Canada's Contributions to Deep Learning and Artificial Intelligence

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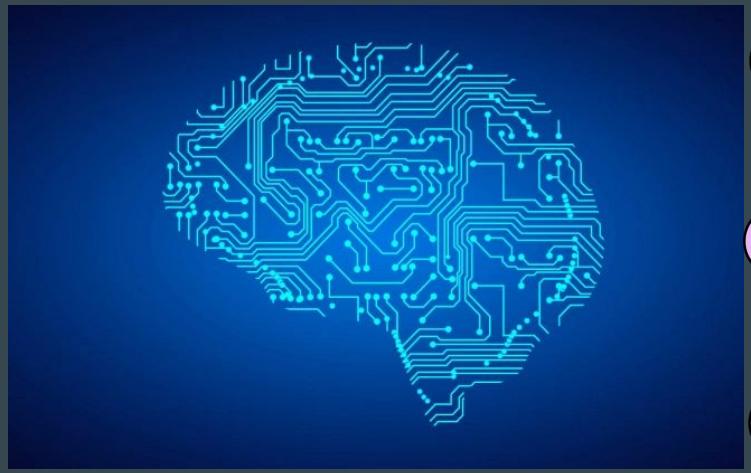
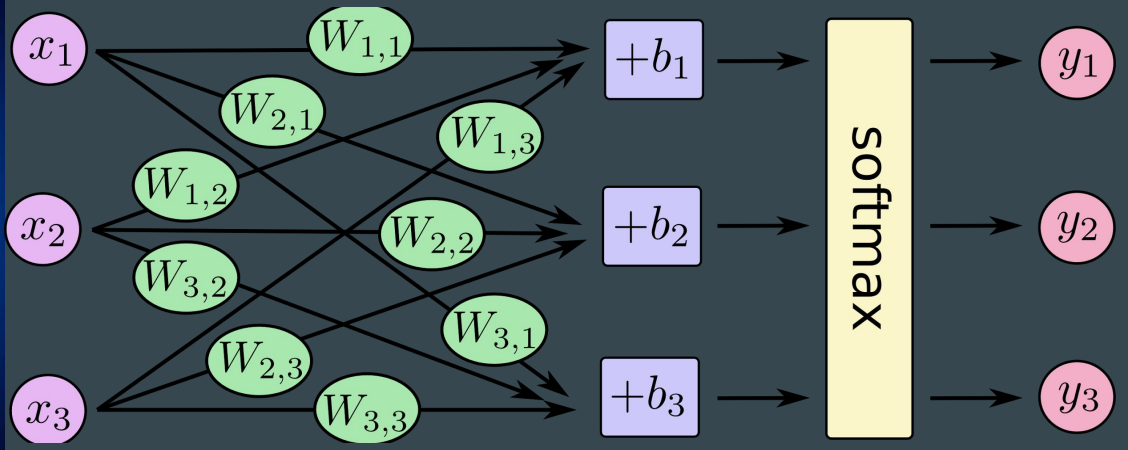


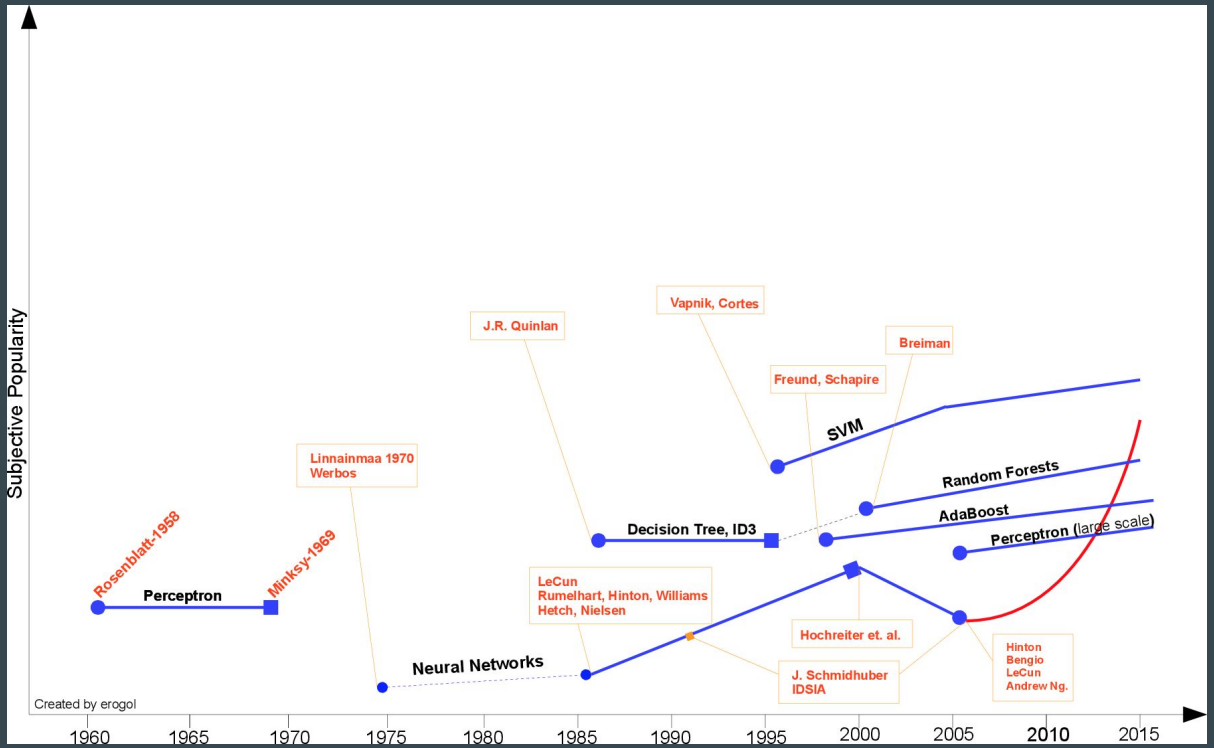


Introduction to Deep Learning and Artificial Intelligence

Historical Overview: A Rough Timeline

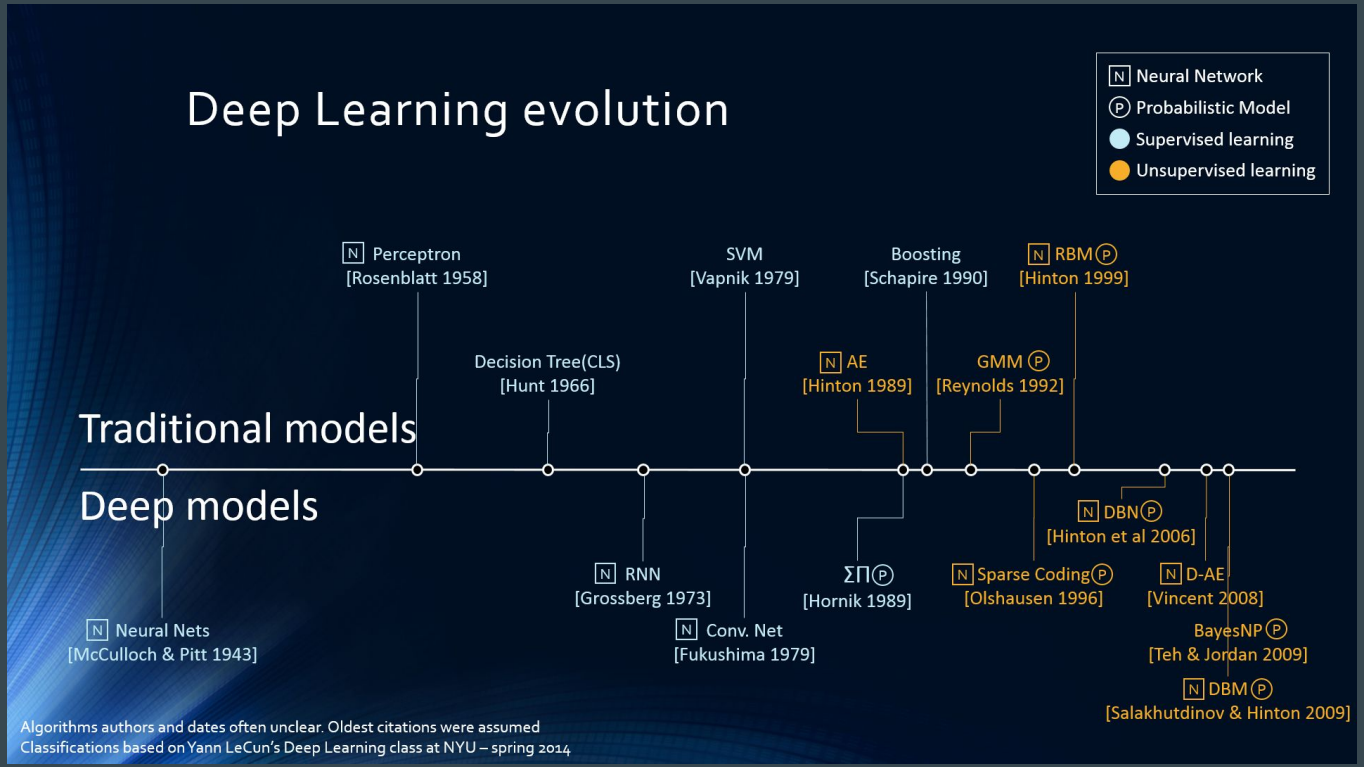
- 1943 - McCulloch-Pitts model of a neuron presented
- 1950 - Alan Turing proposes the “Turing Test”
- 1955 - John McCarthy coins the term “Artificial Intelligence”
- 1957 - Frank Rosenblatt develops the Perceptron, an early neural network
- 1959 - Arthur Samuel coins the term “Machine Learning”
- 1960s - 70s - Backpropagation is developed
- 1970s - 80s - The AI Winter
- 1990s - Advances are made in Neural Networks
- 2006 - Hinton et al. publish their Deep Belief Net
- 2000s - 2010s - More *Nets: AlexNet (2012), ResNet (2015), SyntaxNet (2016)...

Visualizing this timeline



Source: Eren Golge, http://www.erogol.com/brief-history-machine-learning/

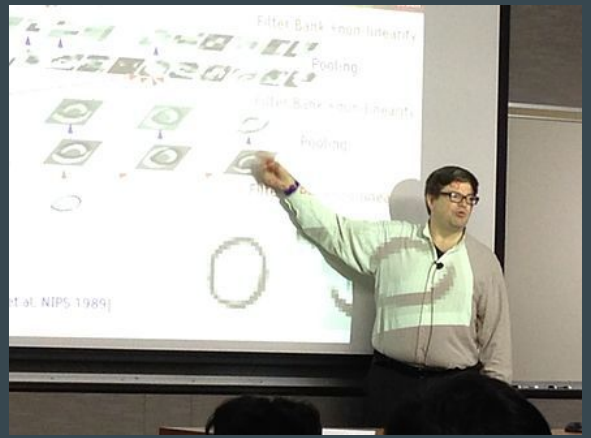
Another visualization

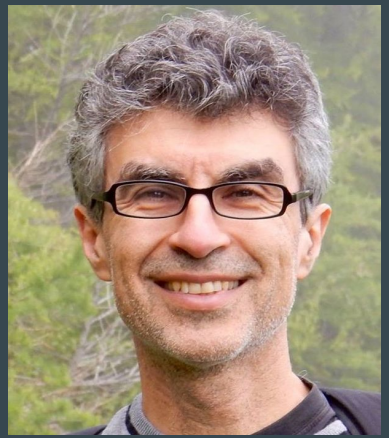


Source: Andrew Yuan, http://andrewyuan.github.io/

Canada's Contributions

- The "Canadian Mafia": Geoffrey Hinton, Yann LeCun, Yoshua Bengio
- Their research was supported by the Canadian Institute for Advanced Research (CIFAR) during the AI Winter when others abandoned neural networks





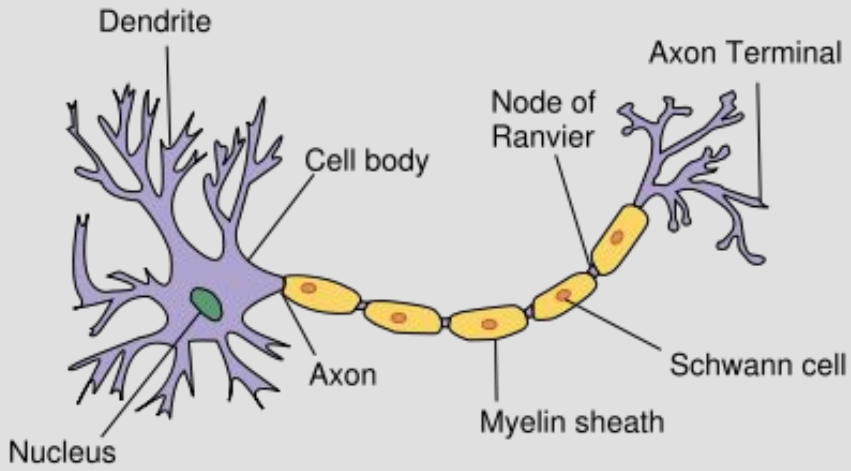
Canada's Contributions

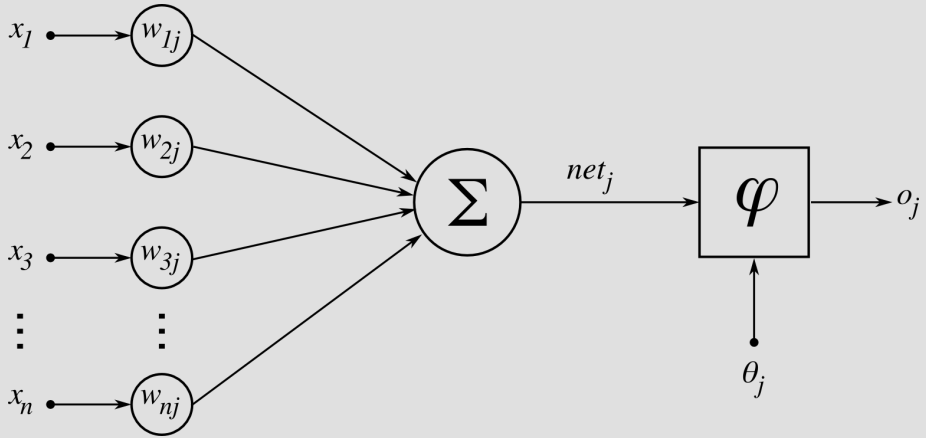
- All are now based at a major tech company
- Geoffrey Hinton
  - University of Toronto
  - Google, since 2013
- Yann LeCun
  - New York University
  - Facebook, since 2013
- Yoshua Bengio
  - University of Montreal
  - Microsoft, since 2017

Deep Learning

Deep Learning: Theory

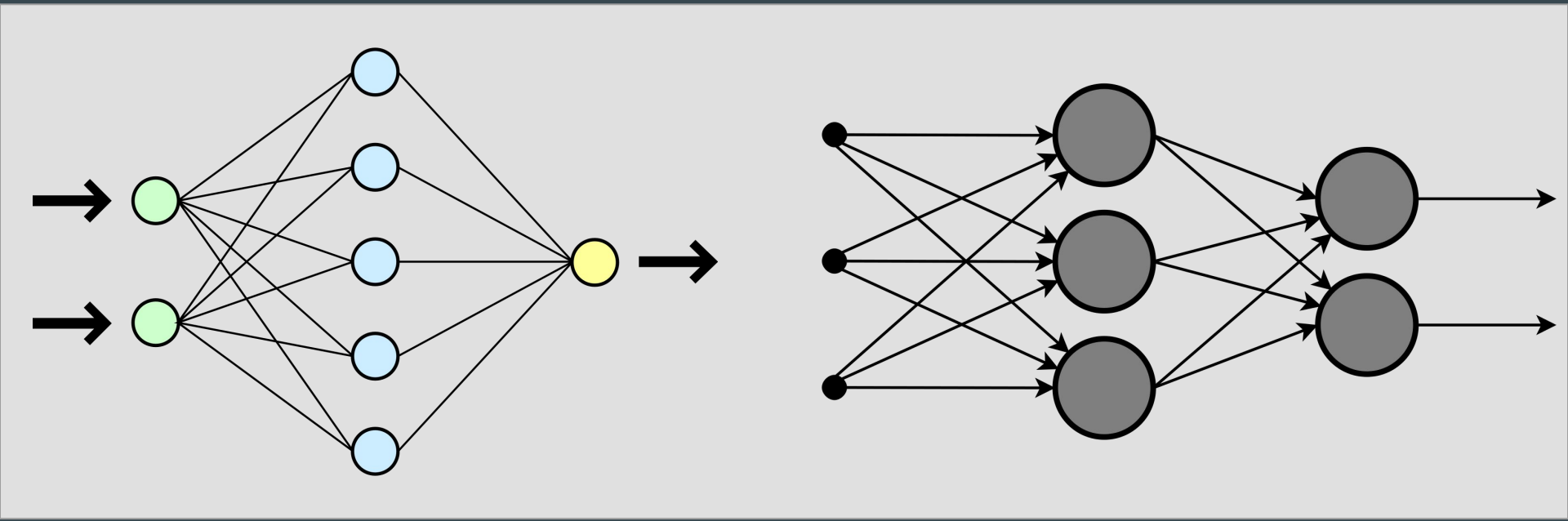
- A **neuron**, biological and artificial model





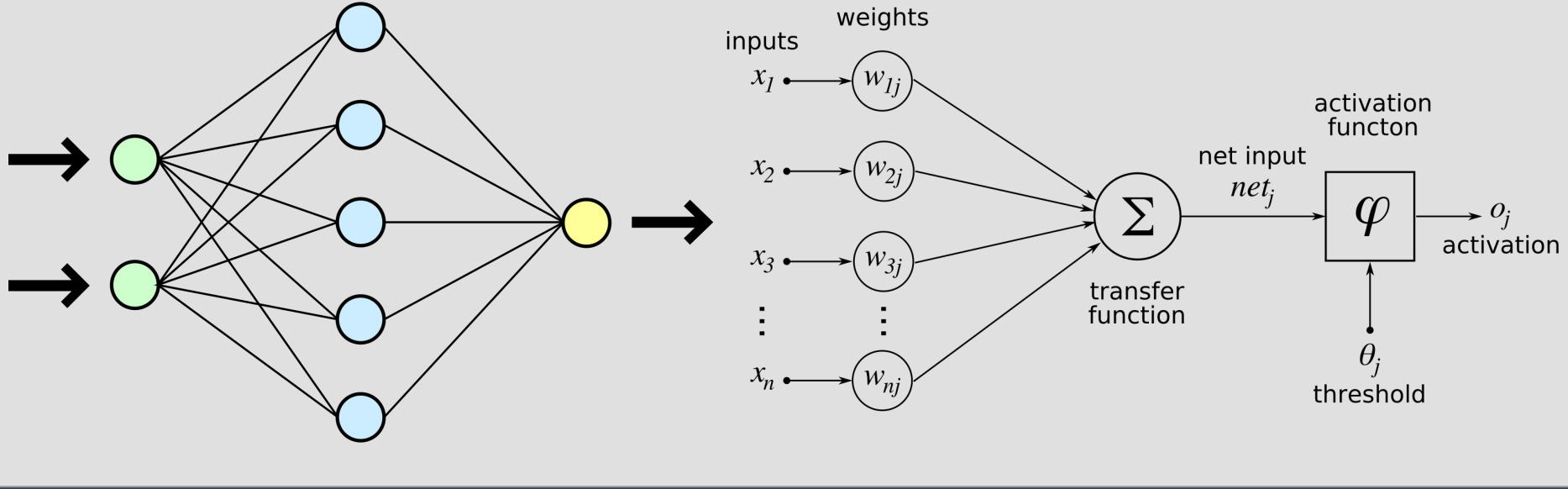
Deep Learning: Theory

- A *Neural Network* combines many neurons into layers: *input, hidden, output*



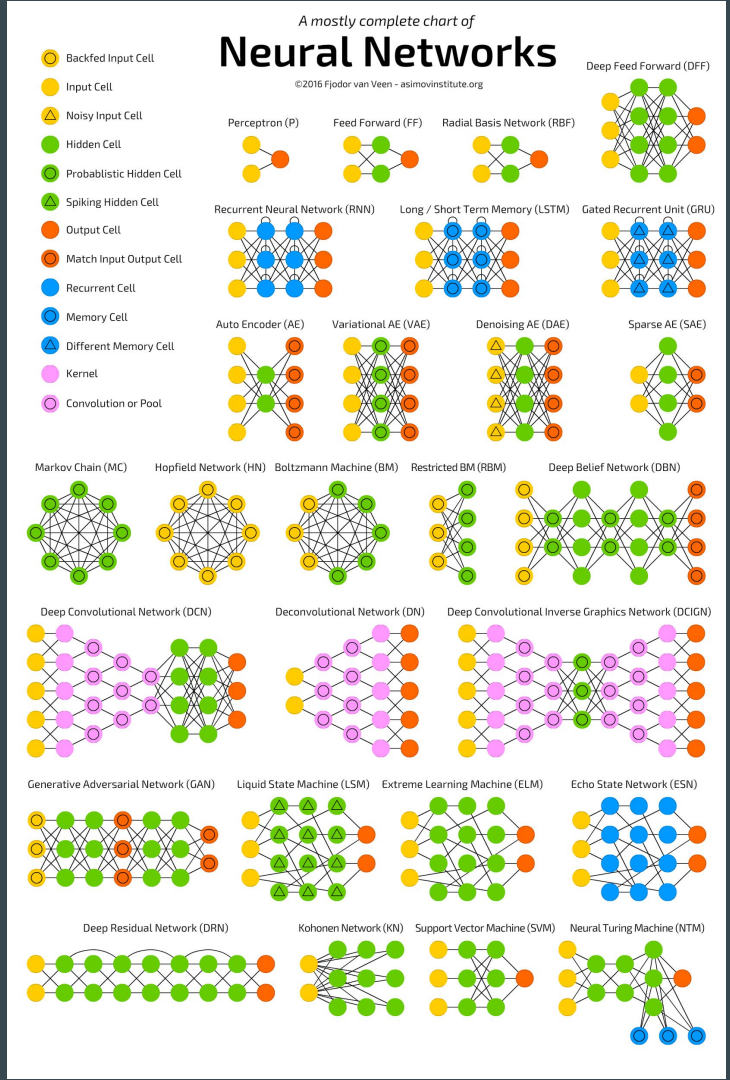
Deep Learning: Theory

- During *training*, the NN is given training data. With *backpropagation*, it learns the optimal *weights* and *biases* that reduce the *errors* on the training data.

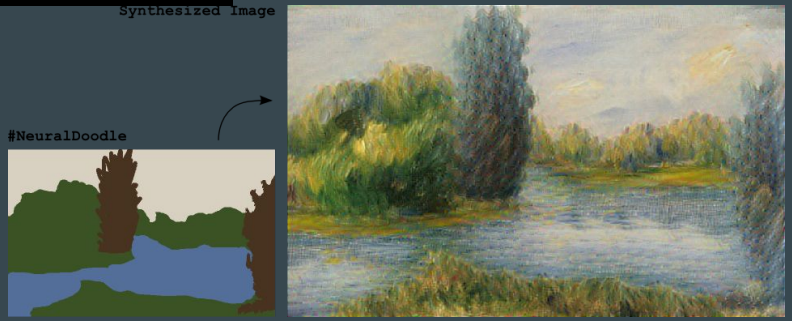


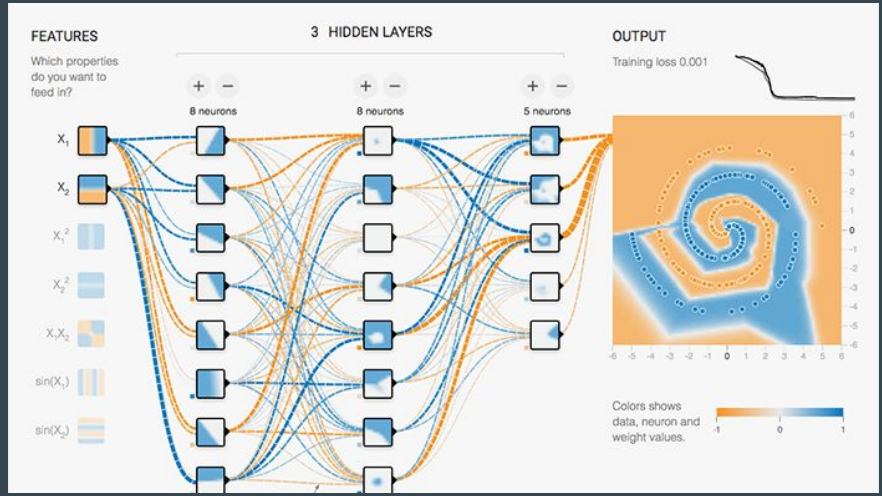
Deep Learning: Theory

- There are many different variations of neural networks.



Deep Learning: Applications

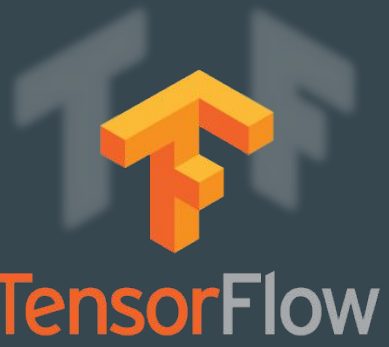




Demonstration: TensorFlow

TensorFlow Installation

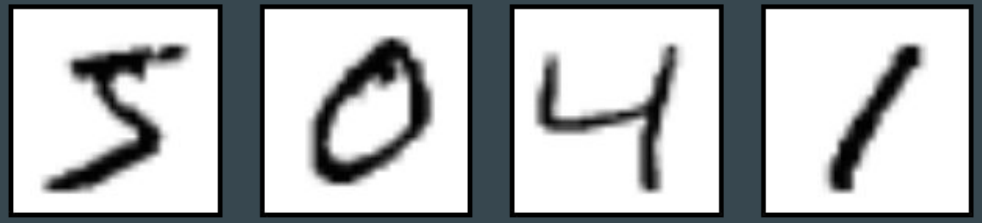
- TensorFlow is a machine learning library developed by Google
- Python APIs supported in TensorFlow

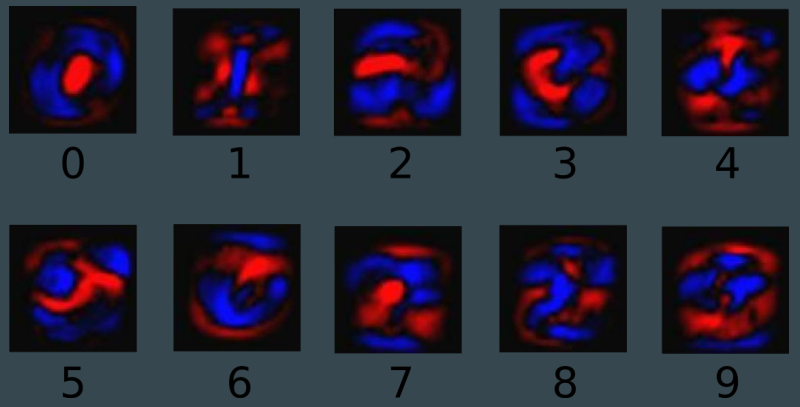


- Instructions for OS X, Windows, Linux are at https://www.tensorflow.org/install/
- Personal choice: Installing with Anaconda

TensorFlow MNIST Tutorial

- https://www.tensorflow.org/get_started/mnist/beginners





Q & A

Thank you!