FUNDAMENTALS OF DEEP LEARNING

Part 1: An Introduction to Deep Learning

To see lecture notes, make full screen
and click the "notes" button

WELCOME!
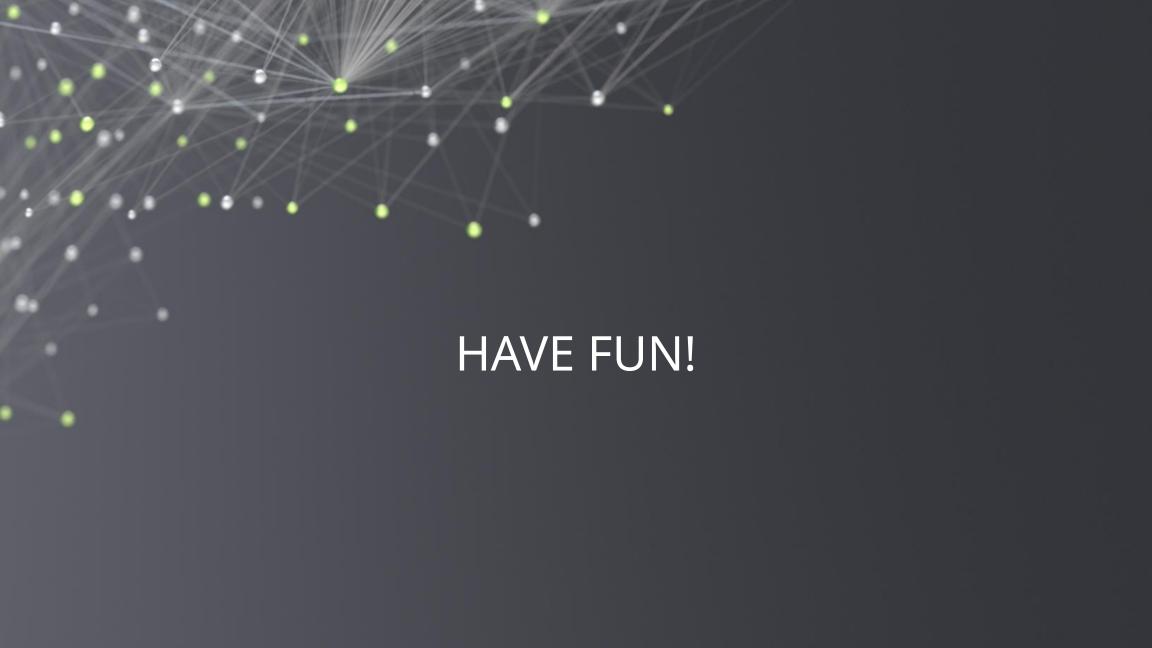
THE GOALS OF THIS COURSE

- Get you up and on your feet quickly

- Build a foundation to tackle a deep learning project right away

- We won't cover the whole field, but we'll get a great head start

- Foundation from which to read articles, follow tutorials, take further classes

AGENDA

Part 1: An Introduction to Deep Learning

Part 2: How a Neural Network Trains

Part 3: Convolutional Neural Networks

Part 4: Data Augmentation and Deployment

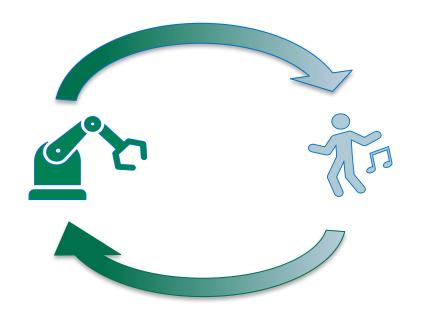Part 5: Pre-trained Models

Part 6: Advanced Architectures

AGENDA – PART 1

- History of AI

- The Deep Learning Revolution

- What is Deep Learning

- How Deep Learning is Transforming the World

- Overview of the Course

- First Exercise

HAVE FUN!

HUMAN VS MACHINE LEARNING

Relaxed Alertness

Human	Machine
Rest and Digest	Training
Fight-or-flight	Prediction

LET'S GET STARTED

HISTORY OF AI

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

THE DEEP LEARNING
REVOLUTION

DATA

- Networks need a lot of information to learn from

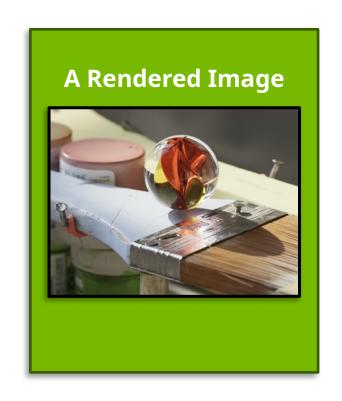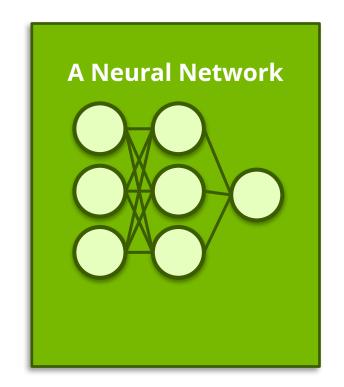- The digital era and the internet has supplied that data

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

A Rendered Image

A Neural Network

WHAT IS DEEP LEARNING?

DEEP LEARNING FLIPS
TRADITIONAL PROGRAMMING ON
ITS HEAD

TRADITIONAL PROGRAMMING
Building a Classifier

1

Define a set of rules for classification

2

Program those rules into the computer

3

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

MACHINE LEARNING
Building a Classifier

1

Show model the examples with the answer of how to classify

2

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

3

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

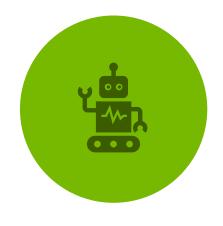If rules are nuanced, complex, difficult to discern, use deep learning

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

HOW DEEP LEARNING IS TRANSFORMING THE WORLD

COMPUTER VISION

ROBOTICS AND
MANUFACTURING

OBJECT
DETECTION

SELF DRIVING
CARS

NATURAL LANGUAGE PROCESSING

REAL TIME TRANSLATION

VOICE RECOGNITION

VIRTUAL ASSISTANTS

RECOMMENDER SYSTEMS

CONTENT CURATION

TARGETED ADVERTISING

SHOPPING RECOMMENDATIONS

REINFORCEMENT LEARNING

ALPHAGO BEATS WORLD CHAMPION IN GO

AI BOTS BEAT PROFESSIONAL VIDEOGAMERS

STOCK TRADING ROBOTS

DEEP LEARNING INSTITUTE

OVERVIEW OF THE COURSE

HANDS ON EXERCISES

- Get comfortable with the process of deep learning

- Exposure to different models and datatypes

- Get a jump-start to tackle your own projects

STRUCTURE OF THE COURSE

"Hello World" of Deep Learning

Train a more complicated model

New architectures and techniques to improve performance

Pre-trained models

Transfer learning

PLATFORM OF THE COURSE
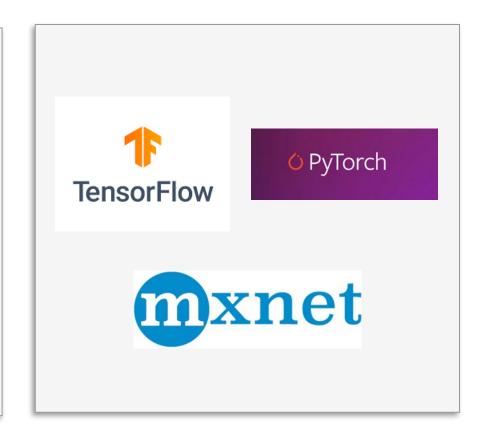
GPU powered cloud server

JupyterLab platform

Jupyter notebooks for interactive coding

SOFTWARE OF THE COURSE

- 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

FIRST EXERCISE:
CLASSIFY HANDWRITTEN
DIGITS

HELLO NEURAL NETWORKS

Train a network to correctly classify handwritten digits

- Historically important and difficult task for computers

Try learning like a Neural Network

- Get exposed to the example, and try to figure out the rules to how it works

LET'S GO!