CSC 461: Machine Learning

Fall 2024

Intro to ML

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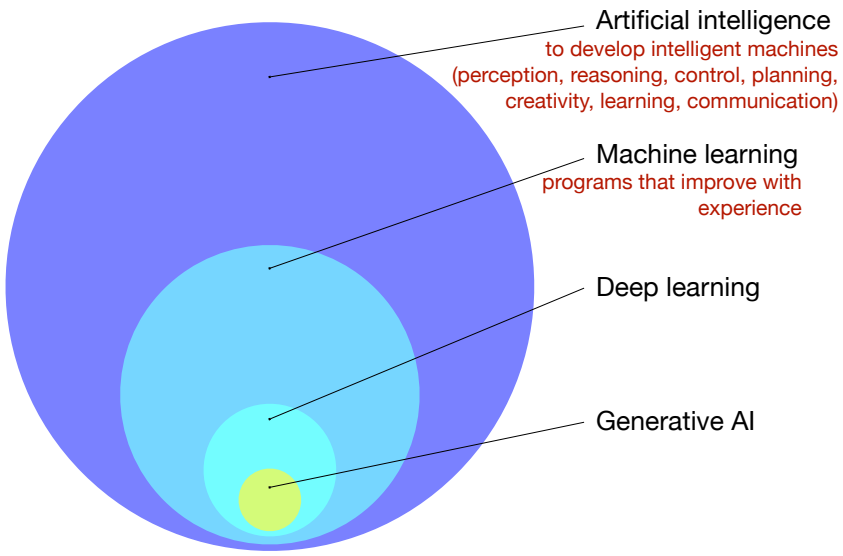
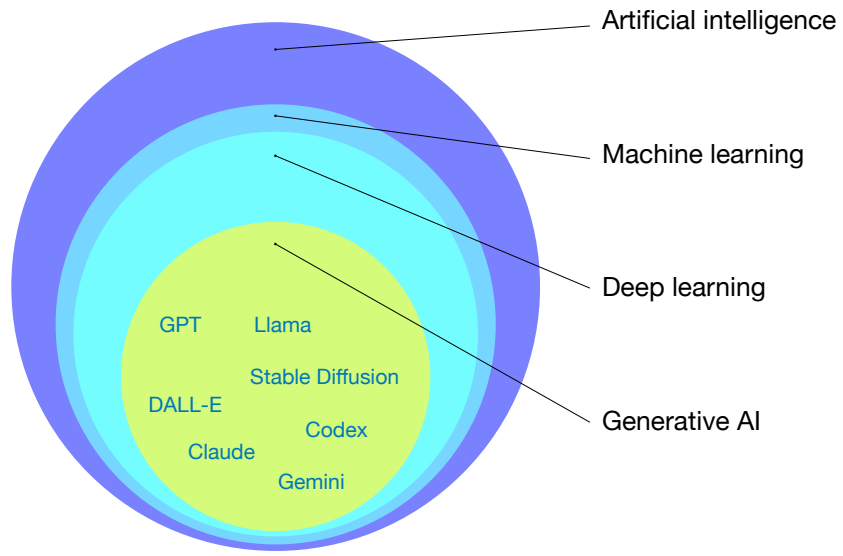
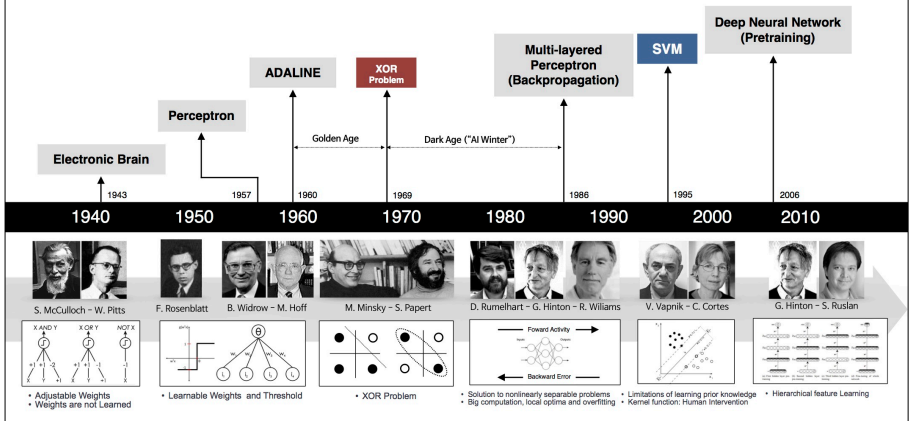
University of Rhode Island

Context



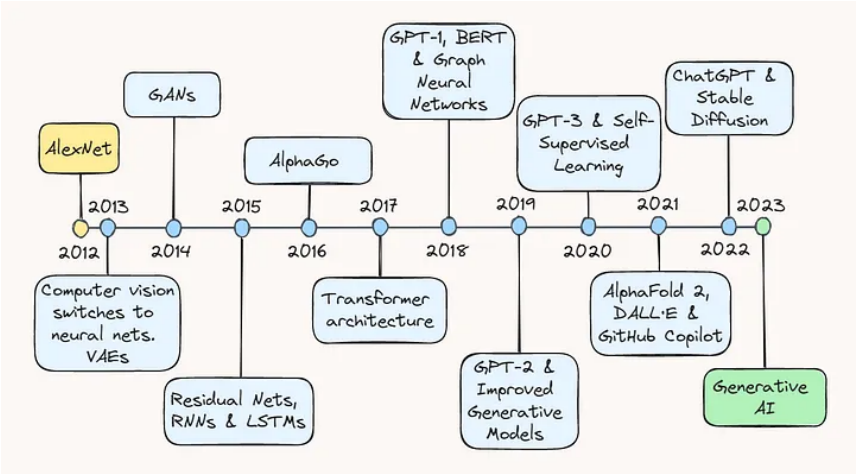


Milestones in ML/AI



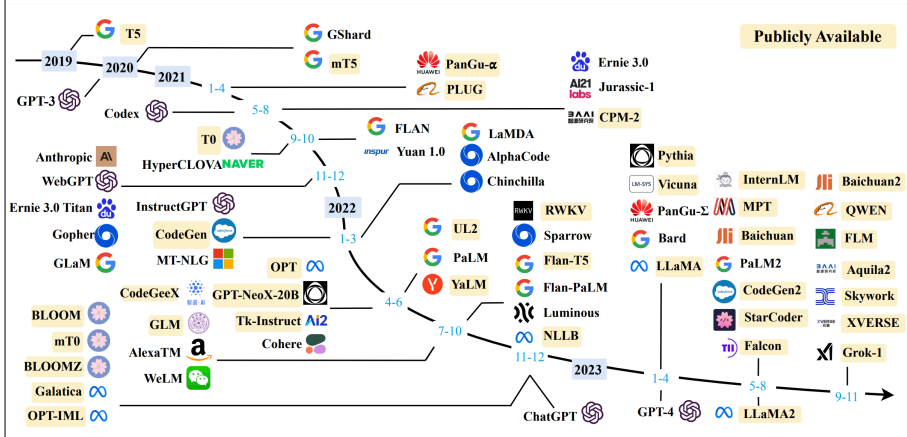
http://beamandrew.github.io/deeplearning/2017/02/23/deep_learning_101_part1.html

It only took 10 years …



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

Large language models (LLMs)

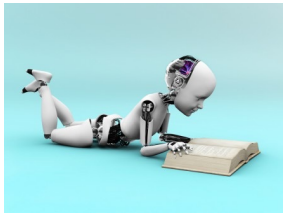


A Survey of Large Language Models, 2023 (ArXiv)

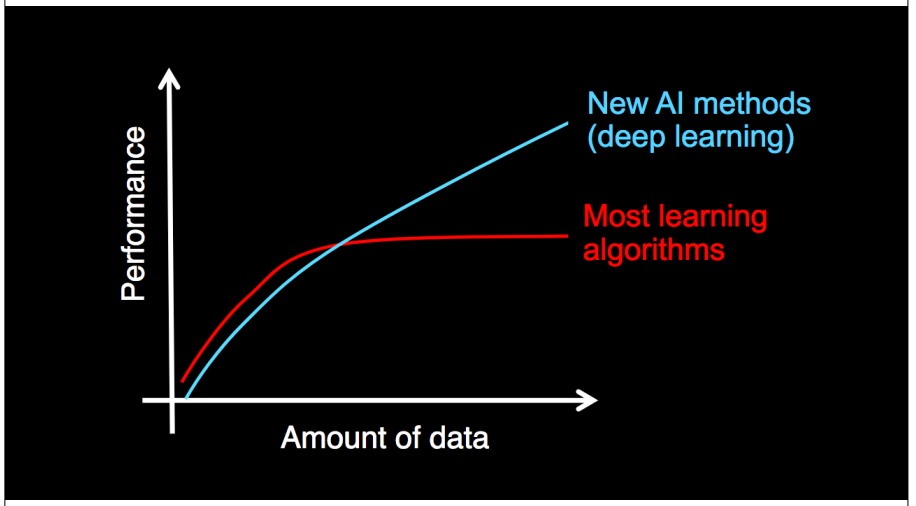
Machine learning

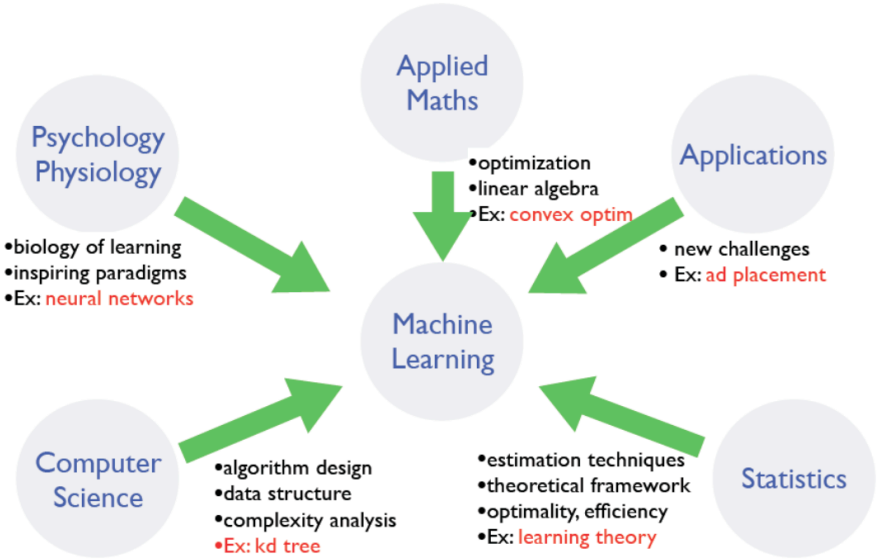
What is ML?

- 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





credit: Fei Sha

Applications

INTERNET & CLOUD
Image Classification
Speech Recognition
Language Translation
Language Processing
Sentiment Analysis
Recommendation

MEDICINE & BIOLOGY
Cancer Cell Detection
Diabetic Grading
Drug Discovery

MEDIA & ENTERTAINMENT
Video Captioning
Video Search
Real Time Translation

SECURITY & DEFENSE
Face Detection
Video Surveillance
Satellite Imagery

AUTONOMOUS MACHINES
Pedestrian Detection
Lane Tracking
Recognize Traffic Sign

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