What is Deep Learning?

Session 2

Slides Link:
https://teachla.uclaacm.com/classes/ml

ACM AI + ACM TeachLA

What do you think?

1. What are artificial intelligence and machine learning?
2. What's the relationship between them?

So what does AI *actually* mean?

- **Artificial Intelligence** - The theory and development of computer systems able to perform tasks that normally require human intelligence, such as visual perception, decision-making, and translation between languages.
- **Machine Learning** - A type of AI that provides computers with the ability to learn without being explicitly programmed.

What is Deep Learning?

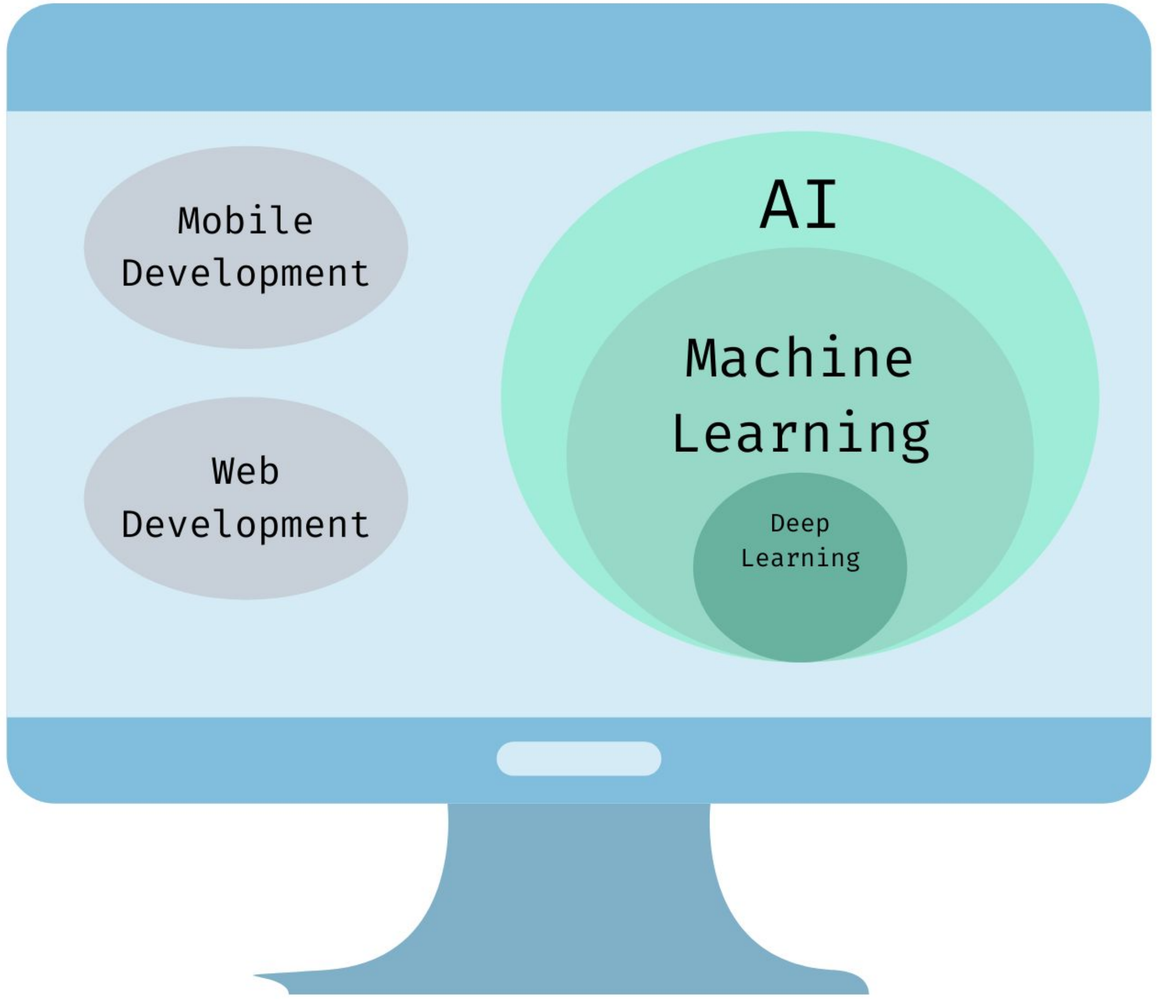
Keeping those definitions in mind...

- **Deep Learning** - An ML method based on artificial neural networks (a fancy machine learning method we'll cover later!).

AI vs ML

- All machine learning is artificial intelligence, but not all artificial intelligence is machine learning!
  - (AI ⟷ ML) is like (rectangle ⟷ square)
- Put simply, machine learning is a specific type of artificial intelligence
- And deep learning is a specific type of machine learning!

Map of Computer Science



What are some examples of artificial intelligence that are NOT machine learning?

AI

- if-else statements
- Decision Trees + Bayesian decision-making
- data mining

ML

- supervised learning
- unsupervised learning
- reinforcement learning
- deep learning
  - neural networks

- natural language processing

Normal/AI vs ML

f(x) = y

Normal/AI outside ML

- **Given:** input and defined relationship / function
- **Find:** the output

f(x) = y

Machine Learning

- **Given:** input and output
- **Find:** the relationship / function

What can machine learning do?

There are two main kinds of tasks ML tries to perform:

Classification

- “Discrete” output
- Classifying between two (binary) or many (multi) classes
- Examples:
  - Cat or dog
  - Benign or malignant tumor
  - Detecting objects in an image

Regression

- “Continuous” output
- Predicting numbers
- Examples:
  - Housing prices
  - Age of a star
  - Tomorrow’s high/low temperatures

Key ML techniques: an outline

Various kinds of ML that try to solve these two problems:

- Linear regression
  - Regression
- Logistic regression
  - Classification
- Neural networks
  - Multiple kinds of neural networks (NNs):
    - Fully-connected (FCNNs)
    - Convolutional (CNNs) -- image classification
    - Recurrent (RNNs) -- text and speech, sequential data
    - Generative Adversarial (GANs) -- image, text, etc. generation

What can machine learning do?

Here are some examples of problems of what ML can solve:

1. Predict housing prices
2. Classify animals in pictures
3. Predict weather for the next week
4. Classify handwritten digits
5. Detect and count the number of cells in an image taken by a microscope
6. Determine your glucose levels by analyzing a picture of your eye

Notice any patterns / trends? Similarities / differences?

ML: classification vs. regression

Let’s try and classify different tasks as classification or regression:

1. Predict housing prices
2. Cat or dog
3. Classify animals in pictures (ImageNet)
4. Classify handwritten digits (MNIST)
5. Detect and count the number of cells in an image taken by a microscope
6. Determine your glucose levels by analyzing a picture of your eye
7. Predict age of a person
8. Auto-generate music
9. Apply Snapchat filter
10. Hyper-realistic face generation

ML: classification vs. regression

1. **R (Linear Regression)** Predict housing prices
2. **C (CNN)** Cat or dog
3. **C (Logistic Regression)** Classify animals in pictures (ImageNet)
4. **C (Logistic Regression)** Classify handwritten digits (MNIST)
5. **C/R (CNN)** Detect and count the number of cells in an image taken by a microscope
6. **R (CNN)** Determine your glucose levels by analyzing a picture of your eye
7. **R (FCNN)** Predict age of a person
8. **G (RNN/GAN)** Auto-generate music
9. **G (CNN/GAN)** Apply Snapchat filter
10. **G (CNN/GAN)** Hyper-realistic face generation

ACM AI

Thanks!

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