Machine Learning

by Robert Vagt

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What is Machine Learning?

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- The science of making machines:
  - Develop programs from data

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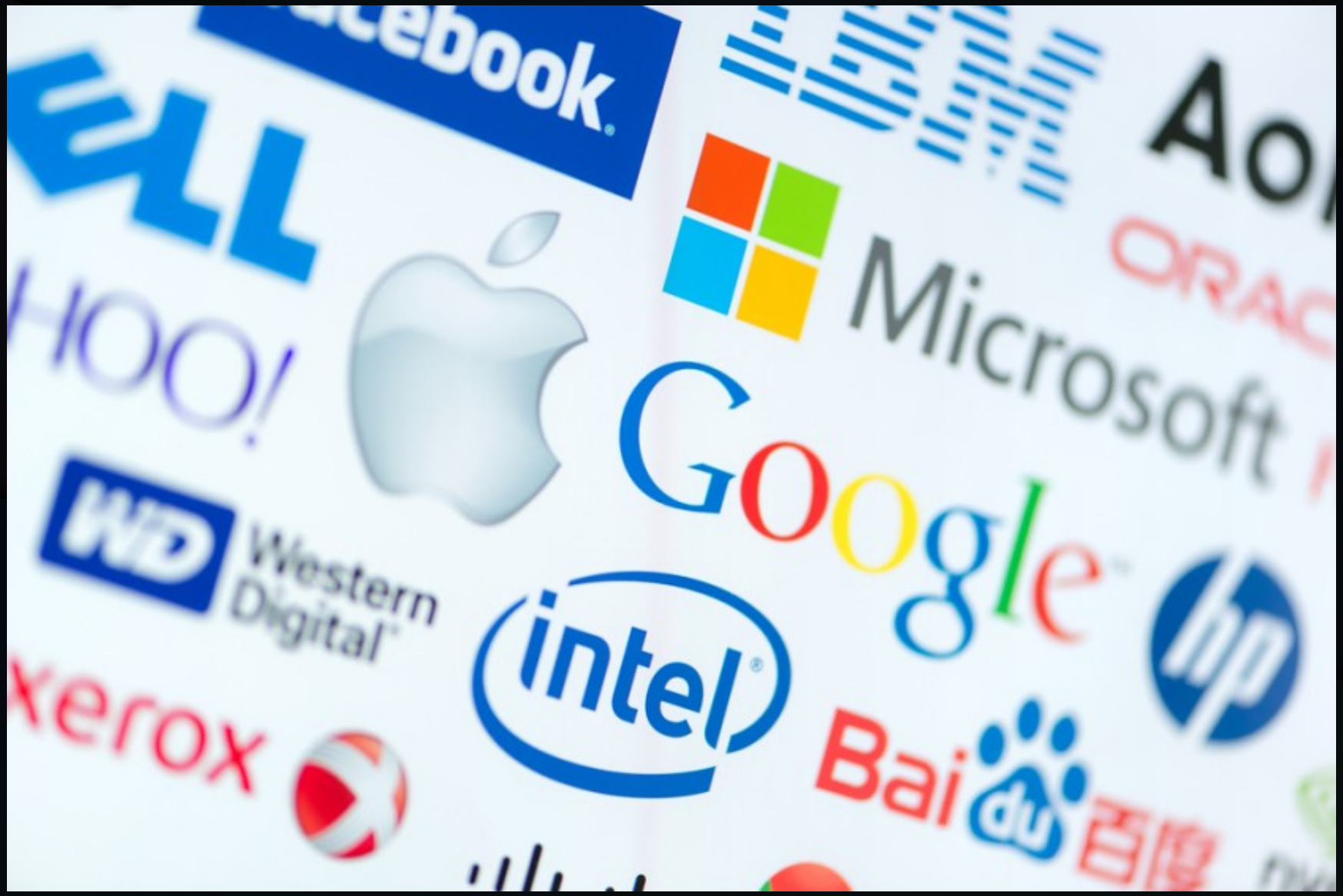
What is Machine Learning?

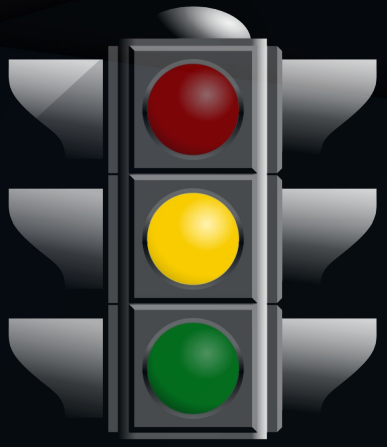
- The science of making machines:
  - Develop programs from data
  - Improve their own efficiency
  - Improve their ability to upgrade themselves

Any questions so far?

Applications of Machine Learning

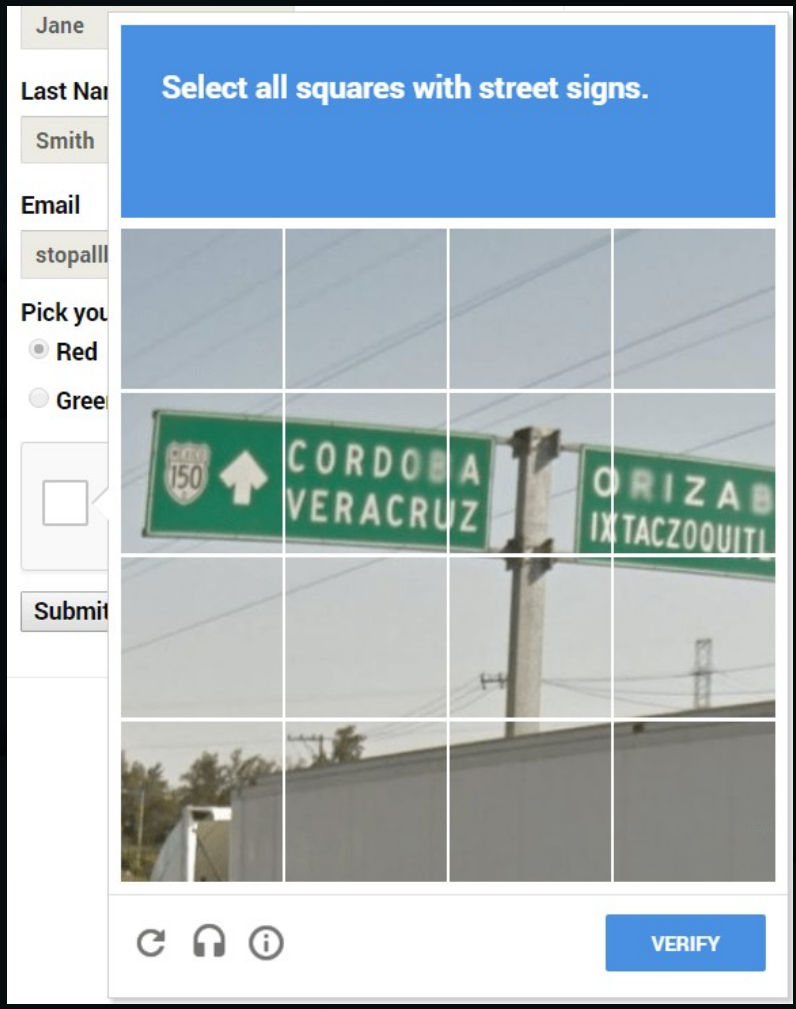


Applications of Machine Learning



Applications of Machine Learning

- Google Captcha
- trains programs for google earth, self driving cars etc.

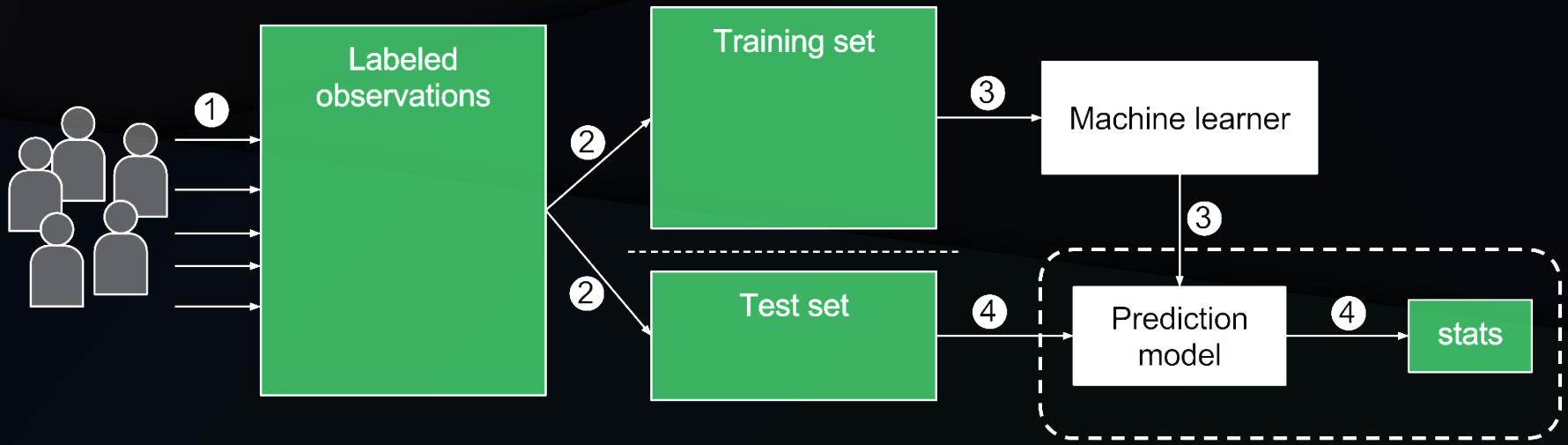


Types of Machine Learning

- Supervised Learning
- Unsupervised Learning
- Reinforcement Learning

Supervised Learning

- Labeled input data sets
- Training set and testing set



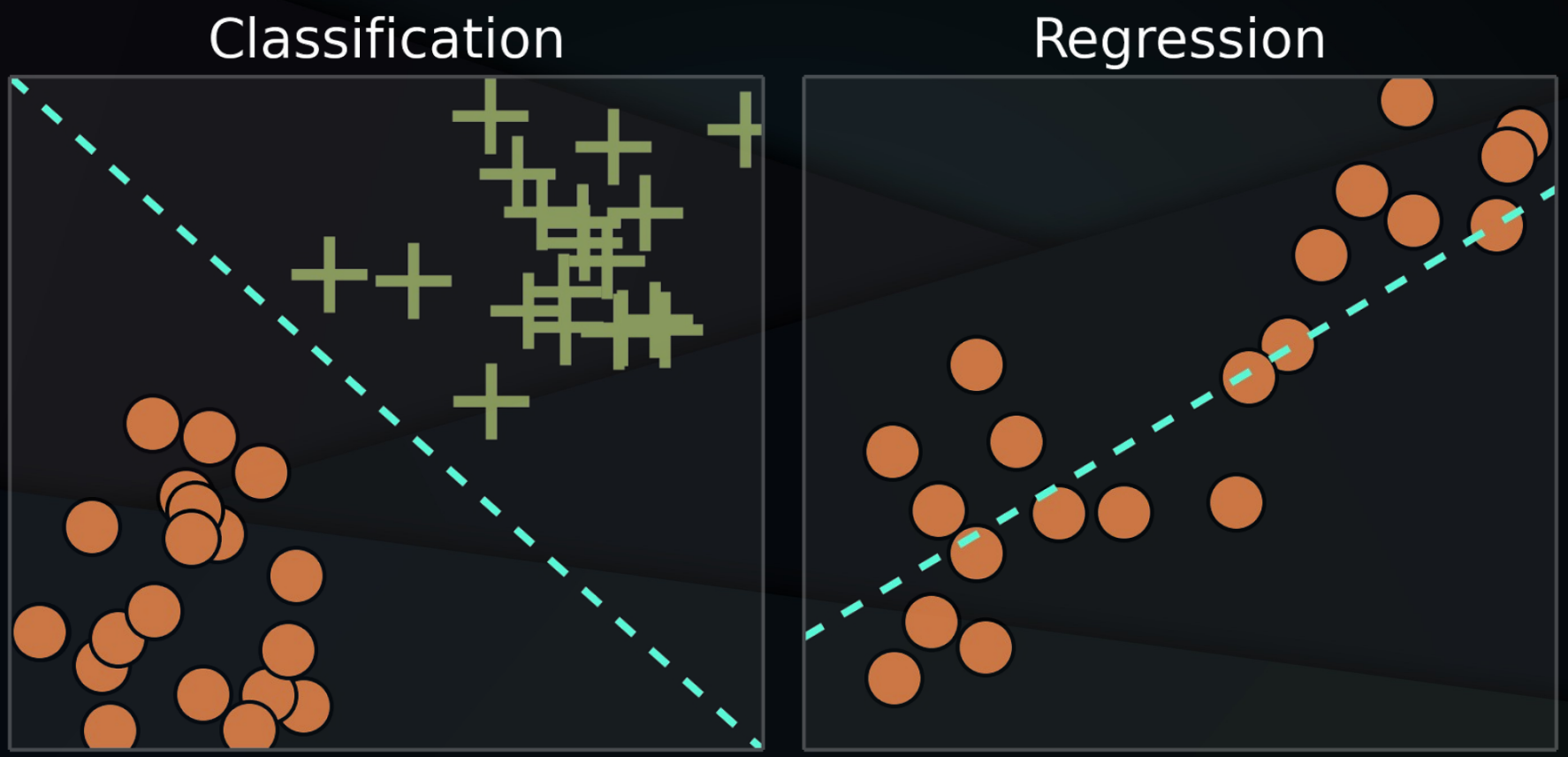
Supervised Learning

- Subcategory: Classification
  - Identifying input data as part of a particular group or class
  - Image/pattern recognition, census, spam detection

Supervised Learning

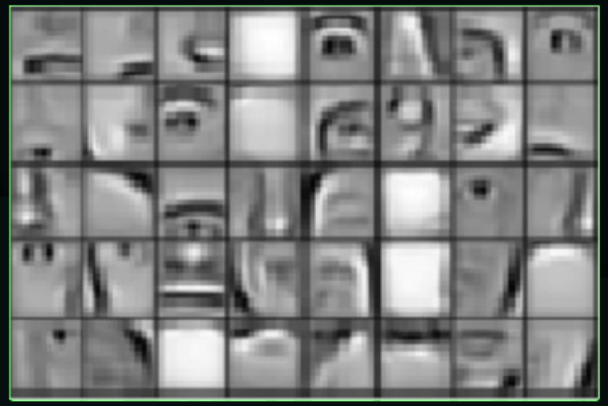
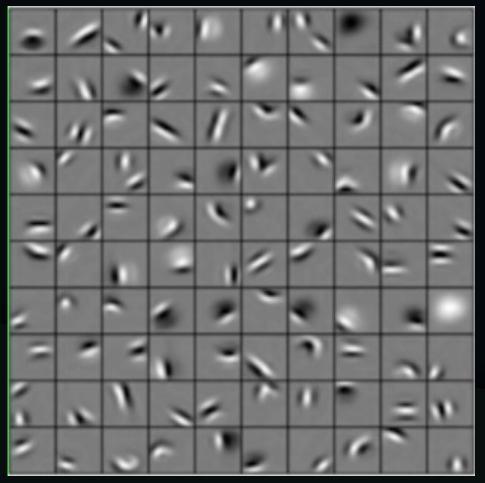
- Subcategory: Regression
  - Explaining continuous data via mathematical functions
  - Financial calculations and analysis, finding relations between data

Supervised Learning



Unsupervised Learning

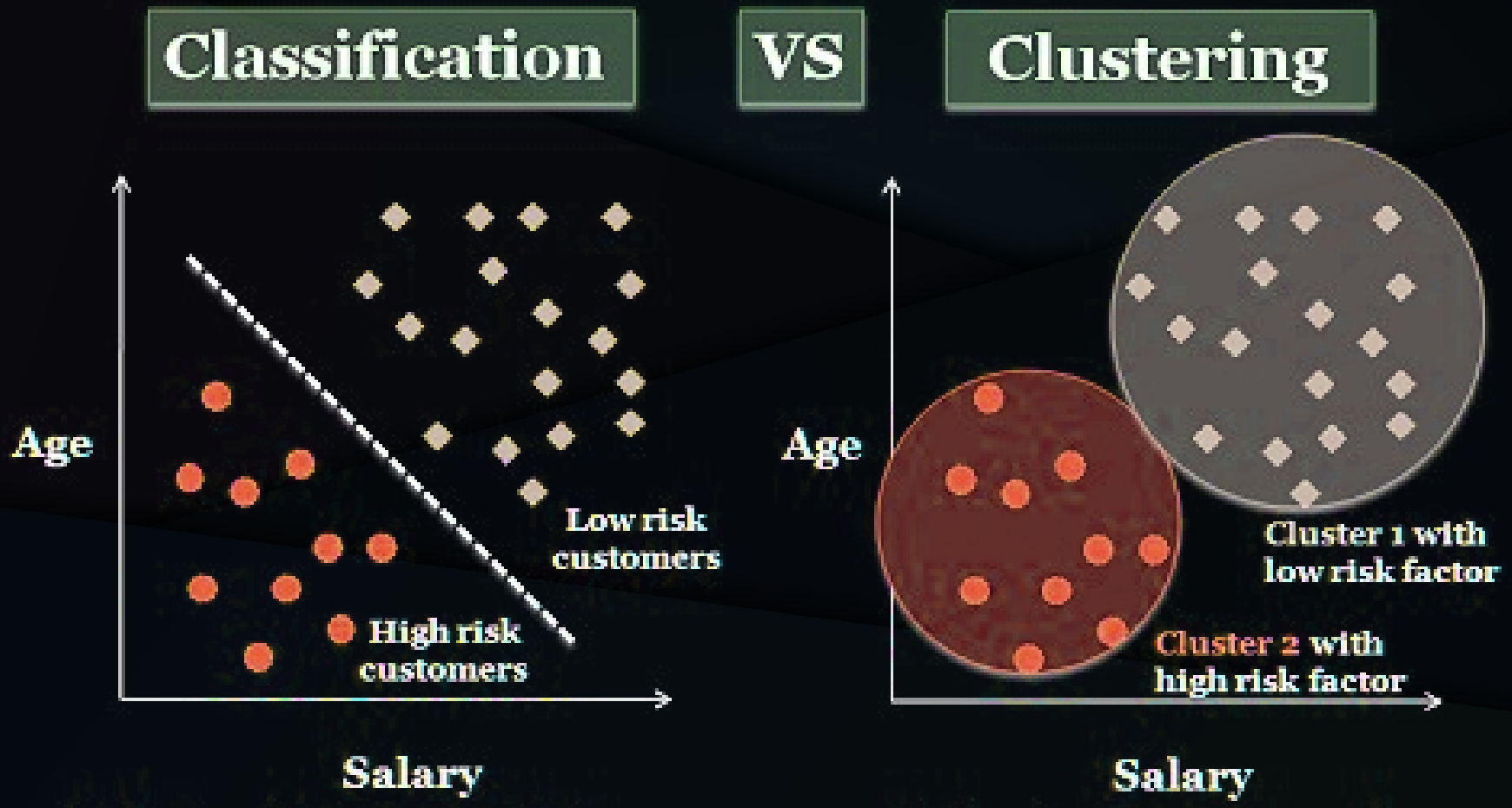
- Unlabeled input data sets
- Find patterns and organize data

Unsupervised Learning

- Subcategory: Clustering
  - Divide data into categories based on data point proximity
  - Similar to classification, but no given classes/groups to identify
  - Predicting future data (online shopping), outlier (fraud) detection

Unsupervised Learning



Risk classification for the loan payees on the basis of customer salary

Reinforcement Learning

- Find the optimal way to finish task, “Utility function”
- Program is “rewarded” for achieving goals
- Agent tries to predict next step with maximum reward

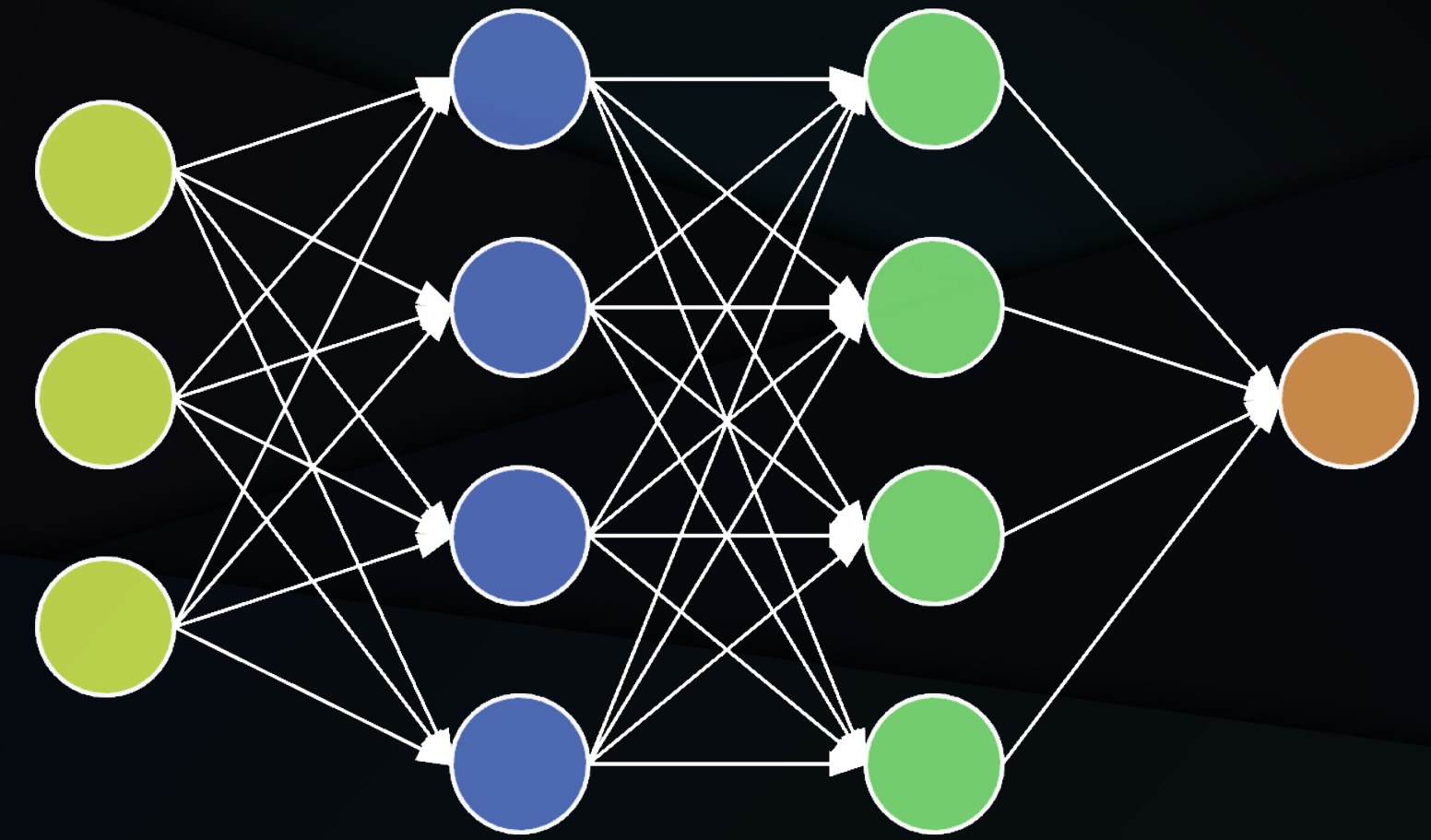
Reinforcement Learning

- Useful in many areas where testing is simple
- Especially for training robots that make a lot of decisions, e.g. self-driving cars, game AI, managing warehouse inventory, stock trading

Deep Learning

- Not a different way of learning
- Incredibly complex systems
- Nobody knows how they work once trained
- Modeled after biological neurons
- “Artificial Neural Networks”

Artificial Neural Network



Milestones and Challenges

A Brief History

- First learning algorithms in 1950s
- Hype died down after 1960s
- Higher processing power of 1980s devices revitalized AI research
- 1996, IBM computer Deep Blue beats Garry Kasparov
- 2000s, many old algorithms reevaluated due to increased processing power
- ~2012-2014, begin of the current hype about Deep Learning and AI
- AlphaGo beats Lee Sedol at Go

What’s in the Future?

- Machines will become better at talking like humans
- Improved simulations of human behaviour
- Unsupervised algorithms will become more intelligent
- Increased automation and singularity

AI safety

- Young field of study, few notable publications so far
- Trying to find standards and rules to keep AI beneficial and safe
- Early stages driven and funded by Elon Musk
- Combines computing and logic with morality, ethics and philosophy

Sources

- https://homes.cs.washington.edu/~pedrod/papers/cacm12.pdf
- https://securityaffairs.co/wordpress/56816/hacking/rebreakcaptcha-google-recaptcha-hacking.html
- https://www.bbc.com/timelines/zypd97h
- https://blogs.nvidia.com/blog/2018/08/02/supervised-unsupervised-learning/

Recommended Reading / Watching

- https://www.youtube.com/user/Computerphile
  Computerphile’s YouTube channel (introductions into AI and a variety of different computer science topics)
- https://www.youtube.com/channel/UCLB7AzTwc6VFZrBsO2ucBMg
  Rob Miles’ YouTube channel (AGI, challenges and standardization of modern AI)
- https://www.youtube.com/channel/UCYO_jab_esuFRV4b17AJtAw
  3Blue1Brown’s Youtube channel (Technical explanations of AI algorithms and other mathematical subjects)
- “A Few Useful Things to Know about Machine Learning”, Pedro Domingos

Thank you!

Discussion

- What dangers do you see in the wide-spread usage of machine learning algorithms?

Discussion

- What challenges does AI safety research face?