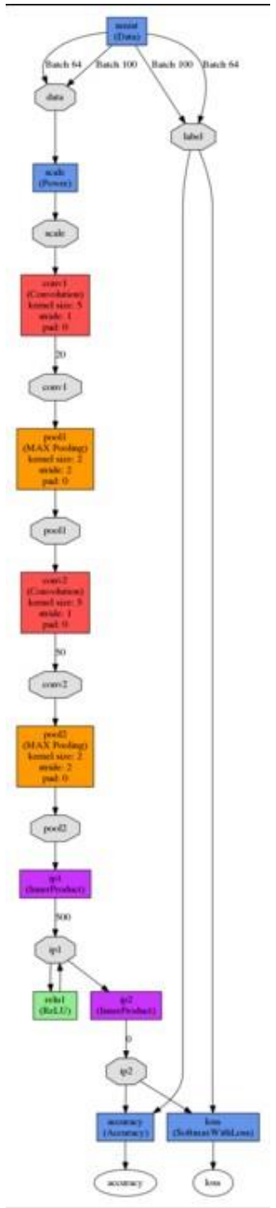
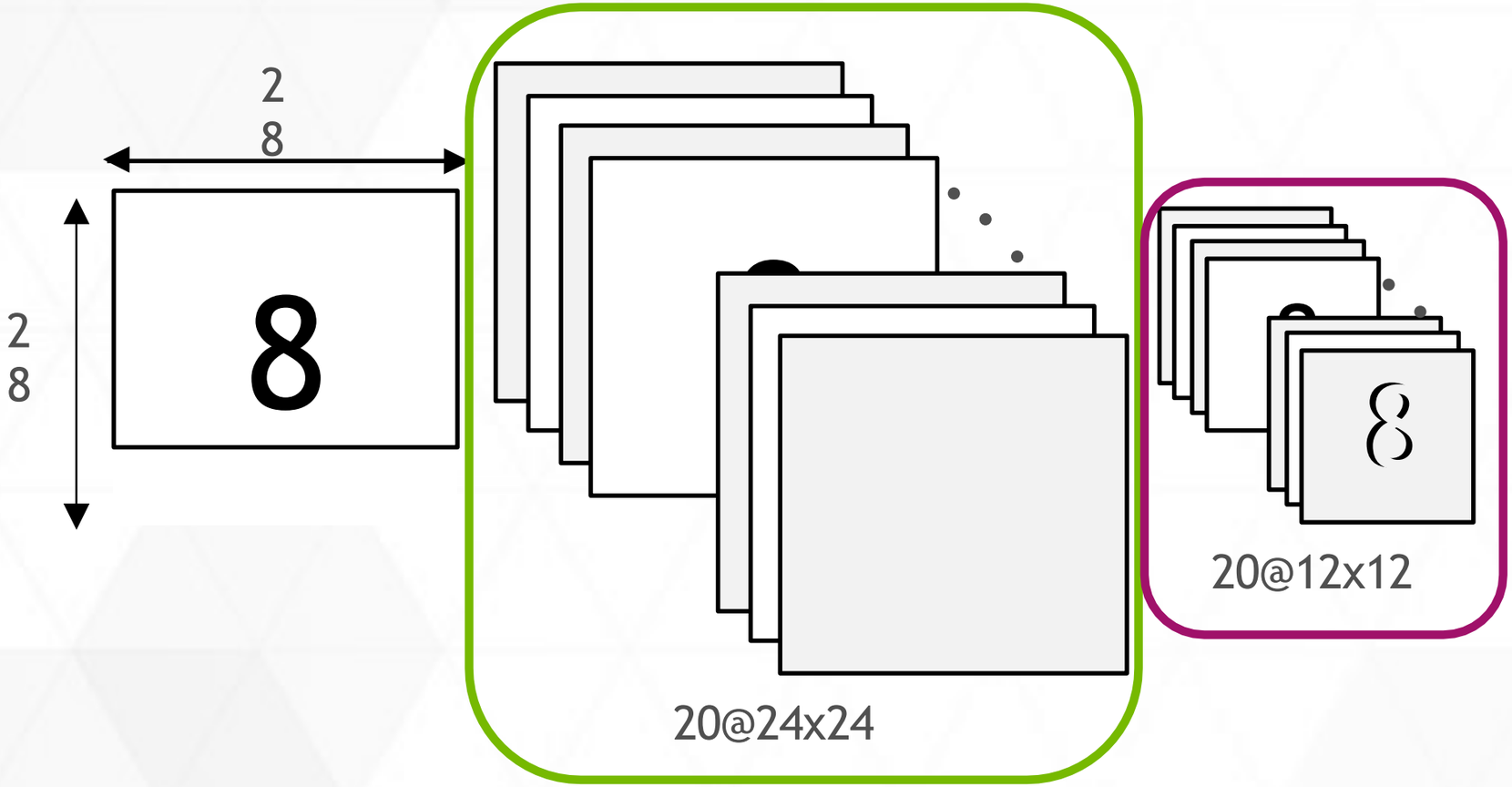
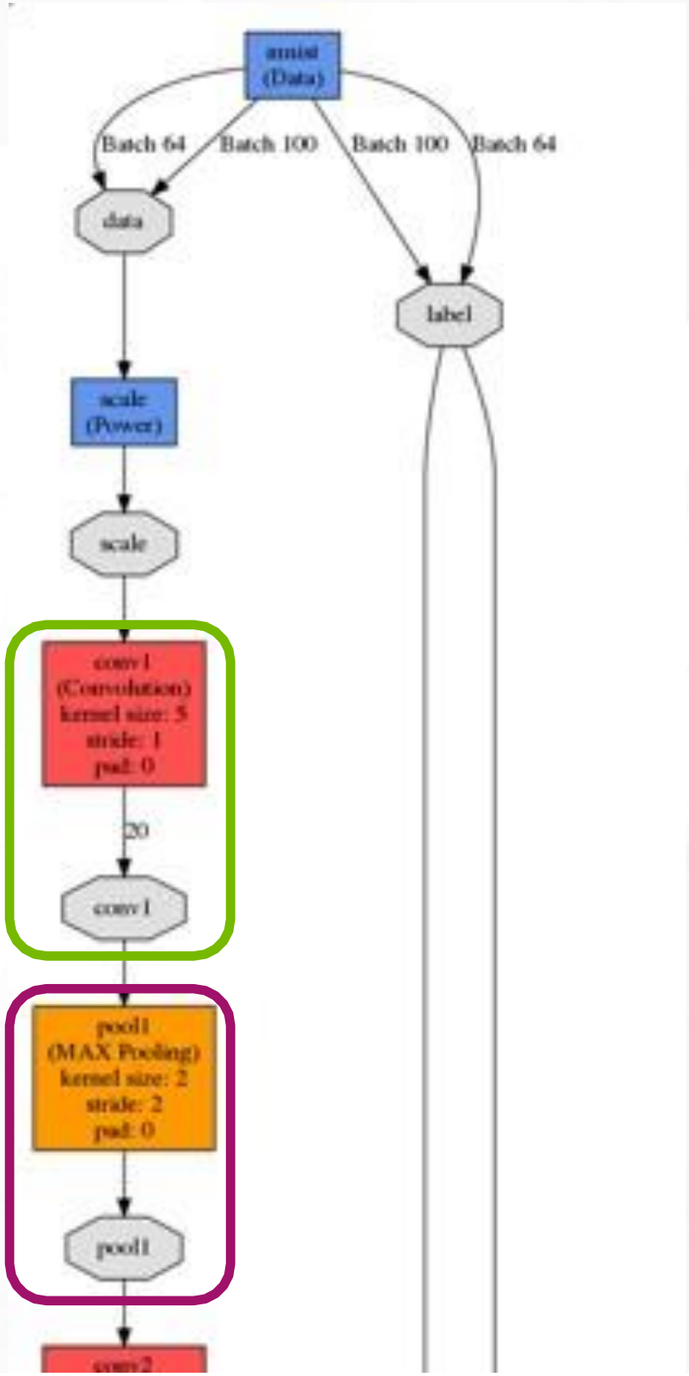
Train a Network-Advance Options





NETWORK PARAMETERS





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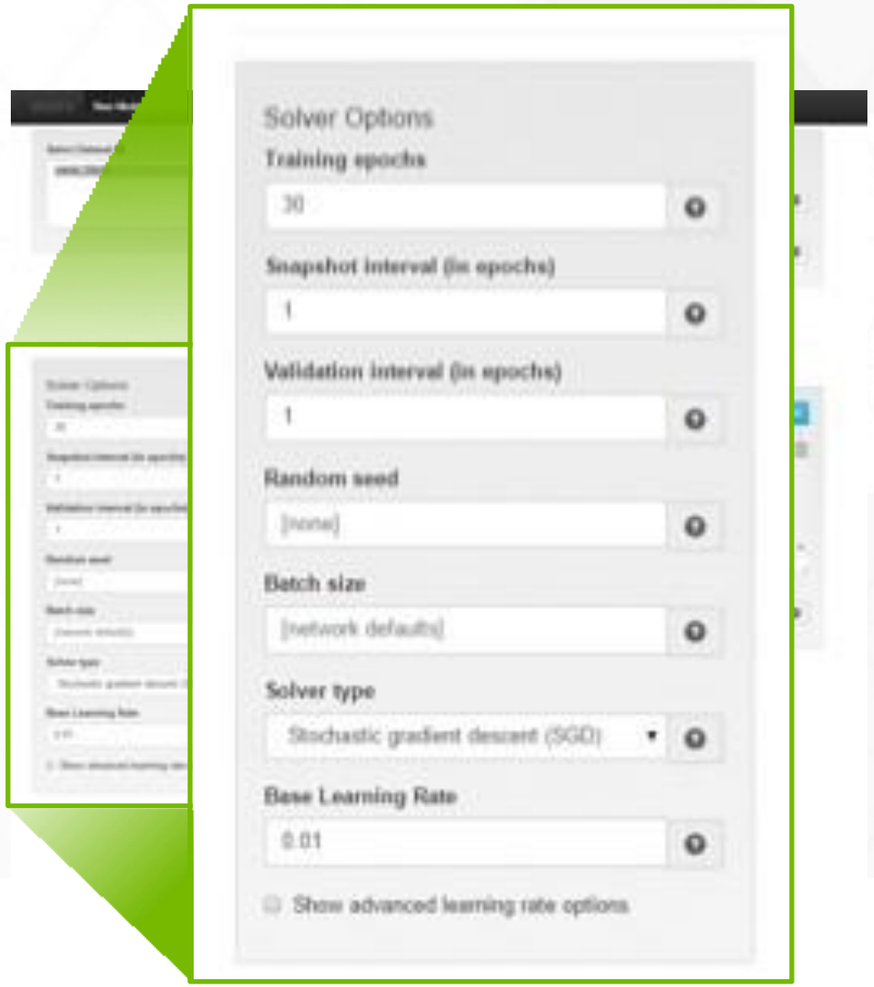
Train a Network-Advance Options

- Training epochs – processing of all data
- Snapshot interval – saving trained network
- Validation interval – DNN test with the validation data
- Batch size – number of images processed together
- Solver type – SGD, ADAGRAD, NAG
- Learning rate and policy



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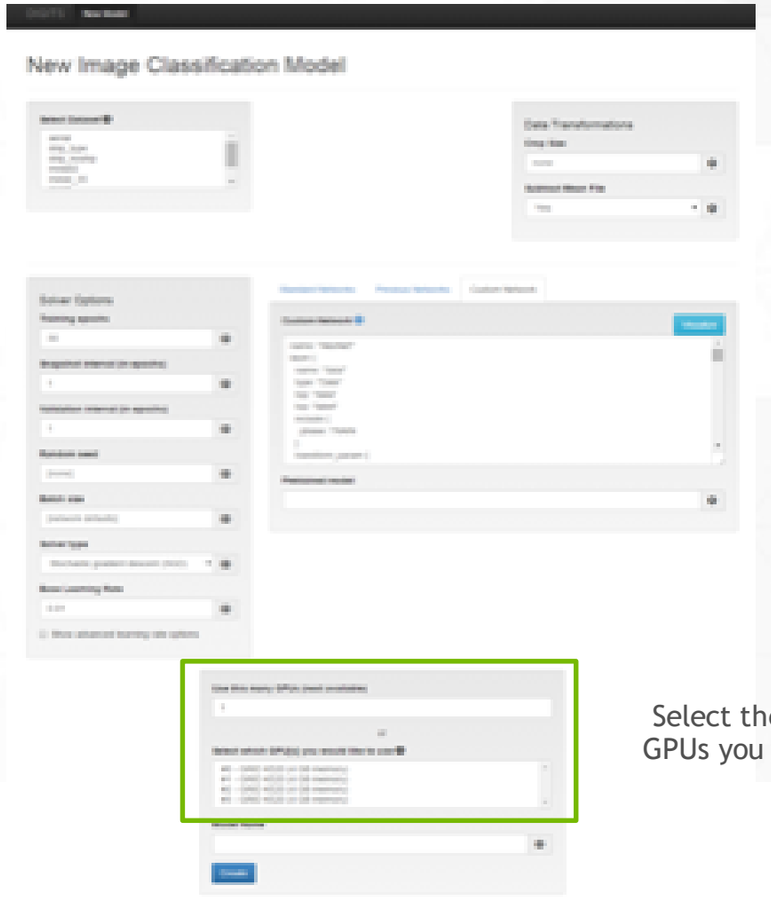
Single and multi-GPU training is easy

Singe GPU system

Multiple GPU system



Select the number of GPUs you want to use.

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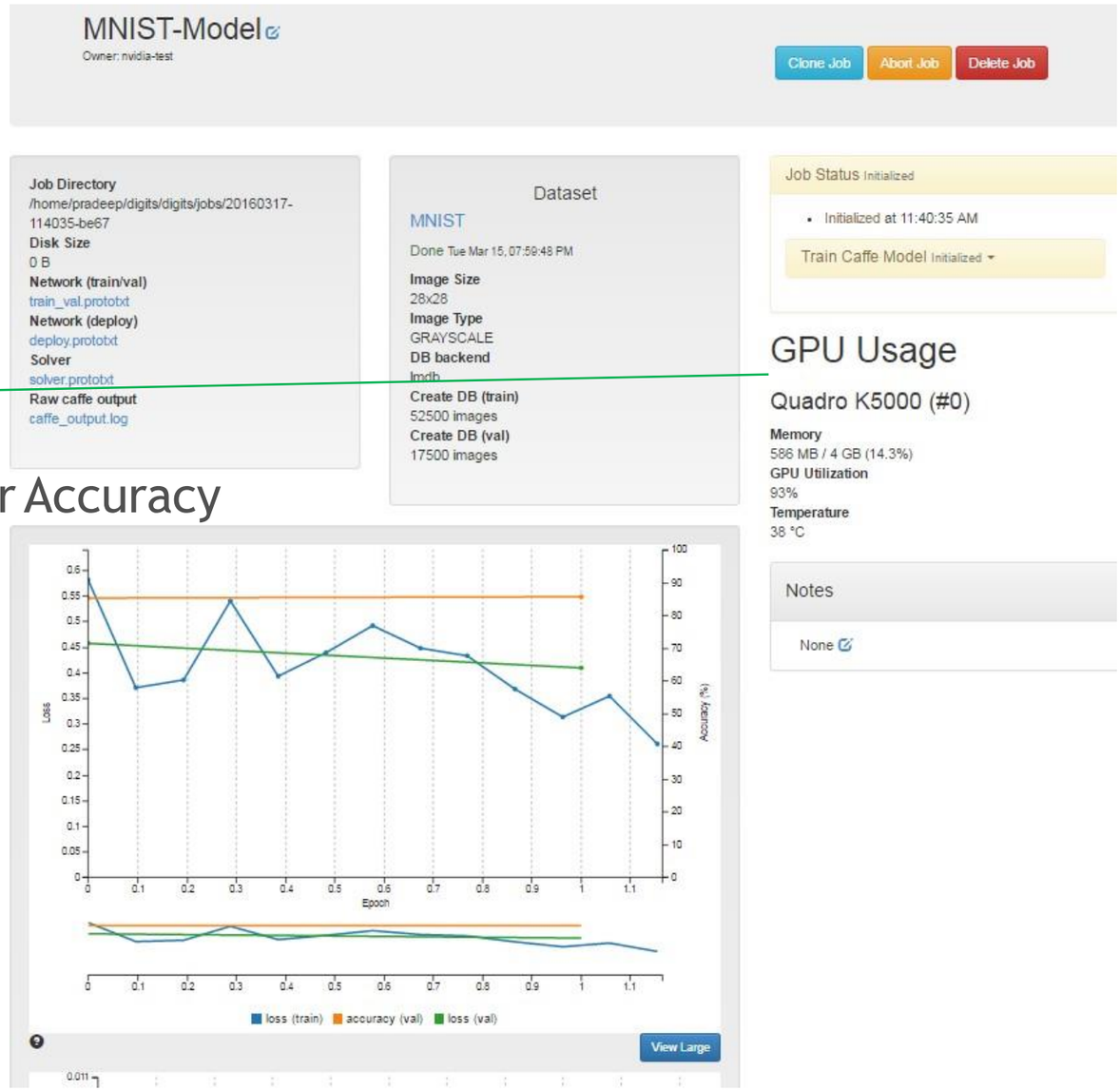
Training Results

Monitor GPU, Memory usage and Temperature

Monitor Accuracy

If performance is poor, abort, modify, and retrain.



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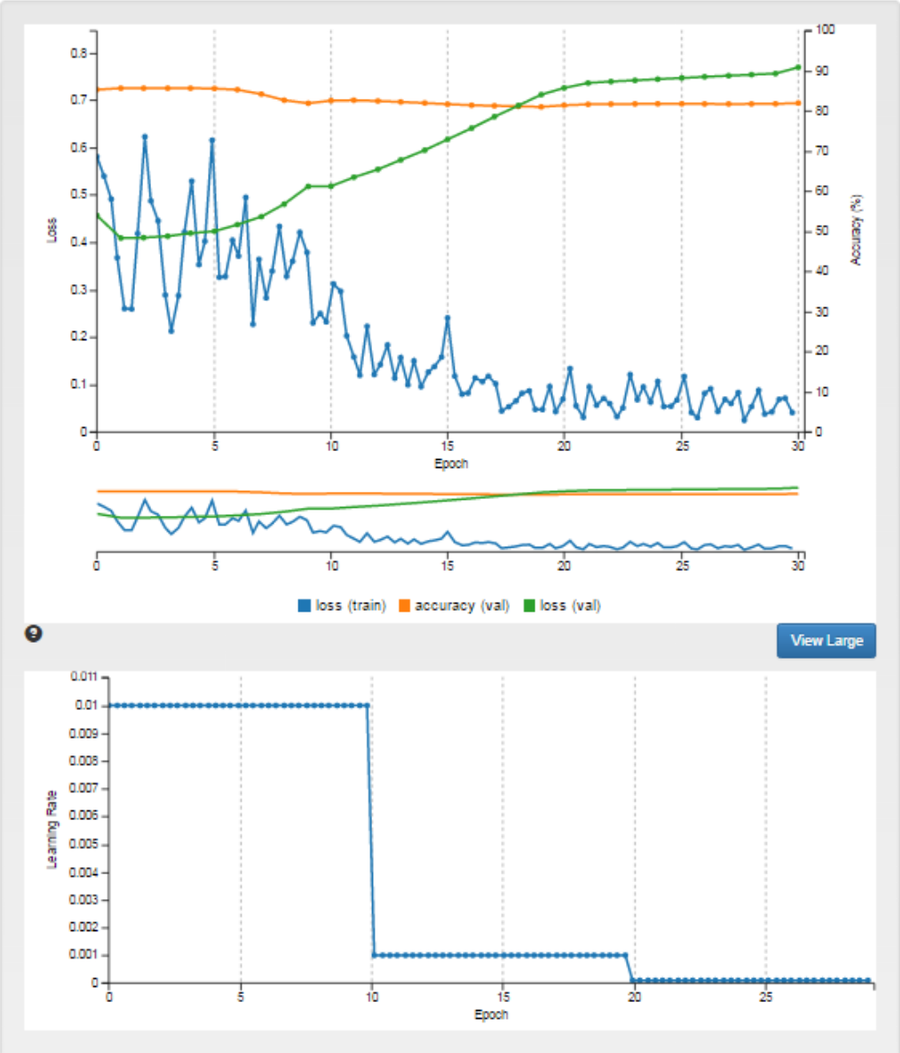
Training Results

First Graph is about the Loss and Accuracy graphs

Second Graph is about the Learning rate, as the training progresses, learning rate goes down as model is getting more mature.



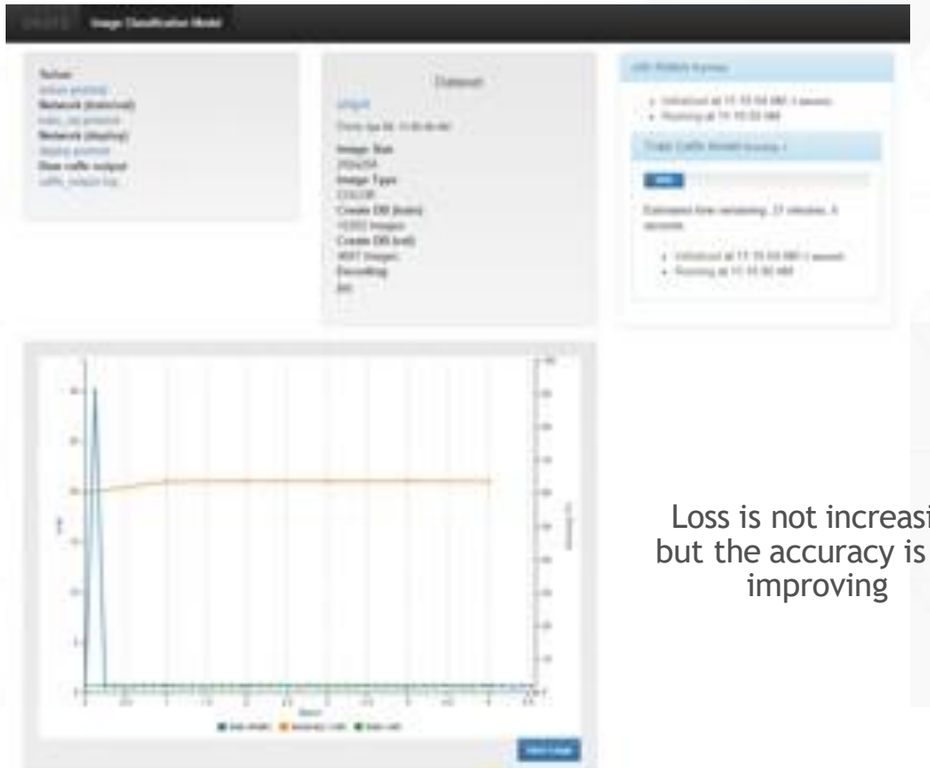
OVERFITTING AND UNDERFITTING

How can I use DIGITS to tell me this is happening?

Overfitting

Loss continues to decrease with training data but increases with validation

Underfitting



Loss is not increasing but the accuracy is not improving

Validation data helps you identify when/if this occurs!

DIGITS Features at a Glance

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Resources

- Where to get DIGITS
  - Easy to use web installer https://developer.nvidia.com/digits
  - github - https://github.com/NVIDIA/DIGITS
    - Remember to install NVIDIA's Caffe branch - https://github.com/NVIDIA/caffe
- User support
  - DIGITS Users Google group - https://groups.google.com/forum/#!forum/digits-users
- For more information ongetting started with DIGITS
  - Parallel forall - http://devblogs.nvidia.com/parallelforall/easy-multi-gpu-deep-learning-digits-2/
  - Getting started guide - https://github.com/NVIDIA/DIGITS/blob/master/docs/GettingStarted.md

HANDS-ON LAB

1. Create an account at nvidia.qwiklab.com
2. Go to “Getting Started with DIGITS” lab at bit.ly/dlnvlab2
3. Start the lab and enjoy!

- Only requires a supported browser, no NVIDIA GPU necessary!
- Lab is free until end of this Deep Learning Lab series

DEEP LEARNING SERIES

- Review the other seminars in series

- Seminar #3 - Getting Started with the Caffe Framework
- Seminar #4 - Getting Started with the Theano Framework
- Seminar #5 - Getting Started with the Torch Framework

- More information available at developer.nvidia.com/deep-learning-courses