



Brandeis
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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

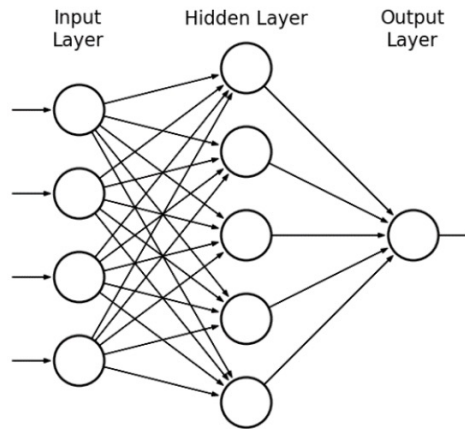


Deep Learning

- Learn underlying features in data using neural networks

Input:

Images,
Natural language,
Graphs,
Signals,
Etc.



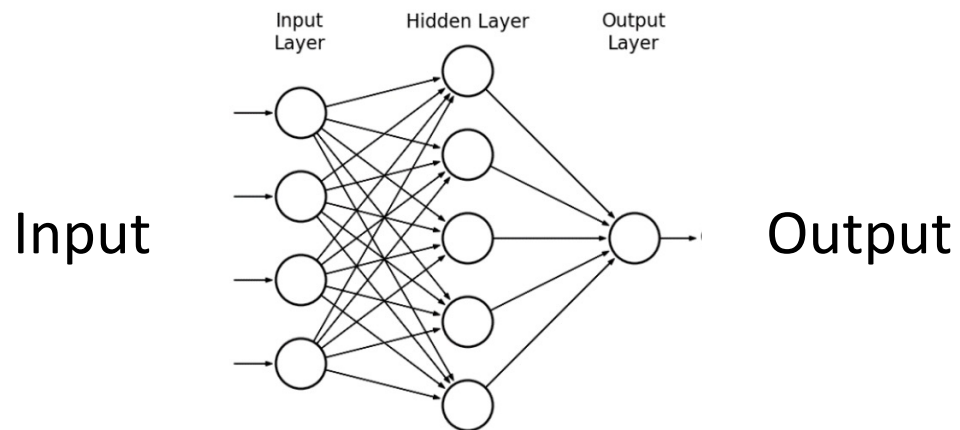
Output:

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

Multi-layer Perceptron Neural Network



Deep Learning

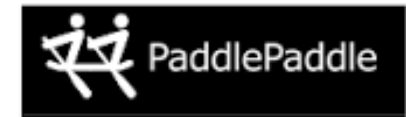


1. **Forward**: compute the output using current model and input data
2. **Compute the loss**: the error/gap between the output and ground-truth label
3. **Backward**: back propagate the loss, compute the gradient, and update the model



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.

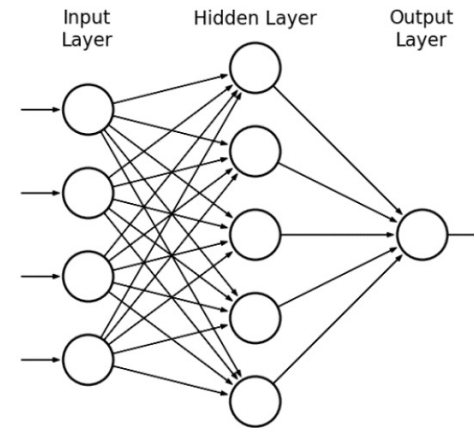


Tensor

- 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, ...



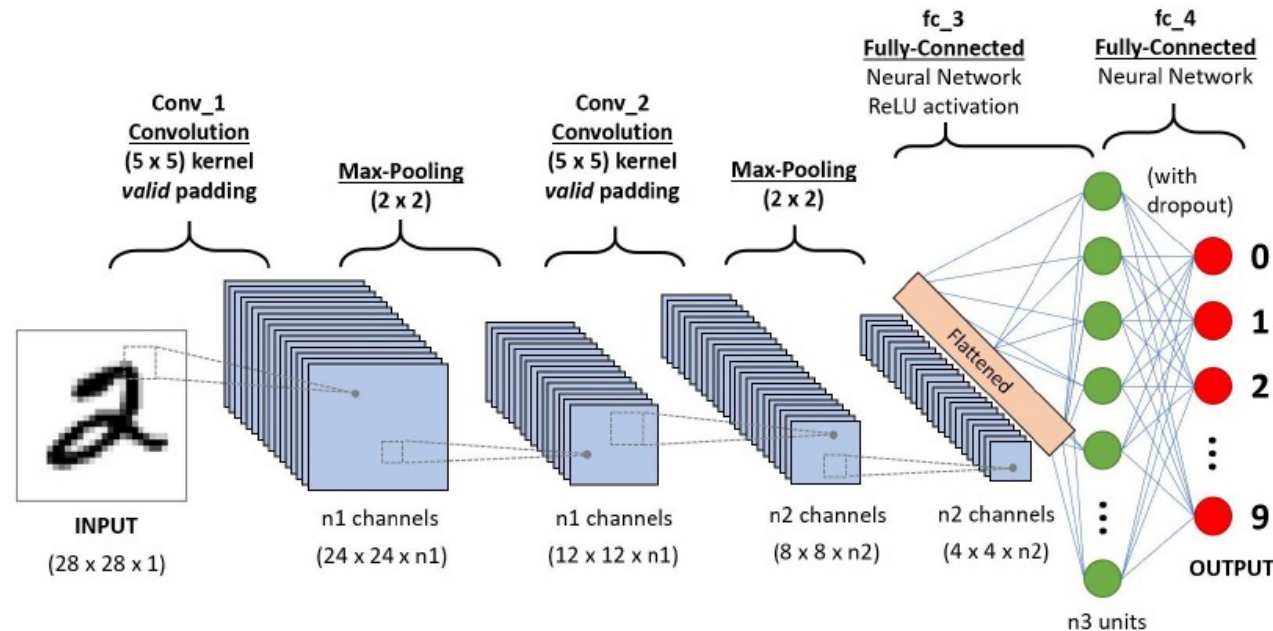
MNIST Classification: a Toy Example

- 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 \(google.com\)](#)



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