### DEEP LEARNING USING PYTHON

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- History of Al
- The Deep Learning Revolution
- What is Deep Learning
- How Deep Learning is Transforming the World
- MNIST Dataset



#### BEGINNING OF ARTIFICIAL INTELLIGENCE



COMPUTERS ARE MADE IN PART TO COMPLETE HUMAN TASKS



EARLY ON, GENERALIZED INTELLIGENCE LOOKED POSSIBLE



TURNED OUT TO BE HARDER THAN EXPECTED

#### EARLY NEURAL NETWORKS



Inspired by biology

Created in the 1950's

Outclassed by Von Neumann Architecture

#### **EXPERT SYSTEMS**



Highly complex



Programmed by hundreds of engineers



Rigorous programming of many rules

#### **EXPERT SYSTEMS - LIMITATIONS**

#### What are these three images?







#### **HOW DO CHILDREN LEARN?**



- Expose them to lots of data
- Give them the "correct answer"
- They will pick up the important patterns on their own



#### DATA

- Networks need a lot of information to learn from
- The digital era and the internet has supplied that data

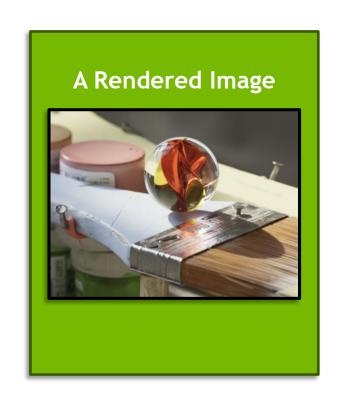


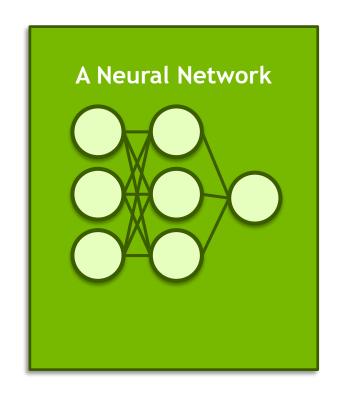
#### COMPUTING POWER

Need a way for our artificial "brain" to observe lots of data within a practical amount of time.



#### THE IMPORTANCE OF THE GPU







## DEEP LEARNING FLIPS TRADITIONAL PROGRAMMING ON ITS HEAD

#### TRADITIONAL PROGRAMMING

#### Building a Classifier



Define a set of rules for classification



Program those rules into the computer



Feed it examples, and the program uses the rules to classify

#### MACHINE LEARNING

#### Building a Classifier

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Show model the examples with the answer of how to classify



Model takes guesses, we tell it if it's right or not



Model learns to correctly categorize as it's training. The system learns the rules on its own

# THIS IS A FUNDAMENTAL SHIFT

#### WHEN TO CHOOSE DEEP LEARNING

Classic Programming

If rules are clear and straightforward, often better to just program it

Deep Learning

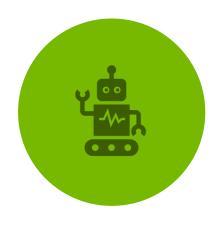
If rules are nuanced, complex, difficult to discern, use deep learning

#### DEEP LEARNING COMPARED TO OTHER AI

Depth and complexity of networks Up to billions of parameters (and growing) Many layers in a model Important for learning complex rules



#### **COMPUTER VISION**







OBJECT DETECTION



SELF DRIVING CARS

#### NATURAL LANGUAGE PROCESSING







VOICE RECOGNITION



VIRTUAL ASSISTANTS

#### RECOMMENDER SYSTEMS







TARGETED ADVERTISING



SHOPPING RECOMMENDATIONS

#### REINFORCEMENT LEARNING



ALPHAGO BEATS WORLD CHAMPION IN GO



AI BOTS BEAT PROFESSIONAL VIDEOGAMERS



STOCK TRADING ROBOTS

#### **PLATFORM**



GPU powered cloud server -Google Colab



Jupyter Notebook -Google Colab

#### **SOFTWARE**

- Major deep learning platforms:
  - TensorFlow + Keras (Google)
  - Pytorch (Facebook)
  - MXNet (Apache)
- We'll be using TensorFlow and Keras
- Good idea to gain exposure to others moving forward

