UC San Diego

Cogs 9 - Discussion (Nov 9, 2022)

Topic: Machine Learning

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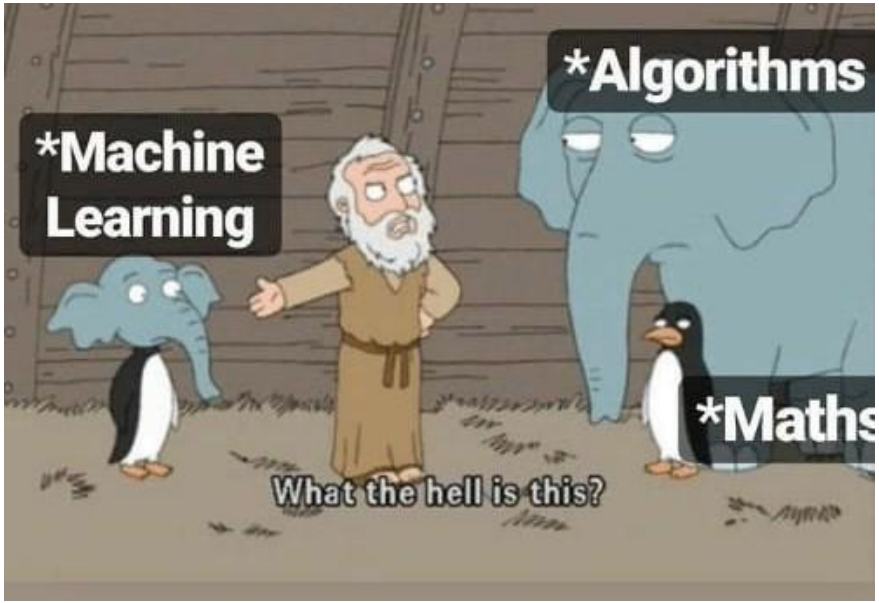
What is machine learning?

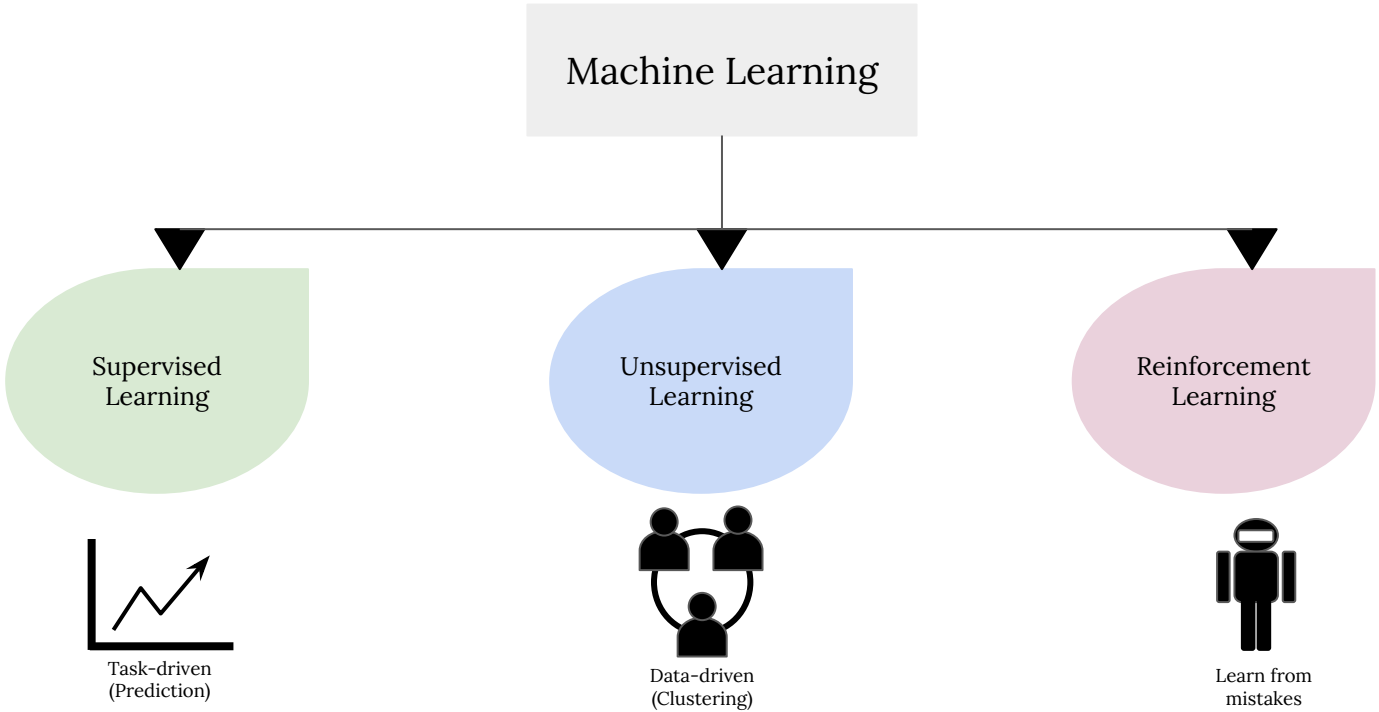
- ➔ A tool to solve complex problems
- ➔ Improve performance from experience
- ➔ Definition by Tom Mitchell (1998):

  ML is the study of algorithms that

  - ◆ improve their performance
  - ◆ at some task
  - ◆ with experience



Types of ML


Machine Learning
Supervised Learning
Unsupervised Learning
Reinforcement Learning
Task-driven (Prediction)
Data-driven (Clustering)
Learn from mistakes

Supervised Learning

enjoy algorithms

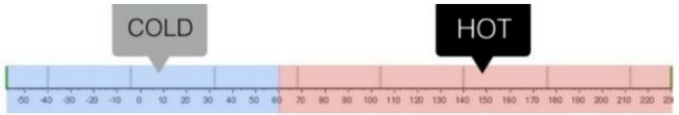
Regression

What will be the temperature tomorrow?

Fahrenheit

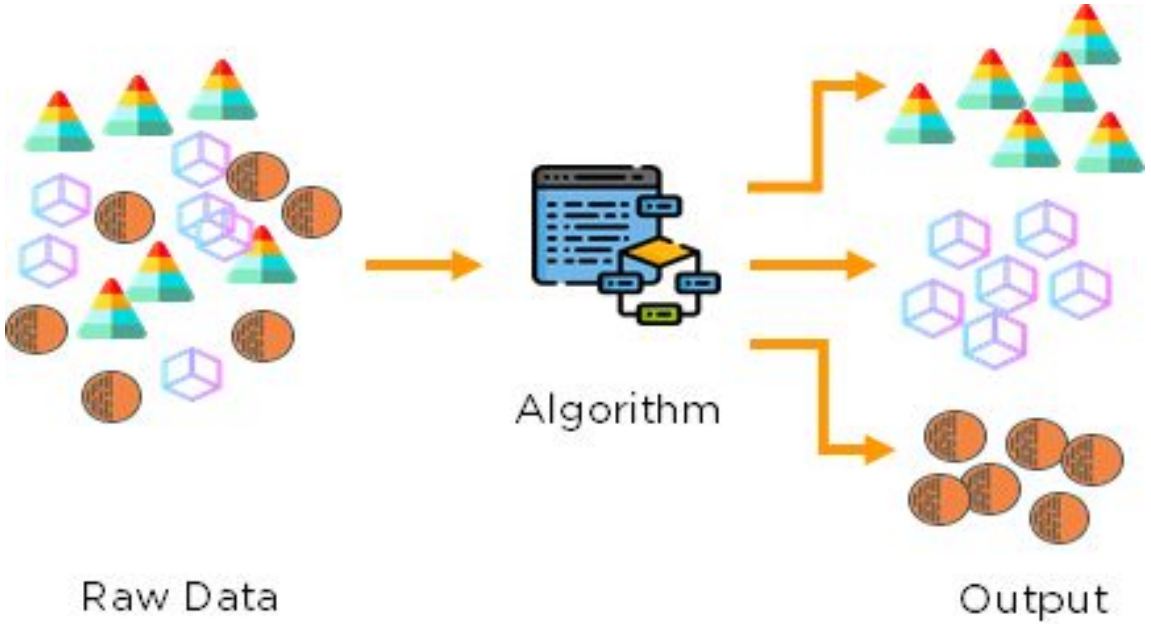
Classification

Will it be hot or cold tomorrow?

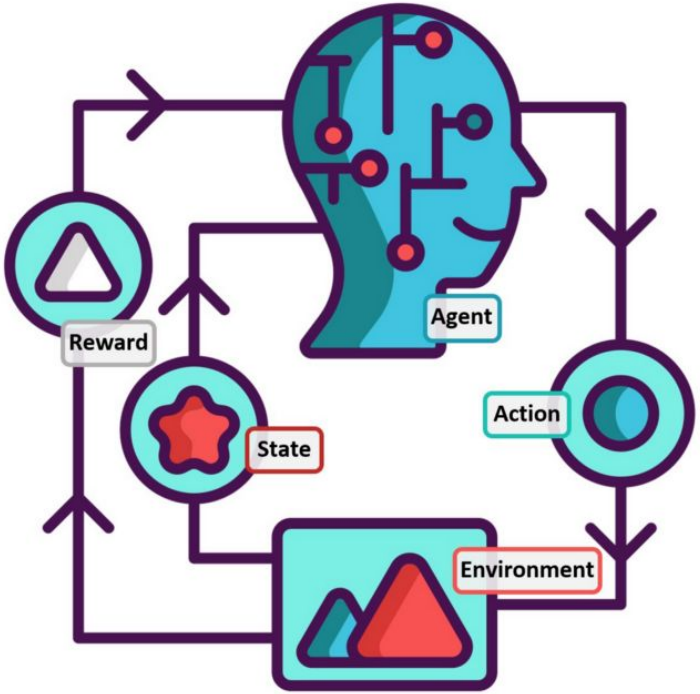


Fahrenheit

Unsupervised Learning



Reinforcement Learning



Live demo (Image recognition)

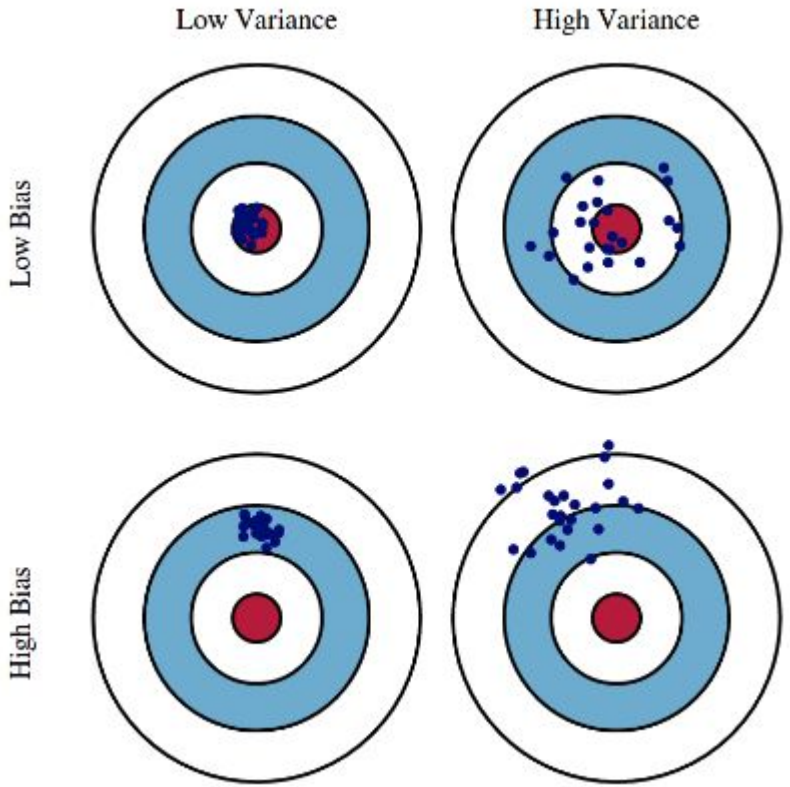
https://colab.research.google.com/drive/1uPYK_rCaWrYlZRB1ug6eQ2S3ie5DgbbK?usp=sharing

Limitations of ML

- Curse of dimensionality
  - More features = exponential growth
- No Free Lunch Theorem
  - No one model works best for all situations
- Debugging Nightmares
  - Black-box libraries/modules
  - Stochasticity
  - Multi-layered
- Bias/Variance tradeoff
  - High bias = Underfitting
  - High variance = Overfitting
- Time & Money
  - Training time can be hours/days
  - Hardware infrastructure $$$

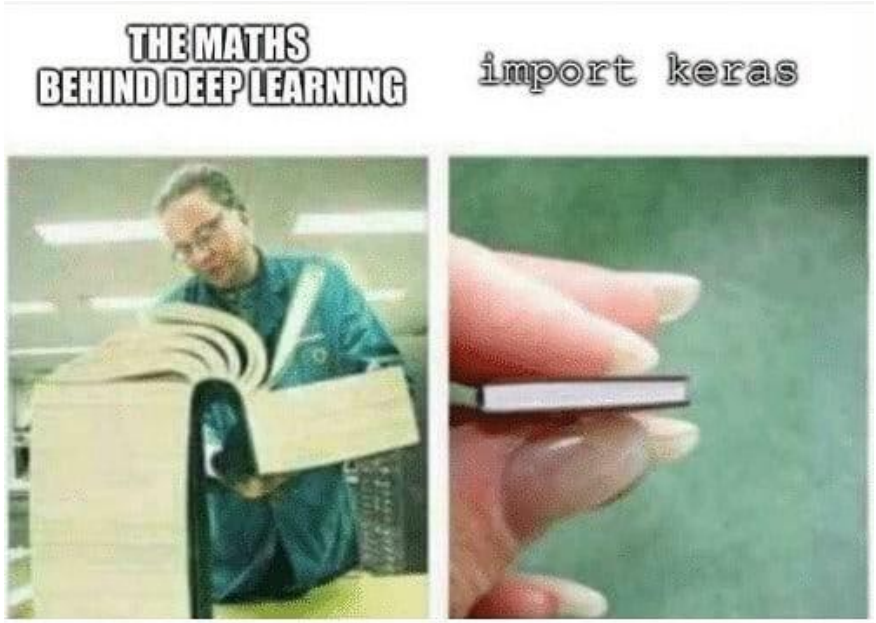
Bias & Variance

- ➔ High bias = Less accurate
- ➔ Low bias = More accurate
- ➔ High variance = Less precise
- ➔ Low variance = More precise



Popular ML libraries

- sklearn
- tensorflow
- keras
- pytorch



Machine learning be like