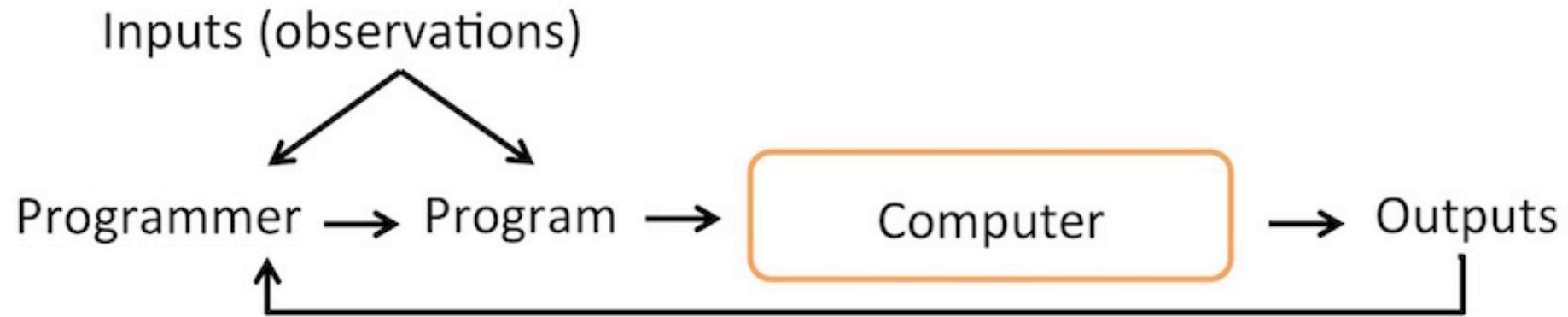


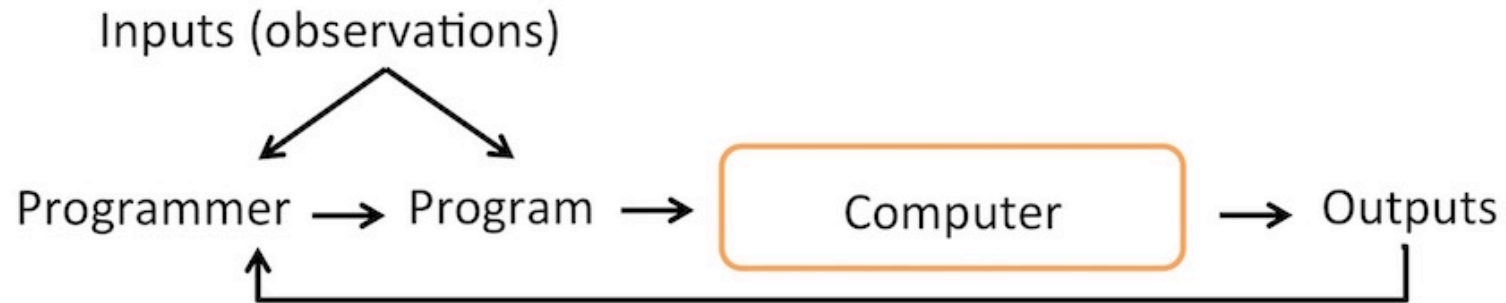
CSE 5214 - Deep Learning & Applications

An Overview

The Traditional Programming Paradigm



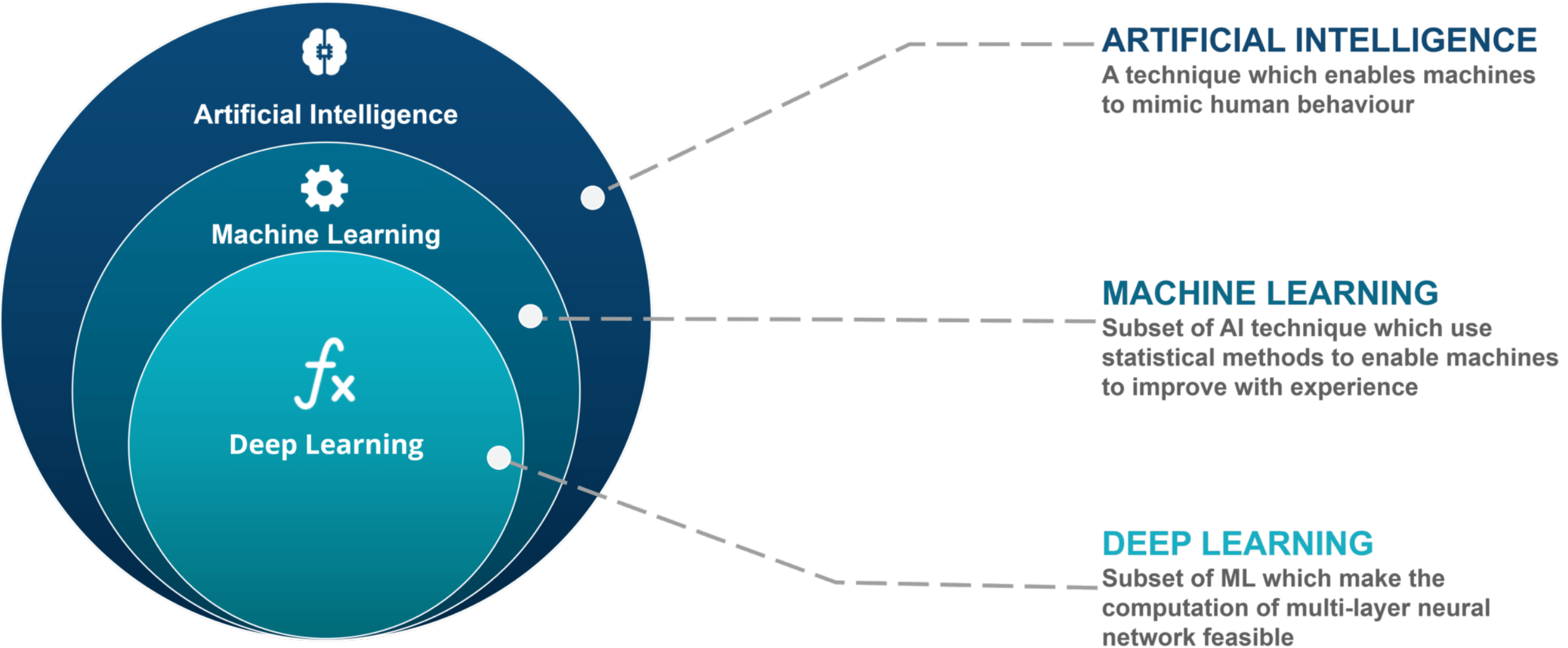
The Traditional Programming Paradigm



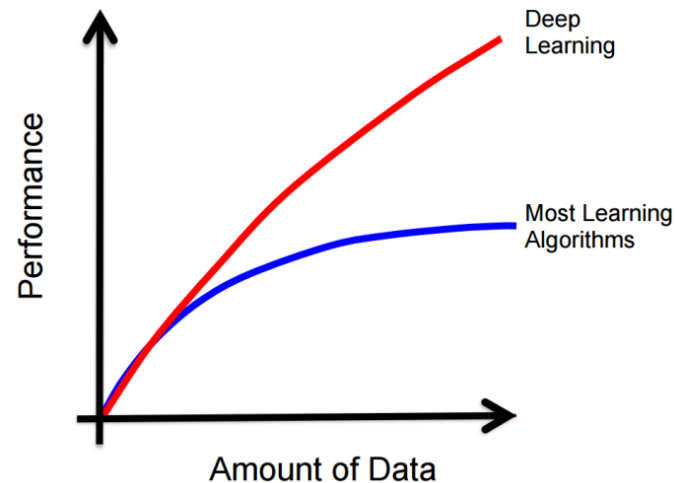
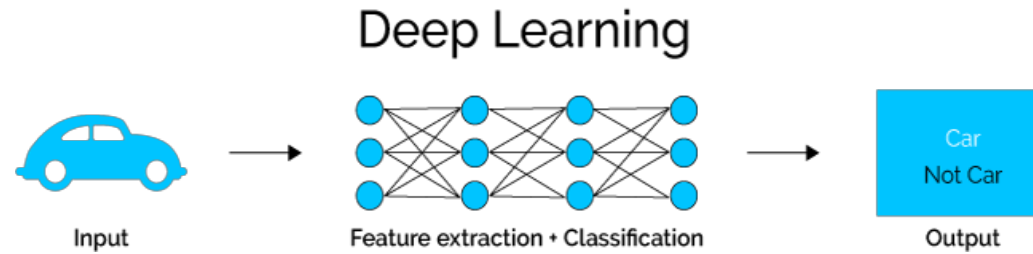
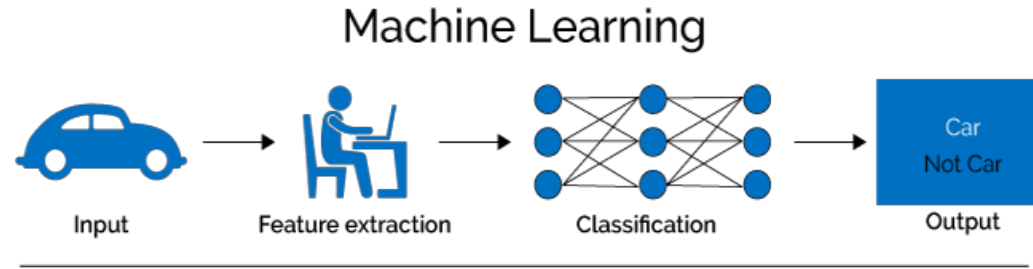
Machine Learning is the field of study that gives computers the ability to learn without being explicitly programmed
– Arthur Samuel (1959)

Machine Learning





Deep Learning vs Machine Learning



Deep Learning in One Slide

- **What is it:**
Extract useful patterns from data.
- **How:**
Neural network + optimization
- **How (Practical):**
Python + TensorFlow & friends
- **Hard Part:**
Good Questions + Good Data
- **Why now:**
Data, hardware, community, tools, investment
- **Where do we stand?**
Most big questions of intelligence have not been answered nor properly formulated

Exciting progress:

- Face recognition
- Image classification
- Speech recognition
- Text-to-speech generation
- Handwriting transcription
- Machine translation
- Medical diagnosis
- Cars: drivable area, lane keeping
- Digital assistants
- Ads, search, social recommendations
- Game playing with deep RL

History of DL Ideas and Milestones

- 1943: McCulloch and Pitts neuron model
- 1957: Rosenblatt's Perceptron
- 1974-86: In 1969, Minsky and Papert published a book called "Perceptrons"
- 1986: Backpropagation Algorithm
- 1997: Long Short-Term Memory
- 1998: Convolutional Neural Networks
- 2006: "Deep Learning"
- 2009: ImageNet
- 2012: AlexNet
- 2014: GANs
- 2014: Deep reinforcement learning
- 2016: DeepMind developed AlphaGo
- 2017: Transformers and BERT
- 2018: Turing Award
- 2018: Turing award has been awarded to the Yoshua Bengio, Geoffrey Hinton and Yann LeCun.
- 2020: GPT-3



Topics

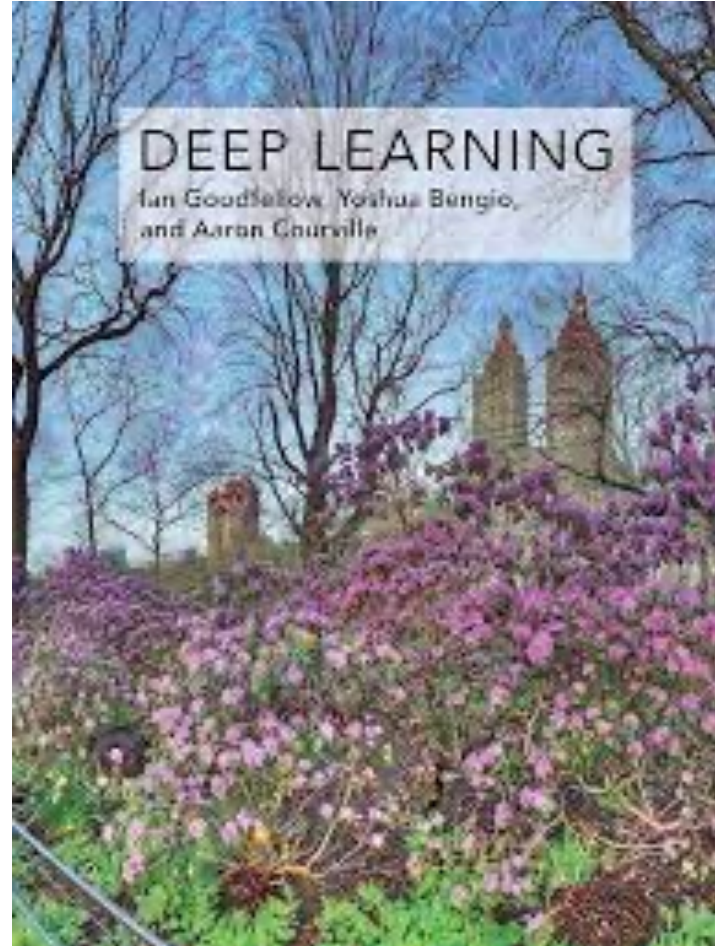
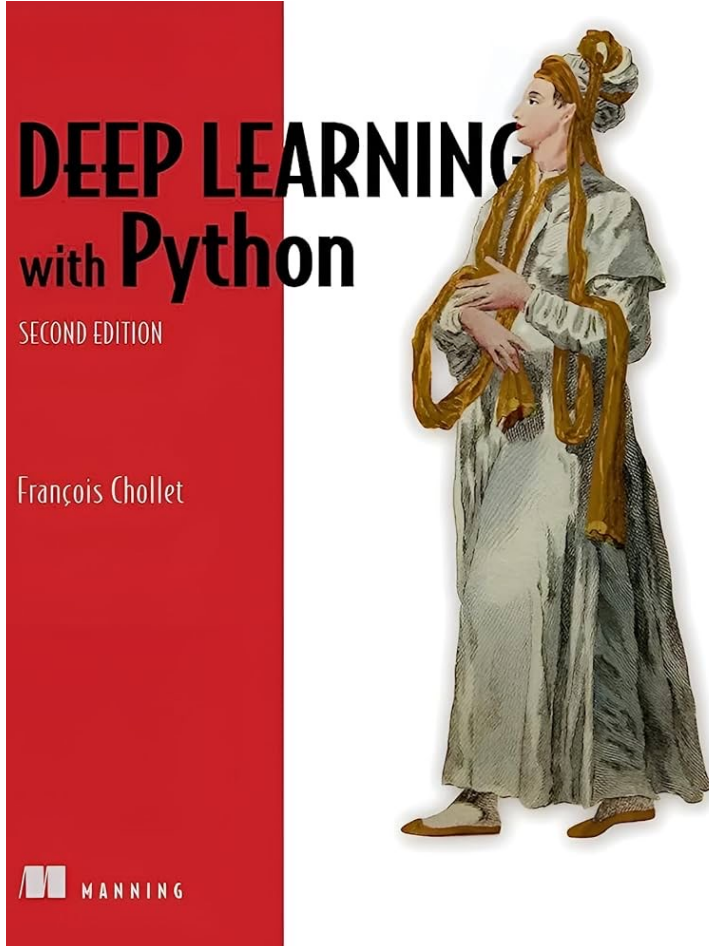
1. Introduction
 - Basic neuron model
 - Activation functions
 - Learning mechanisms
 - Types of learning
2. Mathematical foundations
 - Learning tasks
 - Overfitting & underfitting
 - Hyperparameters
 - Bias and variance



Topics

3. Supervised learning
 - Linear & logistic regression example
 - Perceptron
 - Backpropagation
 - Parameter optimization with gradient descent
 - Regularization
4. Deep neural networks
 - Convolutional neural networks
 - Network architectures
5. Transfer learning techniques
6. Deep generative models

References



- Ian Goodfellow, Yoshua Bengio and Aaron Courville, “Deep Learning”, MIT Press, 2017
- Simon J.D. Prince, “Understanding deep learning”, MIT Press, 2023
- François Chollet, “Deep learning with Python”, Manning press 2021
- <https://machinelearningmastery.com>
- <https://pyimagesearch.com>

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