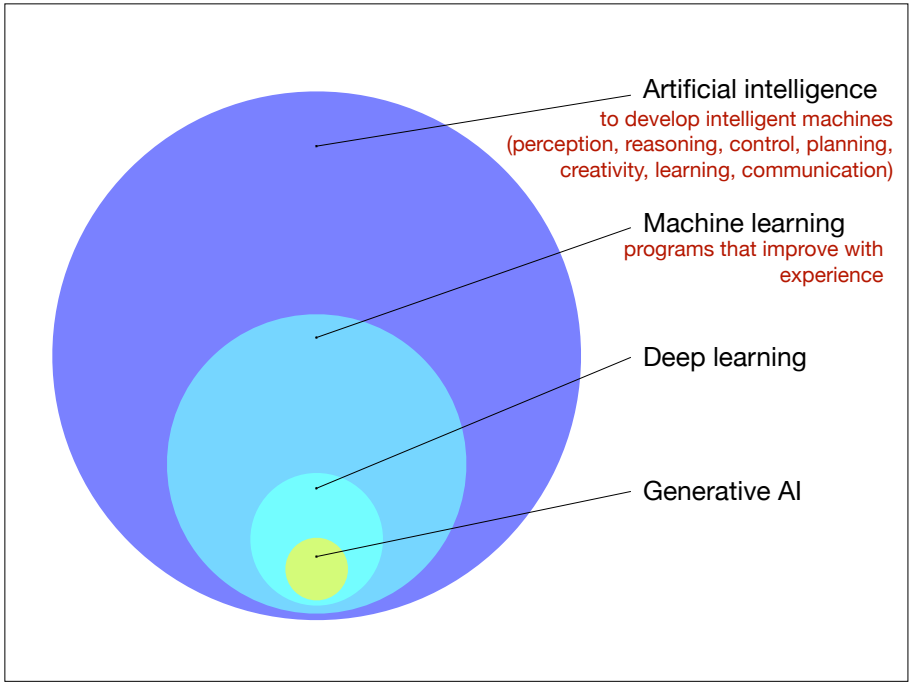
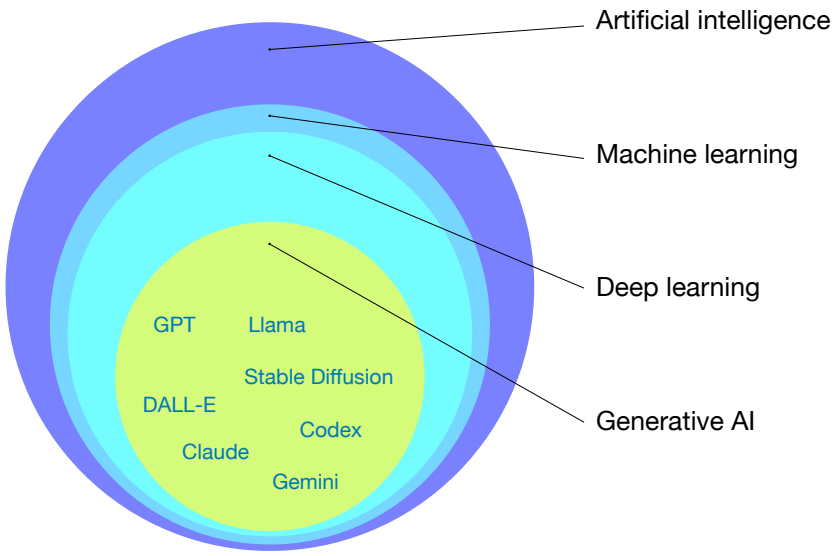
CSC 461

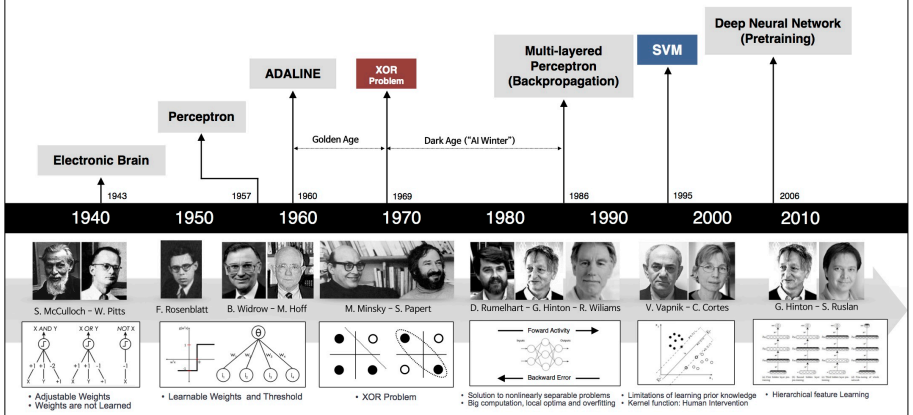
Machine Learning (Fall 2024)
Lecture 02: Machine Learning Basics

Prof. Marco Alvarez, University of Rhode Island



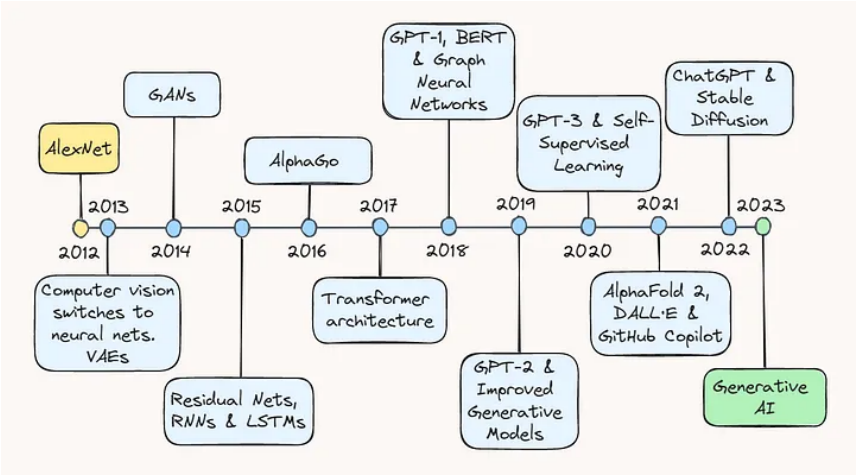


Milestones in ML/AI



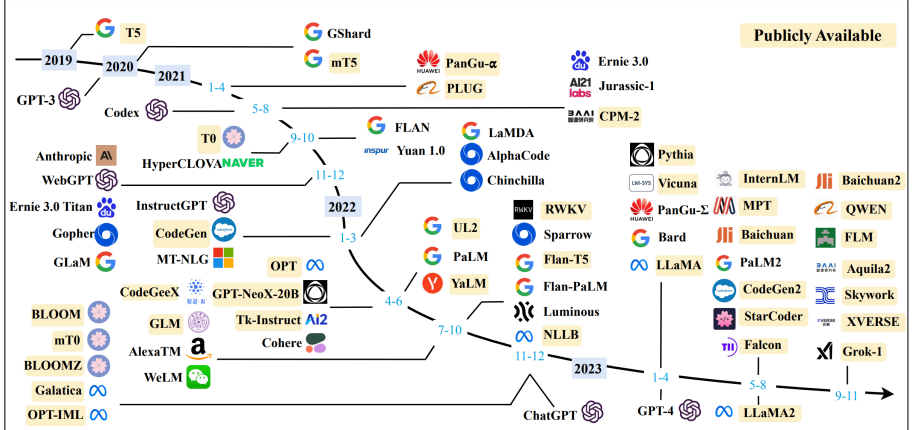
http://beamandrew.github.io/deeplearning/2017/02/23/deep_learning_101_part1.html

It only took 10 years …



https://towardsdatascience.com/ten-years-of-ai-in-review-85decdb2a540

Large language models (LLMs)

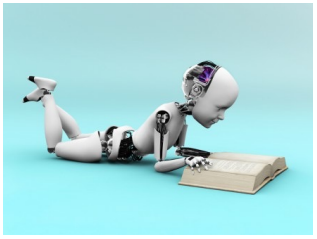


A Survey of Large Language Models, 2023 (ArXiv)

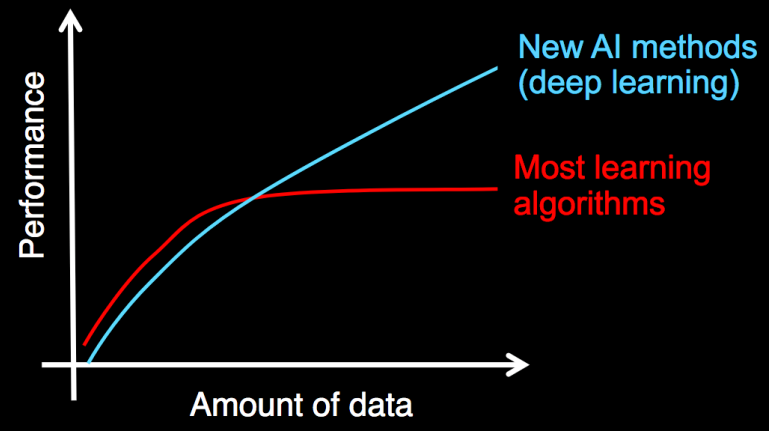
Machine Learning

What is ML?

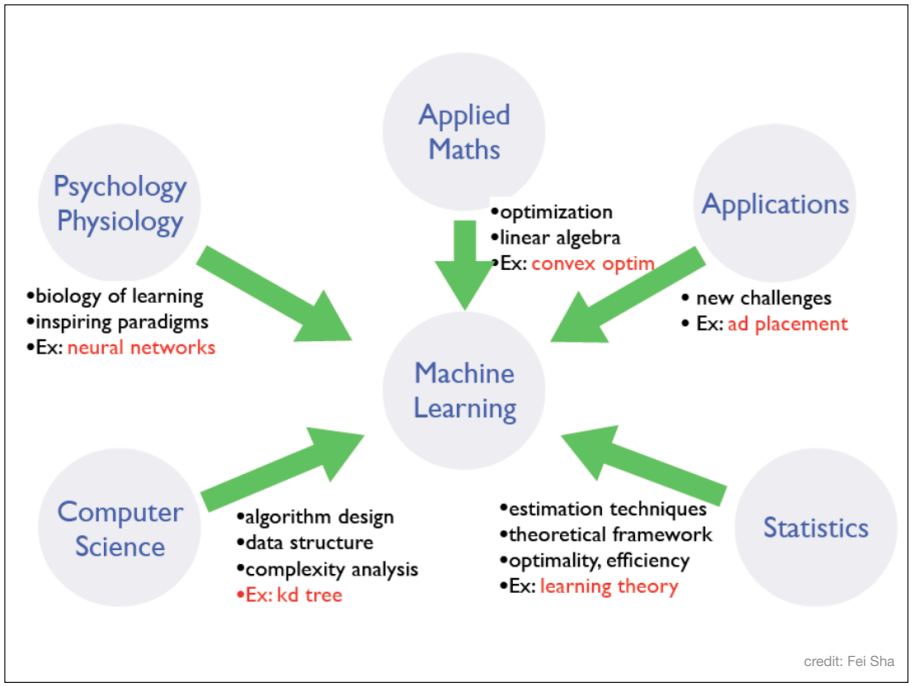
- Machine Learning is … [Tom Mitchell]
  - *"the study of computer algorithms that learn from experience E with respect to a particular task T and performance measure P"*
- Key drivers of advancement
  - progress in algorithms and theory
  - growing amounts of data
  - computational power
  - industry investment



Data and ML

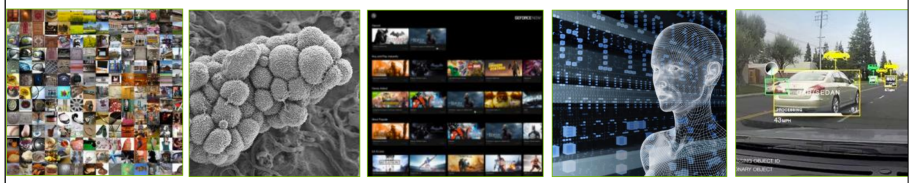


CS229: Machine Learning, Stanford



credit: Fei Sha

Applications



INTERNET & CLOUD	MEDICINE & BIOLOGY	MEDIA & ENTERTAINMENT	SECURITY & DEFENSE	AUTONOMOUS MACHINES
Image Classification Speech Recognition Language Translation Language Processing Sentiment Analysis Recommendation	Cancer Cell Detection Diabetic Grading Drug Discovery	Video Captioning Video Search Real Time Translation	Face Detection Video Surveillance Satellite Imagery	Pedestrian Detection Lane Tracking Recognize Traffic Sign

Deep Learning and HPC, NVIDIA, 2017

Major paradigms in ML

- Supervised Learning
  - learn a function from labeled training data
- Unsupervised Learning
  - find patterns in unlabeled data
- Semi-Supervised Learning
  - learn from a combination of labeled and unlabeled data
- Reinforcement Learning
  - learn optimal actions through interaction with an environment
- Transfer Learning
  - apply knowledge from one domain to a different but related domain
- Self-Supervised Learning
  - learn representations from unlabeled data using auxiliary tasks
- Zero/Few-shot Learning
  - learn from zero or very few examples
- Generative modeling/learning
  - generate new content