

## 17.1 AI & 17.2 ML

**Notebook:** How Computers Work [CM1030]

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Cornell Notes	Topic: 17.1 Artificial Intelligence 17.2 Machine Learning	Course: BSc Computer Science
		Class: How Computer Work [CM1030]-Lecture
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Essential Question:		
What is AI and the branch within AI called Machine Learning?		
Questions/Cues:		
<ul style="list-style-type: none"><li>• What is Artificial Intelligence?</li><li>• What is Computer Vision?</li><li>• What is Natural Language Processing?</li><li>• What is Computational Creativity?</li><li>• What is Narrow AI?</li><li>• How did AI work in the early days?</li><li>• What is Machine Learning?</li><li>• What is Regression?</li><li>• What is a Generative Model?</li><li>• What is Supervised Learning?</li><li>• What is Unsupervised Learning?</li><li>• What is Reinforcement Learning?</li><li>• What is the Nearest Neighbor Algorithm in ML?</li><li>• What are Support Vector Machines?</li><li>• What is Optimization?</li><li>• What are Decision Trees?</li><li>• What are Neural Networks?</li></ul>		
Notes		
<ul style="list-style-type: none"><li>• Artificial Intelligence (AI) = area of Comp. Sci that tries to make machines that can replicate human intelligence to do tasks that humans can do but have been historically very difficult for machines<ul style="list-style-type: none"><li>◦ AI is split in many subareas to address particular challenges that arises in development of AI like Robotics</li></ul></li><li>• Computer Vision = comps that see and understand</li><li>• Natural language processing = comps that understand human lang</li><li>• Computational Creativity = comps that can make creative works of art</li><li>• Narrow AI = task-specific AI, good as individual task but doesn't have the kind of general task independent intelligence that humans have</li></ul>		

AI in the early days used logical rules, for example, expert systems; a type of AI system that tried to do things that expert human would do (ie. diagnosing a disease). One of the big problem with AI based on logical rules was that the rules the AI would follow were very rarely certain. Gradually, AI was developed with the mathematics of probability in mind to deal with the uncertainty in the rules

- Machine Learning(ML) = Instead of programming a comp by telling it every detail of what to do, we "teach" it by giving it examples of what to do. ML uses statistical algos to learn from examples (data); comp learns from data. ML is creating statistical progs called Models; a model takes an input and gives back an output.
  - Model is created with a lot of example data. Each example includes both an input and an output. A ML algo takes the examples & uses them to train the model, this means it adapts the details of the model, so it maps the input in ex data to corresponding outputs
  - In common type of ML, output is one of a number of categories called classes, putting things into categories
- Regression = if the output of ML is a number or several numbers
- Generative Model = where ML takes the given example and creative new examples as output
- Supervised Learning = Training a model on examples of input and output
- Unsupervised Learning = giving the ML model a set of inputs and getting it to figure the categories
- Reinforcement Learning = much like training a dog, the algo does things and gets rewards for doing good things and gets punishment for doing the wrong thing
- Nearest Neighbor = classifying a picture based on its nearest example, which is called a neighbor
  - To reduce errors, we K nearest neighbors or kNN, closest examples and choosing the class that most of them have.
  - A problem with NN is that it can be slow, gotta search through every example to find the most similar
  - Solution could be to not the original examples directly, but use them to create a math function to do the classification, called a model
- Support Vector Machines = comparing with a small important examples together with a sophisticated similarity measure and etc
- Optimization = choosing the numbers that we use in our model so that they give us the best results on the training data
- Decision trees = combines many simple decisions on individual features. Algo performs one decision after another, choosing features to use based on previous decision; the features to use, the order in which they're used & threshold values are all learned from data using optimization
- Neural Networks = combine many features together into complex math functions & only make one decision based on the output of that function. The details of function are also learned from data using optimization

## Summary

In this week, we learned about what AI & ML are and the different types of ML algorithms used when performing supervised classification.