COSI-165B Deep Learning PyTorch Tutorial

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Outline

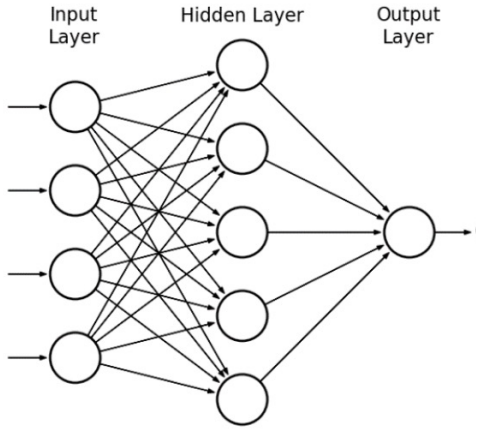
- Introduction to Deep Learning Framework
- PyTorch
- Tensor
- Networks, Forward, and Optimize
- MNIST Classification: a Toy Example
- Google Cloud Platform

Deep Learning

- Learn underlying features in data using neural networks

Input:

Images,
Natural language,
Graphs,
Signals,
Etc.



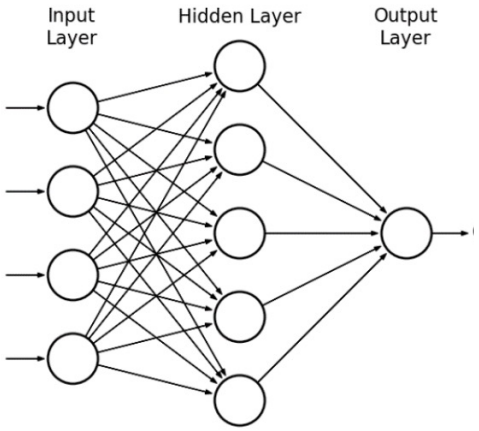
Multi-layer Perceptron Neural Network

Output:

Image categories,
Translated Language,
Link prediction,
Signal labels,
Etc.

Deep Learning

Input



Output

1. Forward: compute the output using current model and input data
2. Compute the loss: the error/gap between the output and ground-truth label
3. Backward: back propagate the loss, compute the gradient, and update the model

Deep Learning Framework

- The framework for automatic differentiation
- APIs for building neural networks, loading data, training, inference, and offering official pre-trained models

PyTorch

- A Python-based scientific computing package
  - Use the power of GPUs and other accelerators
  - Implement neural networks
  - Compute gradient in an automatic way

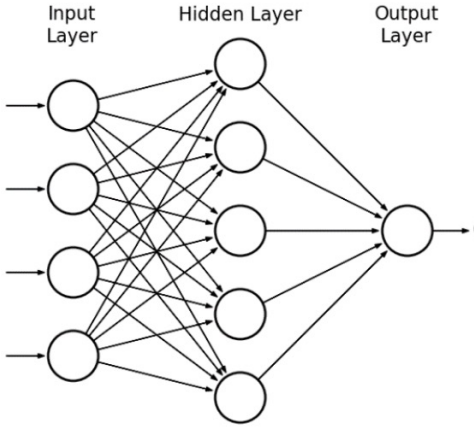
- Installation
  - Anaconda (Recommend): a distribution of the Python for scientific computing which makes python package installation more convenient.

Tensor

- Tensor
  - A specialized data structure
  - Similar to NumPy's ndarrays
  - Can run on GPUs to accelerate computing
- Basic Tensor Operations
  - Create
  - Convert
  - CPU/GPU
  - Matrix Operations
  - Math Operations
  - …

Neural Networks

1. Building neural networks
2. Forward
3. Gradient (equal to partial derivatives) computation
4. Update the model weights



Neural networks: Multi-layer Perceptron, Convolutional Neural Networks, Recurrent Neural Networks, Graph Neural Networks, BERT, …

MNIST Classification: a Toy Example

- MNIST
  - A database of handwritten digits
  - Image classification

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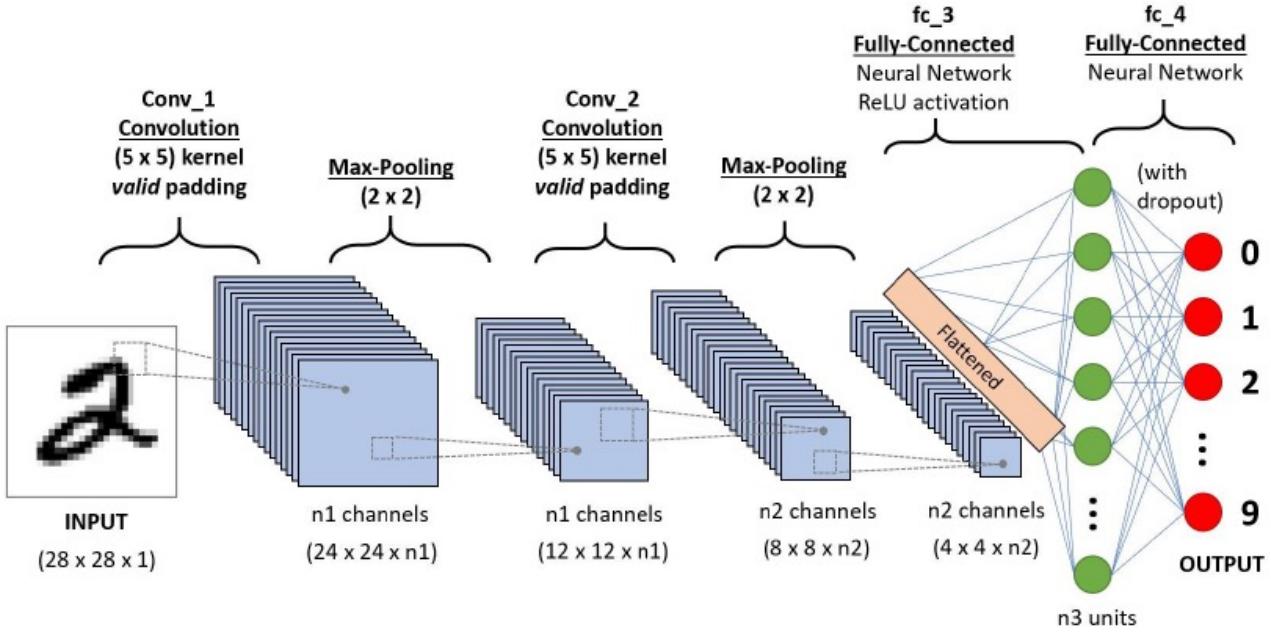

Google Colab – A ***free*** and ***easy*** way to access GPU

1. https://colab.research.google.com
2. Introduction_to_PyTorch.ipynb - Colaboratory (google.com)
3. pytorch_quick_start.ipynb - Colaboratory (google.com)

TRUTH
EVEN UNTO ITS INNERMOST PARTS
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