Overview of Artificial Intelligence and Machine Learning

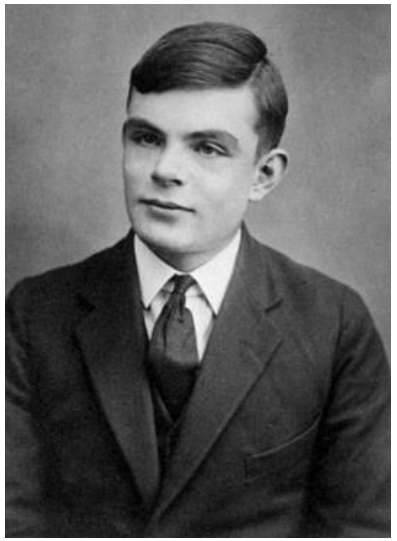
Richard Lui

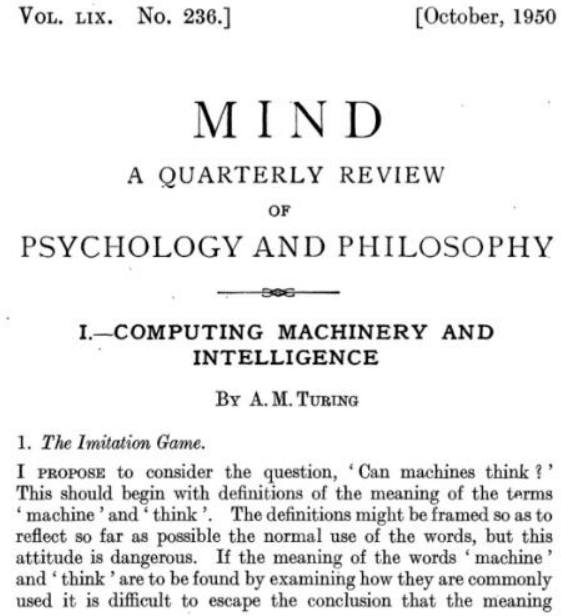
What is Artificial Intelligence (AI)?

- AI is concerned with developing machines with the ability that are usually done by us humans with our natural intelligence

Birth of AI (1950s)

- In 1950, British mathematician and computer scientist Alan Turing posed the Turing test
  - A human evaluator (C) judging natural language conversations between a human (B) and a machine (B) designed to generate human-like responses.
    - The conversation would be limited to a text-only channel, such as a computer keyboard and screen
  - If the evaluator cannot reliably tell the machine from the human, the machine would be said to have passed the test.





VOL. LIX. No. 236.] [October, 1950

MIND

A QUARTERLY REVIEW

OF

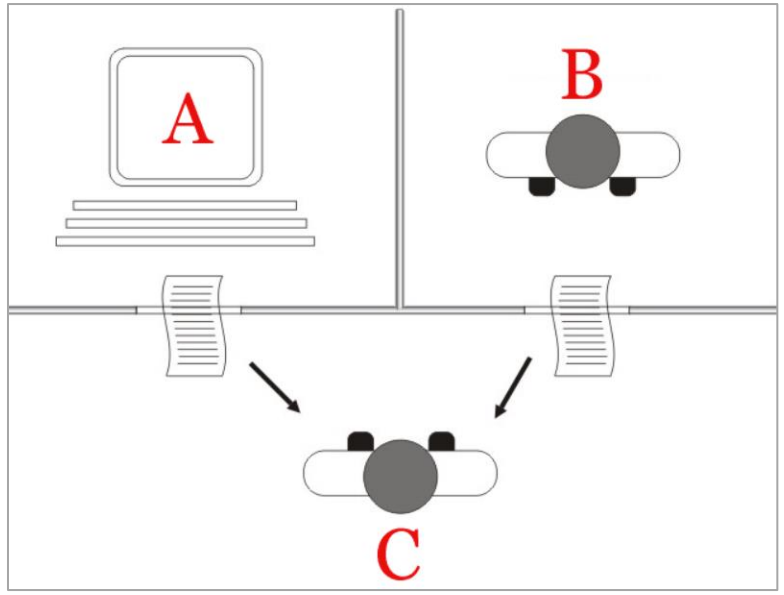
PSYCHOLOGY AND PHILOSOPHY

I.—COMPUTING MACHINERY AND INTELLIGENCE

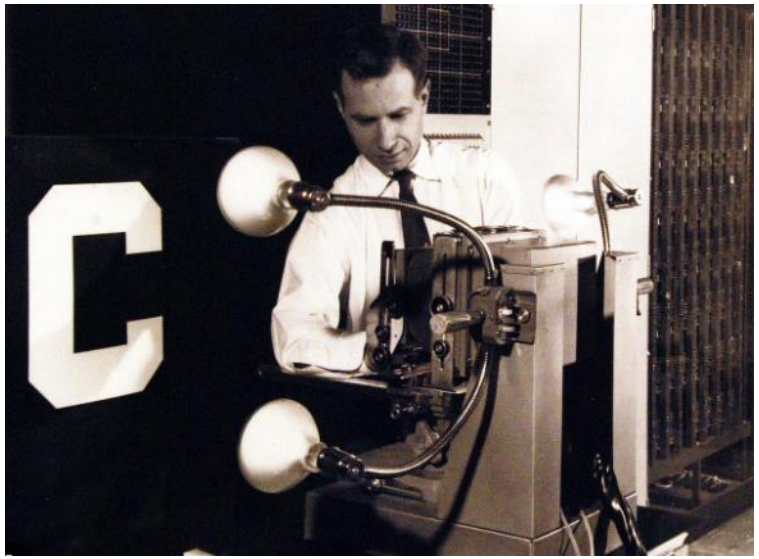
BY A. M. TURING

1. *The Imitation Game.*

I PROPOSE to consider the question, 'Can machines think?' This should begin with definitions of the meaning of the terms 'machine' and 'think'. The definitions might be framed so as to reflect so far as possible the normal use of the words, but this attitude is dangerous. If the meaning of the words 'machine' and 'think' are to be found by examining how they are commonly used it is difficult to escape the conclusion that the meaning



- In 1958, a psychologist Frank Rosenblatt designed the Perceptron, an Artificial neural network
  - Demonstrate the potential of machine learning algorithms to mimic human intelligence.
  - Foundation of deep learning



AI Booms (1960s –1970s)

- Significant progress in AI development
- Development of "Expert Systems"
  - Computer systems that emulates decision making of a human expert.
- Development of Neural Networks and Machine Learning

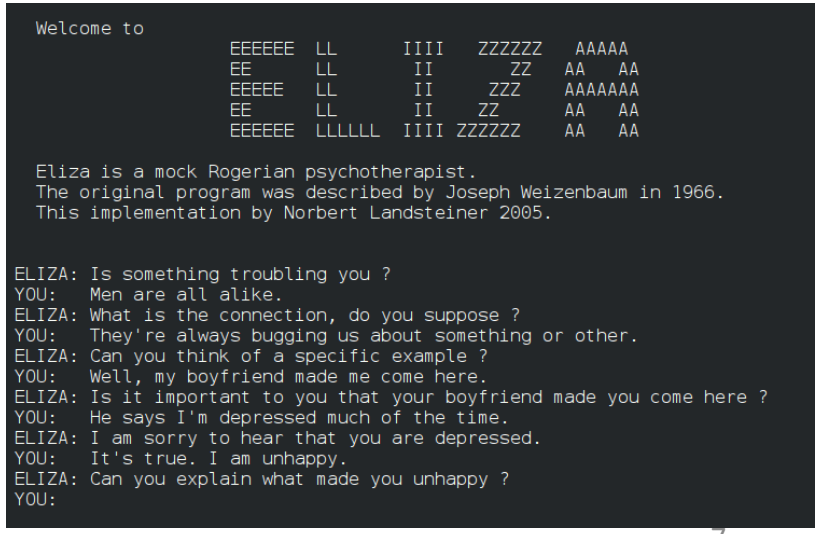
Expert Systems

- Computer programs intended to encapsulate the thought processes of human experts such as doctors, engineers, and even musicians.
  - Study a human expert at work, watch what they do and how they do it, and perhaps ask them to describe their process
  - Capture that thinking and behavior with a set of rules.
- MYCIN Expert System
  - The First AI Medical Diagnosis developed in 1972
  - Help identify bacteria that cause blood infections and other severe infections
  - Perform diagnoses by asking questions about a patient's symptoms, and then comparing the answers to a database of known infections.
  - Used a rule-based system to make decisions.

Eliza

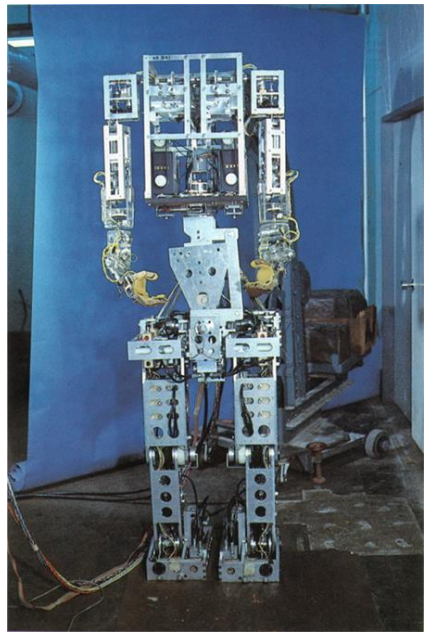
- A chatbot created in 1964 at the MIT Artificial Intelligence Laboratory
- Simulates a conversation with psychotherapist
- Use rules to mechanically transform inputs into outputs

Video: Before Siri and Alexa, there was ELIZA
Try: https://web.njit.edu/~ronkowit/eliza.html



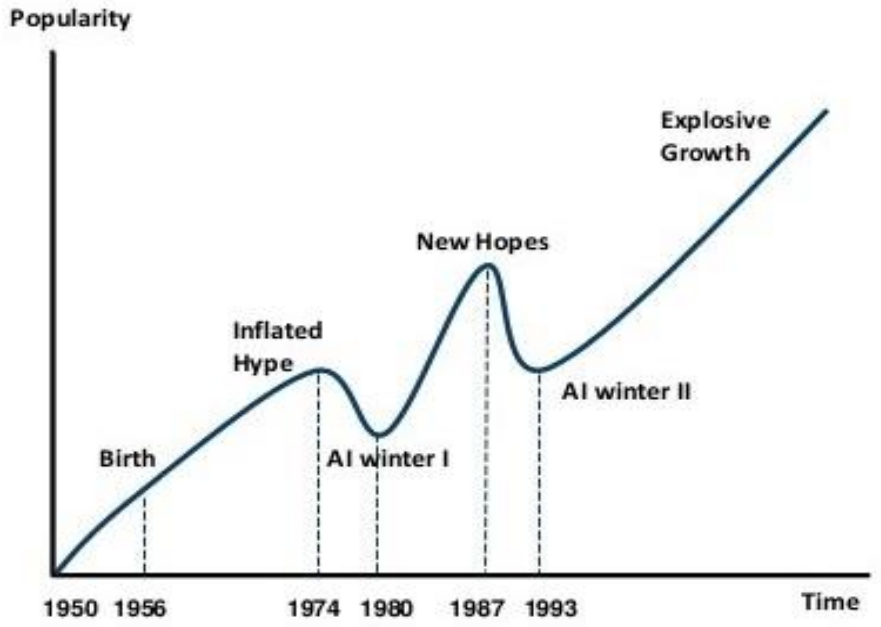
Robots

- WABOT-1 (1970)
  - The first anthropomorphic robot, was built in Japan at Waseda University.
  - Can walk with his lower limbs and was able to grip and transport objects with hands that used tactile-sensors



AI Winters

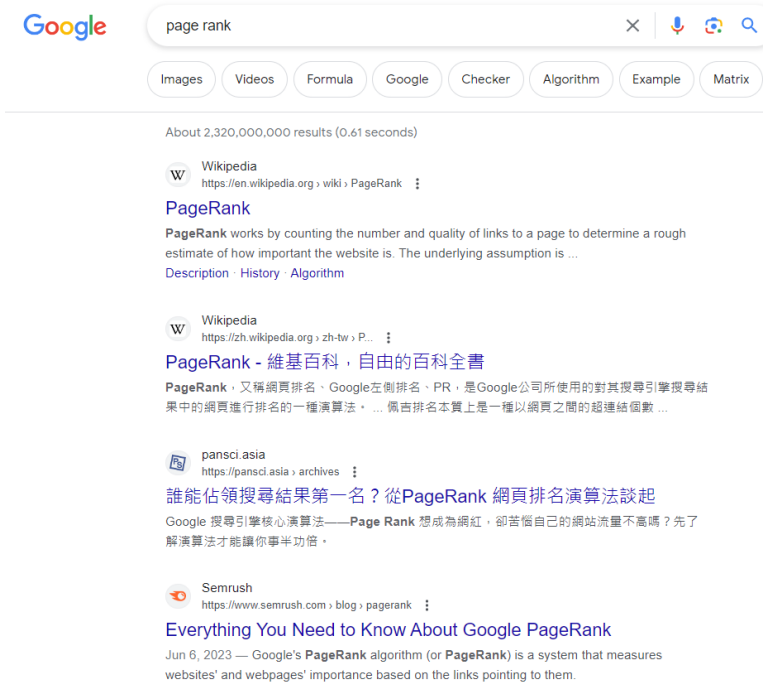
- A period of reduced interest, funding, and progress in the field of artificial intelligence (AI).
- Overpromising results
- Lack of computational power
- Limitations of early AI models
  - Early AI models and techniques, such as those used in expert systems, proved inflexible and difficult to scale.



History of AI Winters.
https://www.actuaries.digital/2018/09/05/history-of-ai-winters

AI Spring (Late 1990s to 2000s)

- Applications like web search, data mining, and computer vision started to demonstrate the potential of AI technologies.
- Deep Blue - A supercomputer developed by IBM that became famous for defeating world chess champion Garry Kasparov in 1997



Rise of Big Data and Deep Learning (2010s - Now)

- Rise of deep learning
  - Availability of vast amounts of data & Advancement in computing power
  - Shows remarkable performance in tasks such as image recognition, natural language processing, and speech recognition.
- Siri, a personal assistant developed by Apple, was released on October 4, 2011, alongside the launch of the iPhone 4S,
  - Utilize natural language processing and machine learning to perform tasks, provide information, and interact with users on Apple devices.
- Google assistant was announced in May 2016

- AlphaGo
  - Developed by DeepMind
  - Utilized deep learning and defeated world champions Lee Sedol and Ke Jie in 2016 and 2017
- Generative AI
  - A new milestone where machines can generate new content that is indistinguishable from those created by humans.
  - Deep fake: First released in 2018, involves he use of artificial intelligence (AI) to create a fake event in photo, video, or audio format.
  - AI generated arts, GPT-3, ChatGPT, …

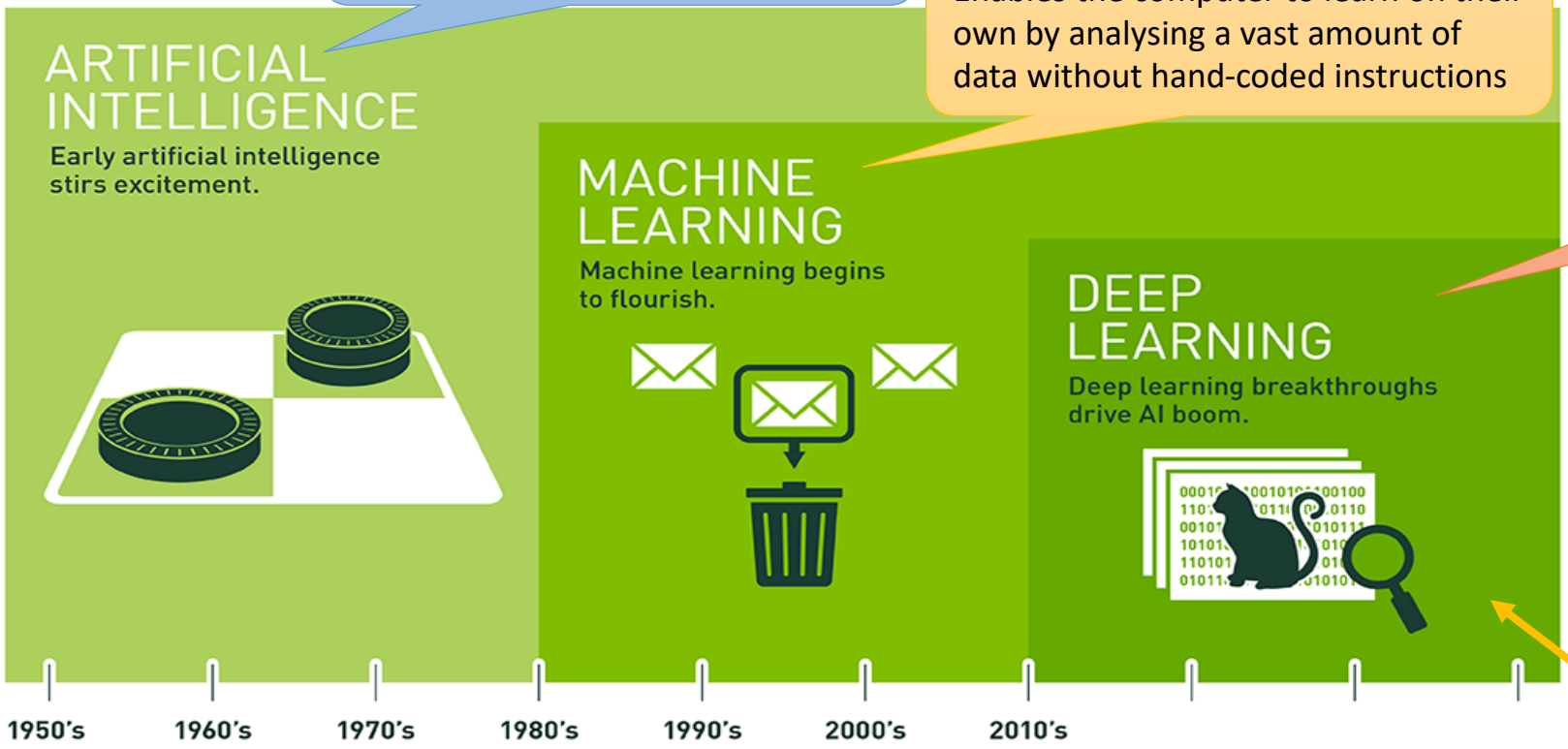
Video: [It's Getting Harder to Spot a Deep Fake Video]

AI, Machine Learning and Deep Learning

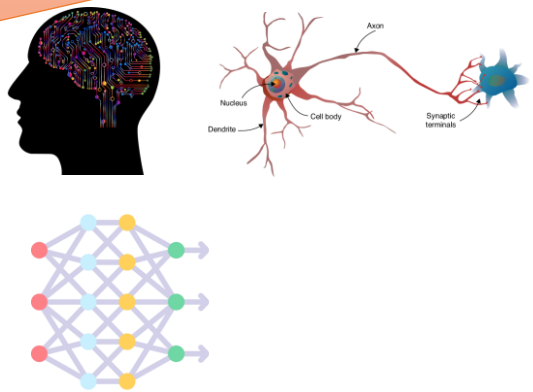
Develop machines with the ability that are usually done by us human with our natural intelligence

Enables the computer to learn on their own by analysing a vast amount of data without hand-coded instructions

A subfield of machine learning. Mimics the activities of neurons in our brains with deep neural networks.



Since an early flush of optimism in the 1950s, smaller subsets of artificial intelligence – first machine learning, then deep learning, a subset of machine learning – have created ever larger disruptions.



Generative AI

ChatGPT *Midjourney* *Bard*

***Source**:*

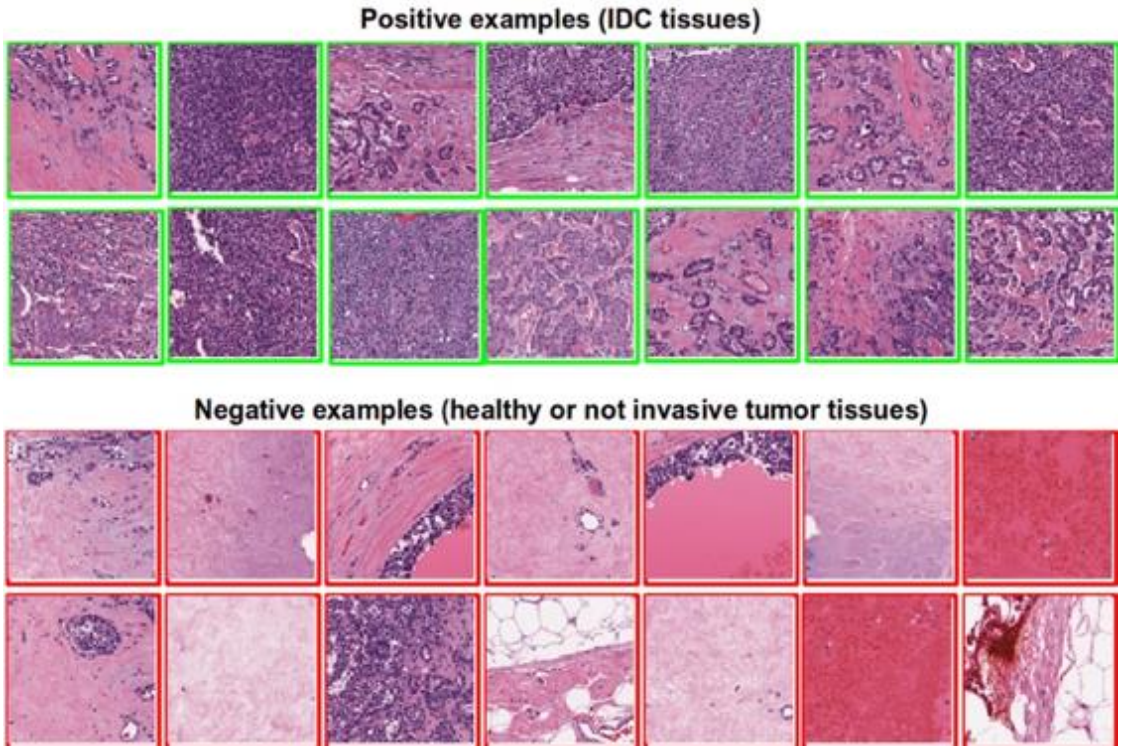
https://blogs.nvidia.com/blog/2016/07/29/whats-difference-artificial-intelligence-machine-learning-deep-learning-ai

Subfields of AI

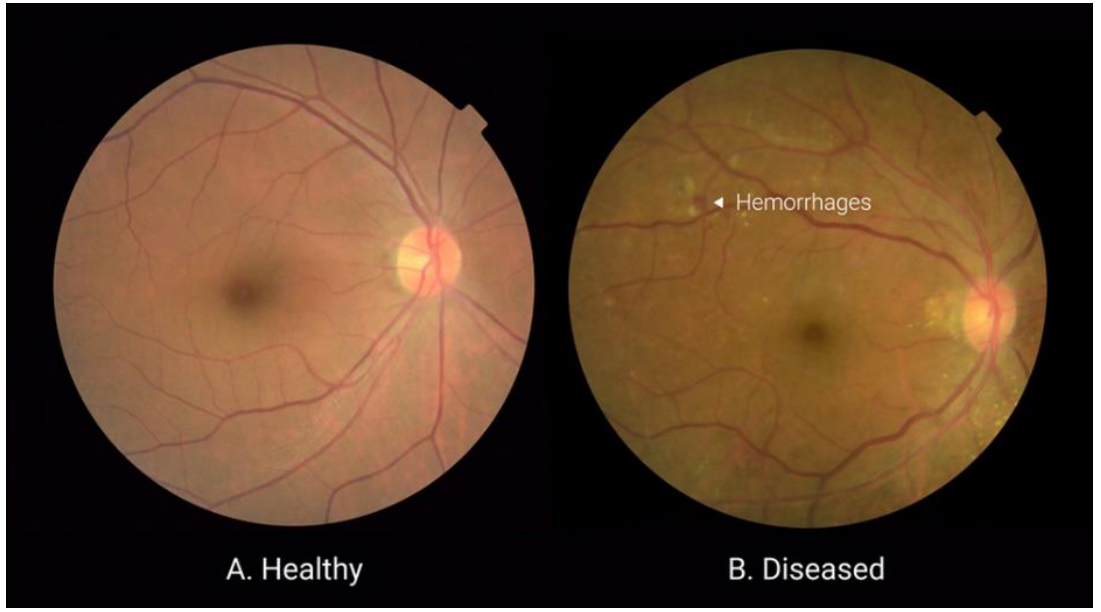
- Computer Vision
  - Enabling computers to derive information from images and videos
- Natural Language Processing (NLP)
  - Giving computers the ability to understand text and spoken words
- Speech Recognition
- Machine Learning
- Deep learning

Disease Detection

- Camels, Code & Lab Coats: How AI Is Advancing Science and Medicine
  - https://www.youtube.com/watch?v=AbdVsi1VjQY



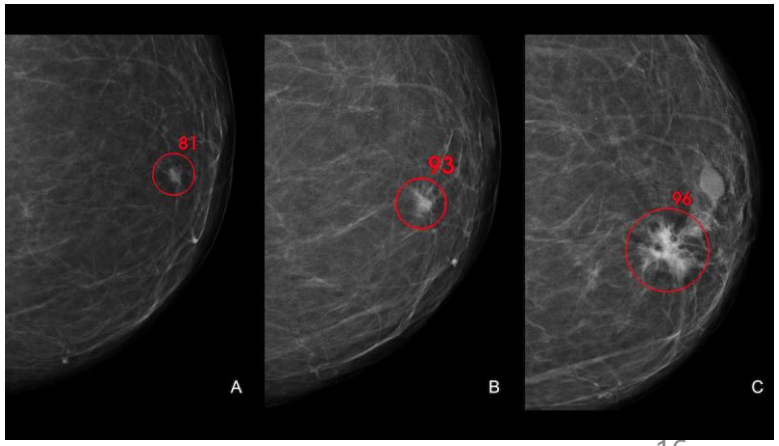
Cancer Detection



Detecting diabetic eye disease

Cancer Diagnosis

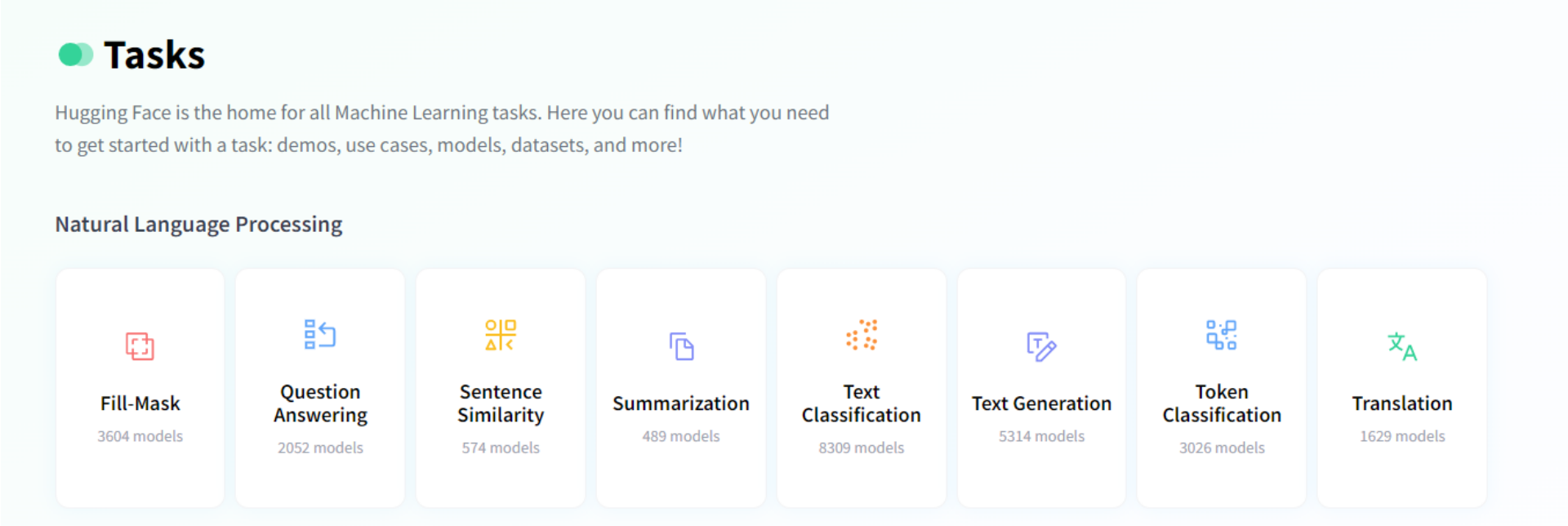
- Breast cancer causes more than 600,000 deaths annually worldwide
- Diagnose breast cancer from mammograms by Radiologist
- Researchers at Lund University in Sweden conducted a randomized, controlled, clinical trial to Determine whether an AI system could save radiologists' time without endangering patients
- AI saved 44.3 percent of the examination workload without increasing the number of misdiagnosed patients.
  - Reference



Video: This AI Is Beating Doctors At Their Own Game

Natural language processing (NLP)

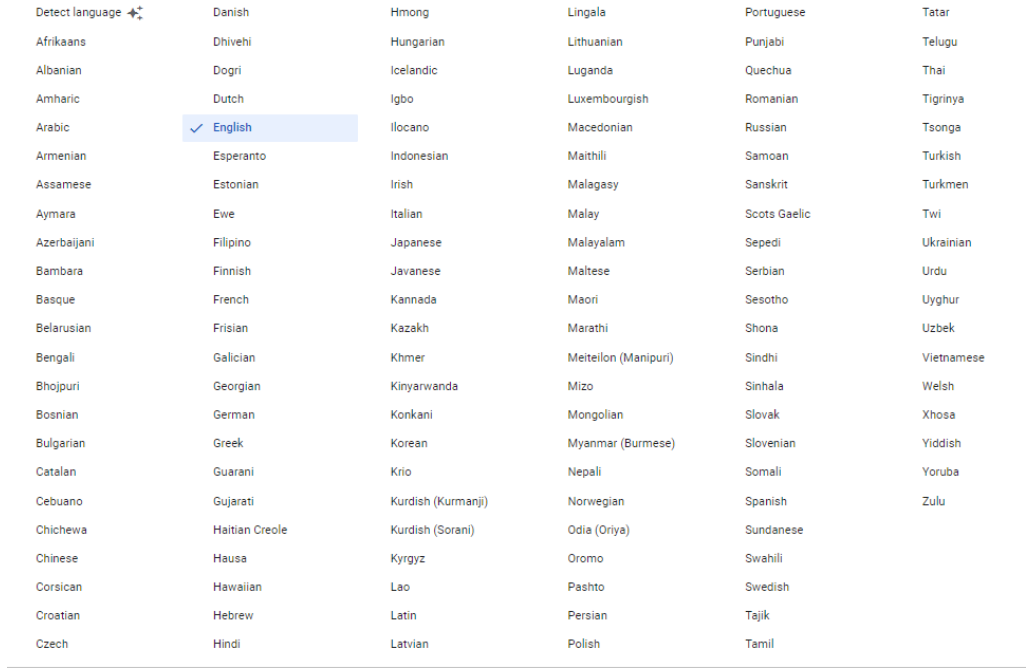
- The branch of artificial intelligence (AI) concerned with giving computers the ability to understand text and spoken words in much the same way human beings can.



https://huggingface.co/task

Language Translation

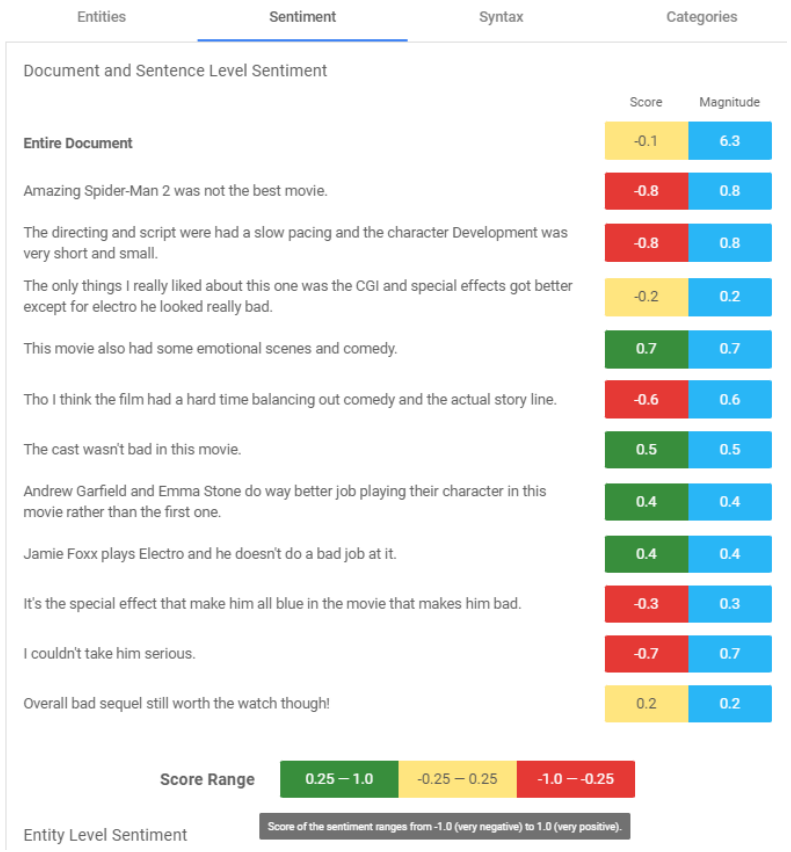
https://translate.google.com



Sentiment analysis

- Extract subjective qualities (e.g. attitude, emotion) from text.
- Predict whether a movie review is positive or negative, based on the words in the movie review

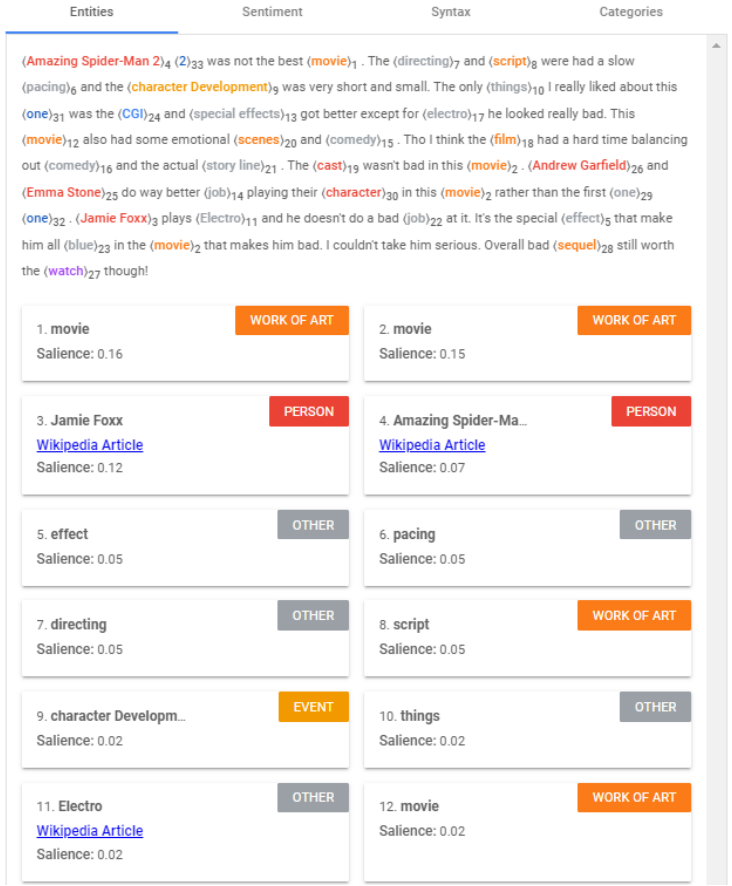
Amazing Spider-Man 2 was not the best movie. The directing and script were had a slow pacing and the character Development was very short and small.
The only things I really liked about this one was the CGI and special effects got better except for electro he looked really bad. This movie also had some emotional scenes and comedy. Tho I think the film had a hard time balancing out comedy and the actual story line. The cast wasn't bad in this movie. Andrew Garfield and Emma Stone do way better job playing their character in this movie rather than the first one. Jamie Foxx plays Electro and he doesn't do a bad job at it. It's the special effect that make him all blue in the movie that makes him bad. I couldn't take him serious. Overall bad sequel still worth the watch though!

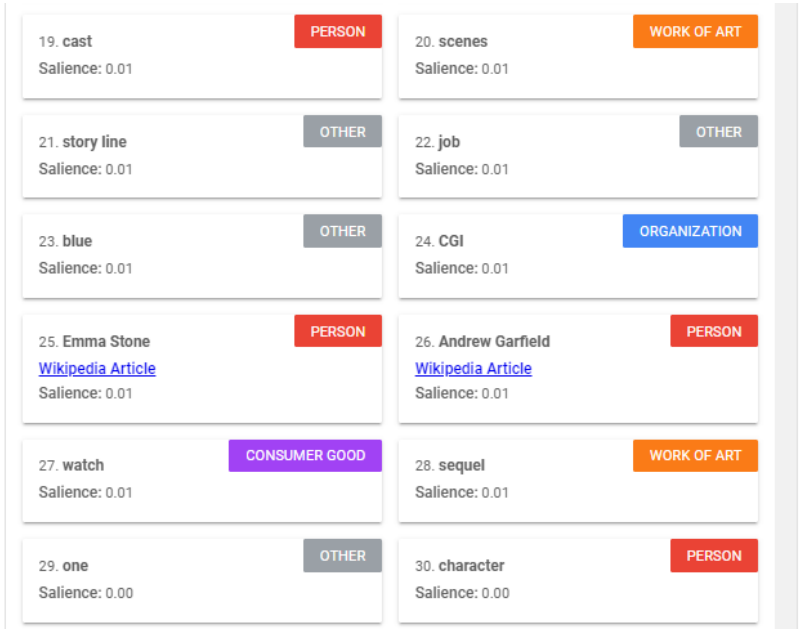


https://cloud.google.com/natural-language

Named Entity Recognition (NER)

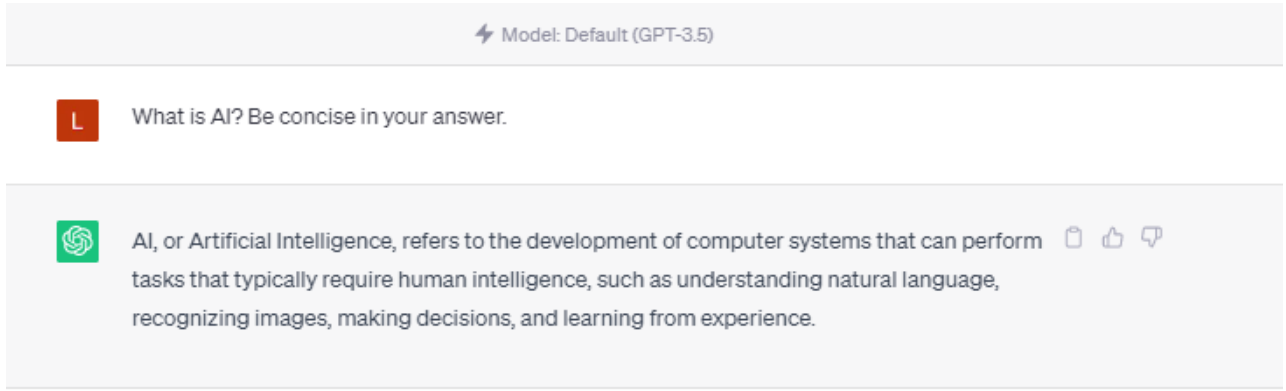
- Identify specific entities in a text, such as dates, individuals and places

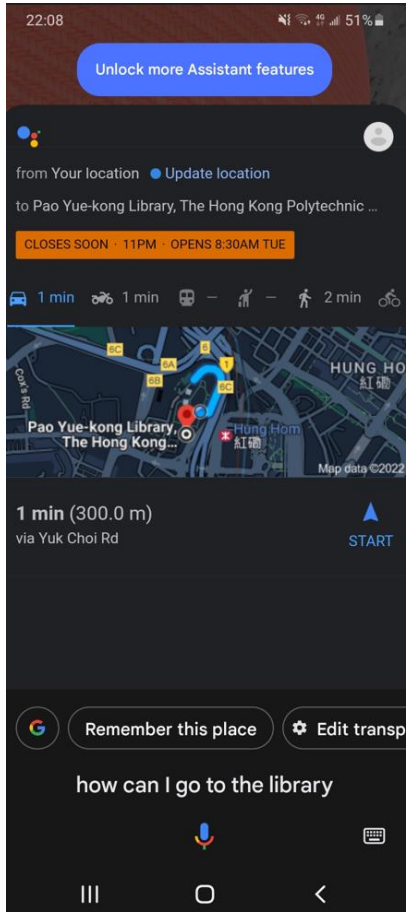




Chatbots

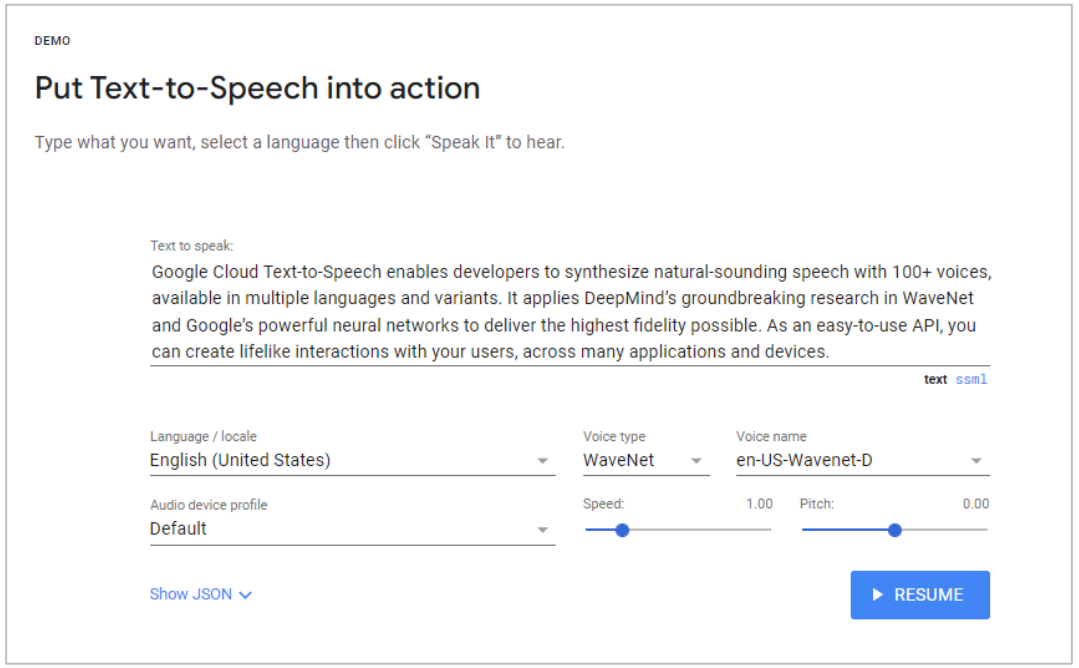
- Software application built to simulate a human-like conversation.
- Involve speech recognition, natural language processing and speech synthesis
- Examples
  - Amazon Alexa, Google Assistant, Siri
- Alexa brings out the best you | Alexa for your kitchen | Amazon Alexa
  - https://www.youtube.com/watch?v=GTFmGsiXC_U





Text to speech

- Text-to-Speech (TTS) is the task of generating natural sounding speech given text input.
- May generates speech for multiple speakers and multiple languages.



https://cloud.google.com/text-to-speech

Speech to text

- Convert voice to text

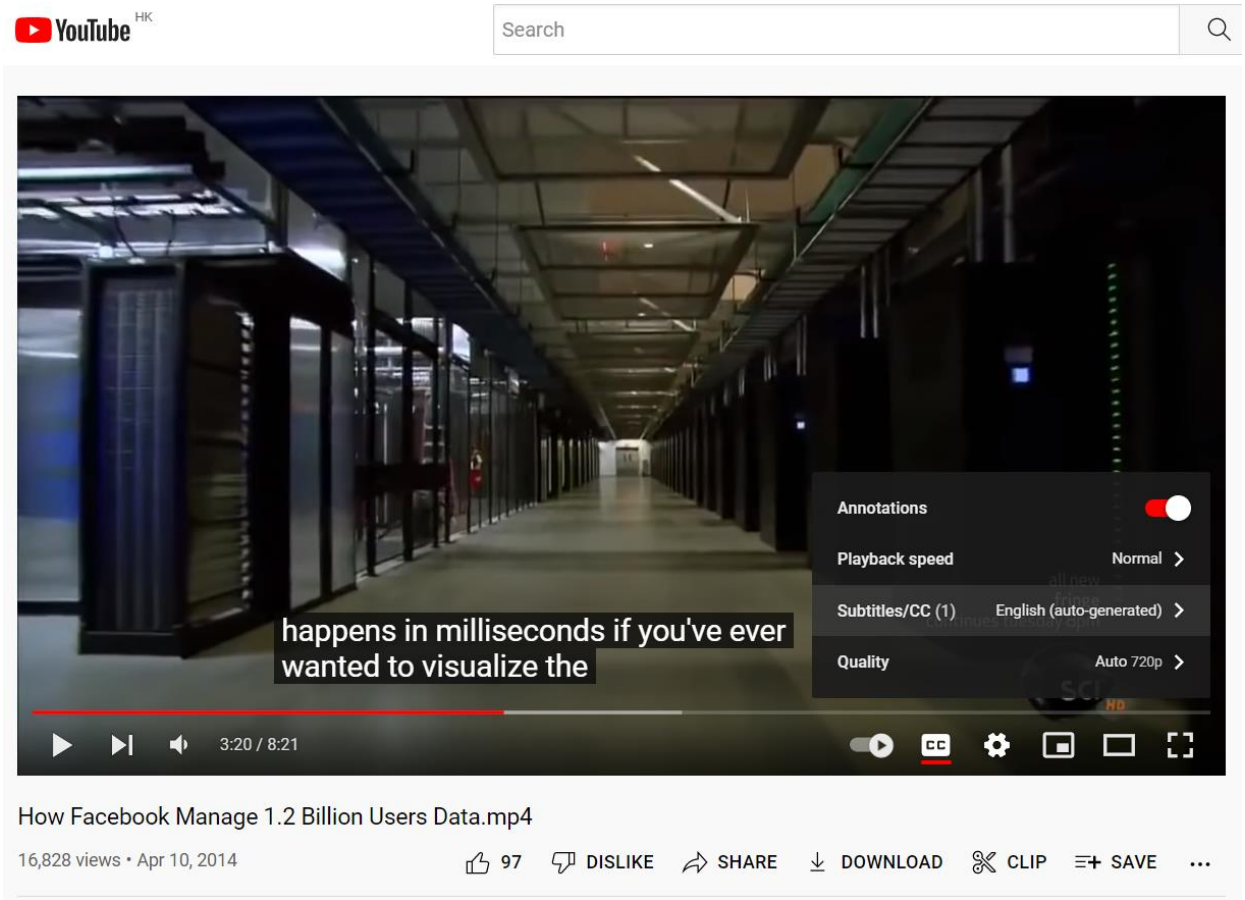
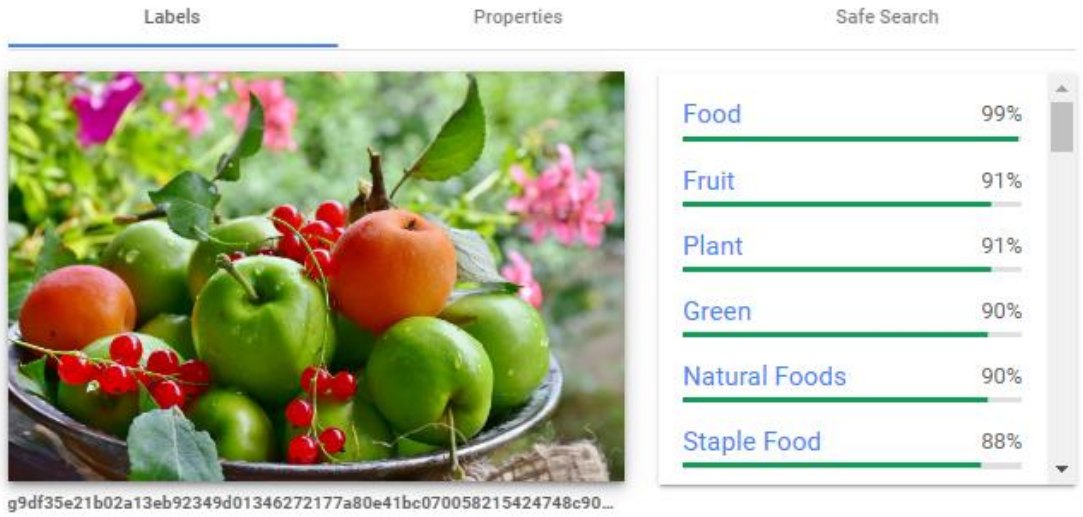


Image classification

- Image classification models take an image as input and return a prediction about which class the image belongs to.
- Images are expected to have only one class for each image.



https://cloud.google.com/vision

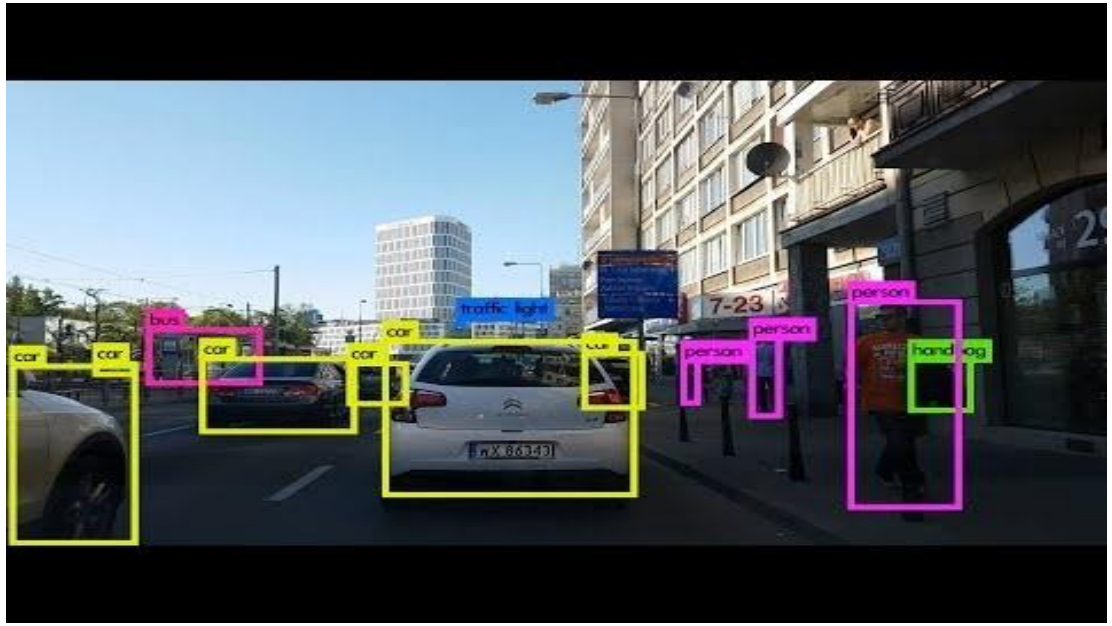
Object Detection

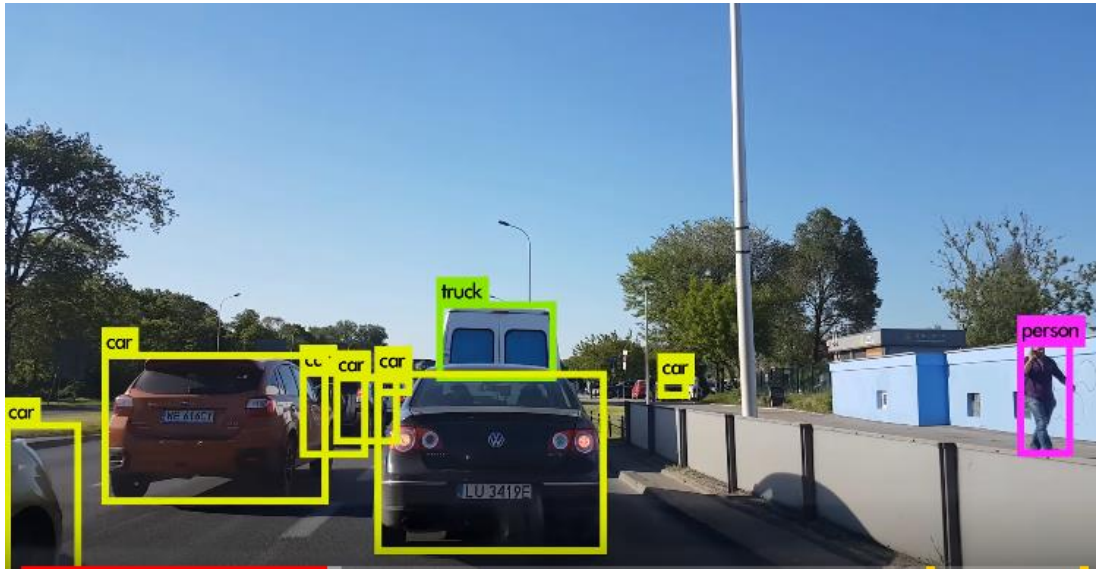
- Takes an image as input and output the images with bounding boxes and labels on detected objects.

Video: [How computers learn to recognize objects instantly]

Vehicle/Object Detection

- Classify and detect the objects in the image.
- Assign a class to each object and draw a bounding box around it.





https://www.youtube.com/watch?v=EhcpGpFHCrw

Autonomous Driving Car

- Self-driving vehicles or “driverless” cars
- Combine sensors and software to control, navigate, and drive the vehicle.
- Drivers are NOT required to take control to safely operate the vehicle.

Dave-2 A Neural Network Drives A Car

https://www.youtube.com/watch?time_continue=438&v=NJU9ULQUwng

Demo: Steering angle prediction with deep learning