RESPONSIBLE ARTIFICIAL INTELLIGENCE LAB (RAIL)

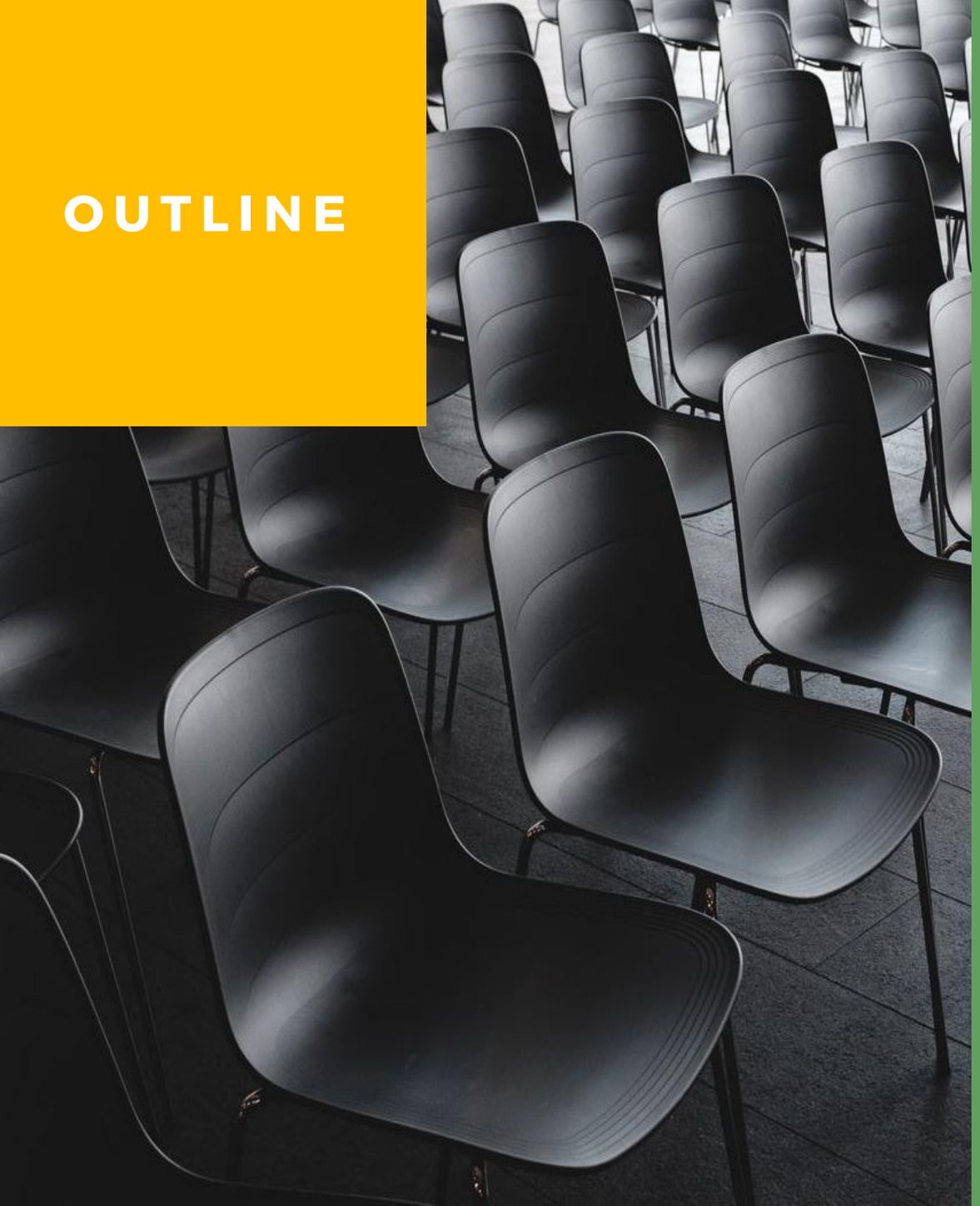
Introduction to Artificial Intelligence

ARTIFICIAL INTELLIGENCE FOR DEVELOPMENT AFRICA

RESPONSIBLE ARTIFICIAL INTELLIGENCE LAB

5th December 2022

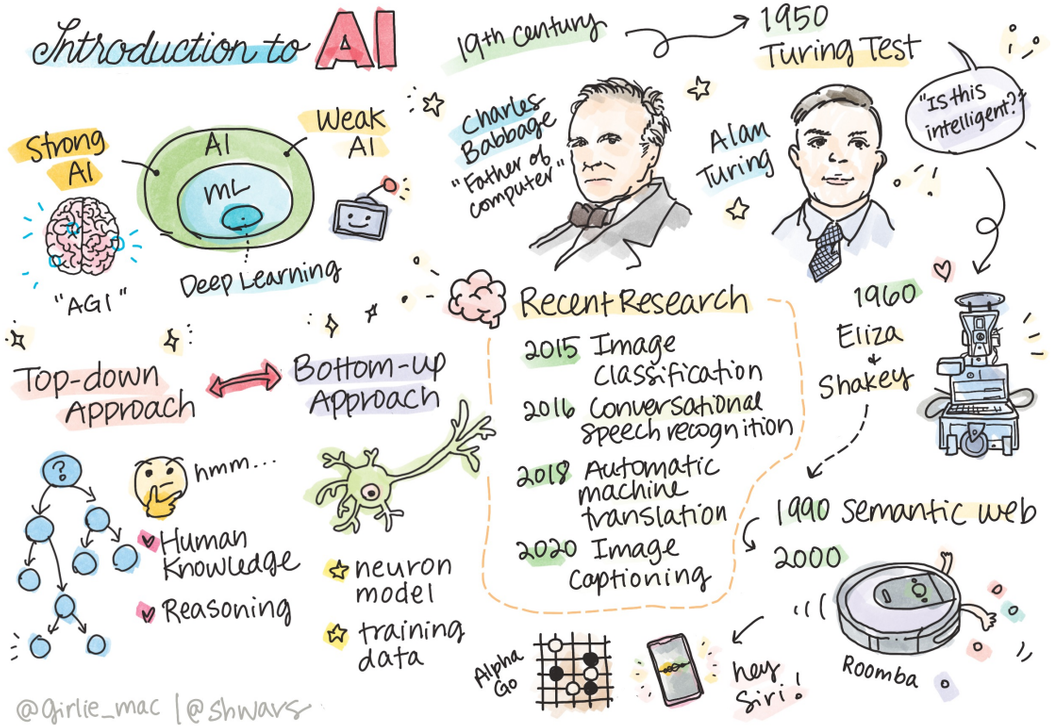
OUTLINE



1. What is AI
2. Weak AI vs Strong AI
3. Intelligence in AI
4. Different Approaches to AI
5. Brief History
6. Recent Advances

What is AI?

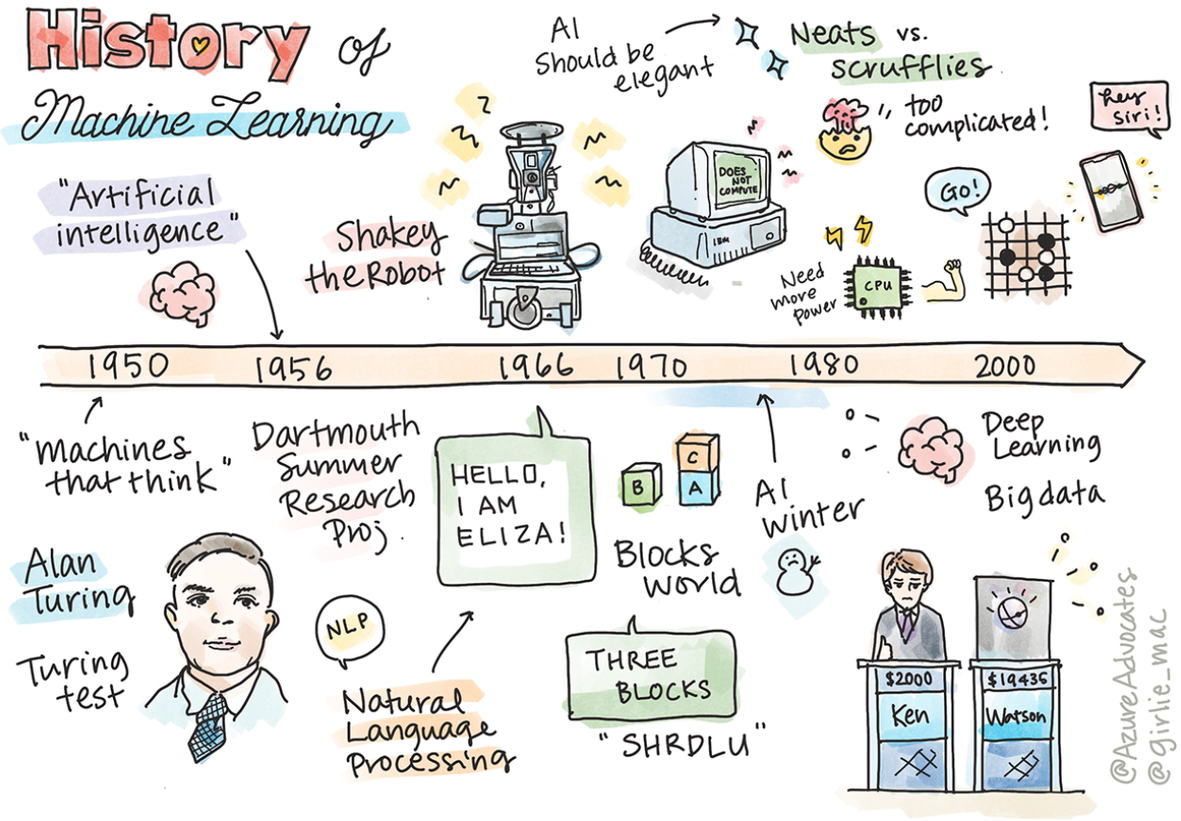
- Artificial Intelligence is an exciting scientific discipline that studies how we can make computers exhibit intelligent behaviour, e.g. do those things that human beings are good at.



What is AI?

Though significantly more advanced, modern computers still operate on numbers following a well-defined procedure - an algorithm.

Thus it is possible to program a computer to do something if we know the exact sequence of steps that we need to do to achieve the goal.



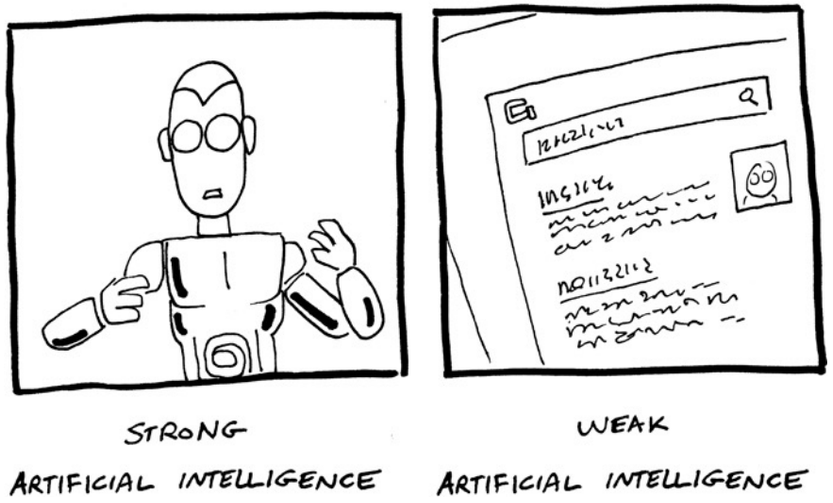
What is AI?

- There are some tasks, however, that we do not explicitly know how to solve.
- Consider determining the age of a person from their photograph.
- This is precisely the category of task that interests Artificial Intelligence (AI for short).

Weak AI vs. Strong AI

- Weak AI
  - creating a system for only one task, and not a system that can solve many tasks, such as can be done by a human being. (e.g. Age Guesser)

- Strong AI (Artificial General Intelligence(AGI)
  - developing a generally intelligent computer system is also extremely interesting from many points of view, including for students of the philosophy of consciousness.

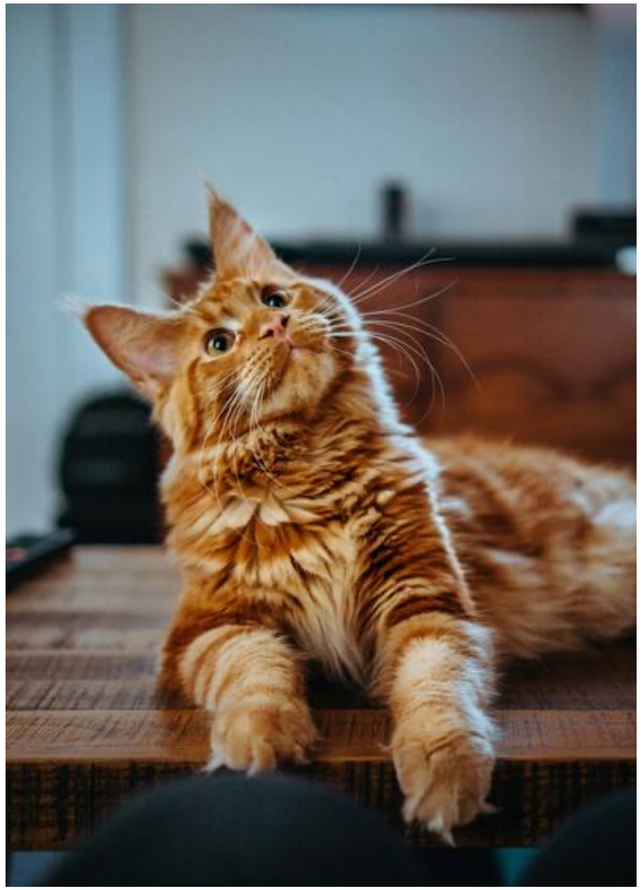


Intelligence in AI

- When speaking about AGI, we need to know if we have created a truly intelligent system.

- Alan Turing proposed a way called the ”**Turing Test**”, which also acts as a definition of intelligence.

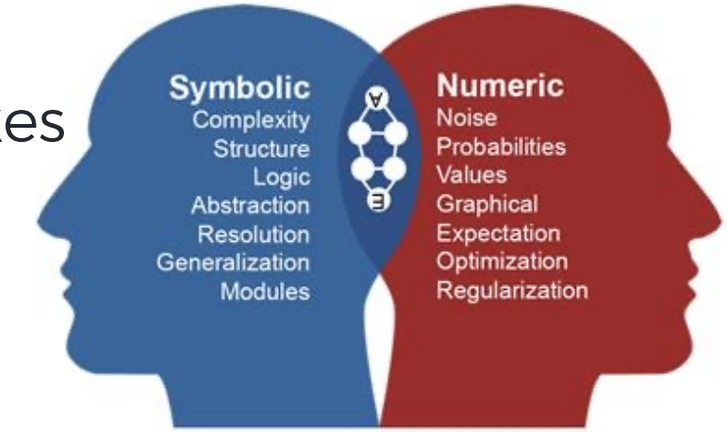
- Have you ever been fooled by a chatbot into thinking you were speaking to a human?
  - How did it convince you?



Different Approaches to AI

- If we want a computer to behave like a human, we need to model somehow our way of thinking into a computer.

- Consequently, we must try to understand what makes a human intelligent.



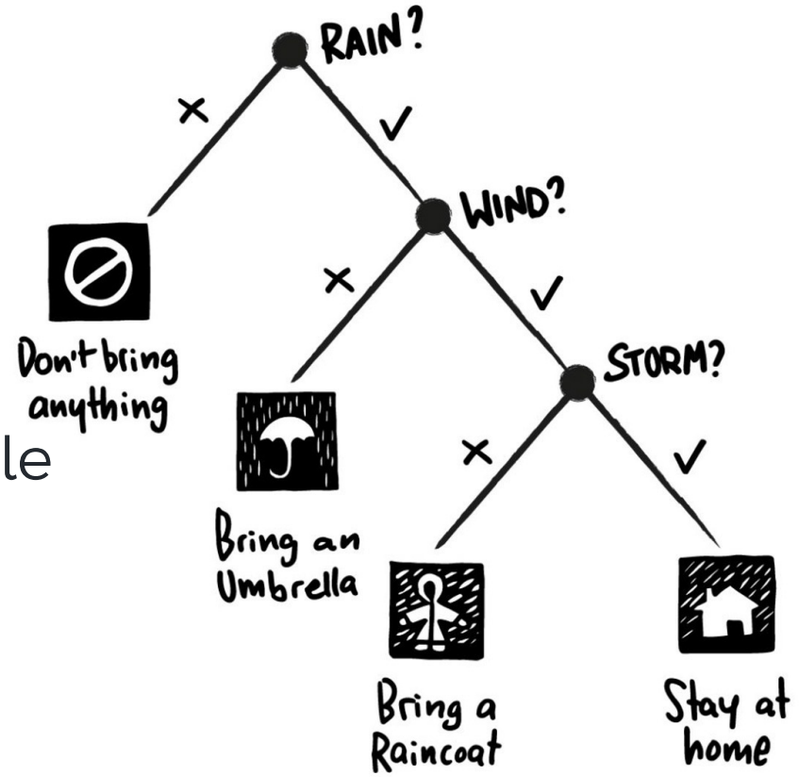
- There are two possible approaches to this problem:
  - Top-down approach (Symbolic Reasoning),
  - Bottom-up approach (Neural Networks)

Top-Down Approach (Symbolic Reasoning)

- A top-down approach models the way a person reasons to solve a problem.

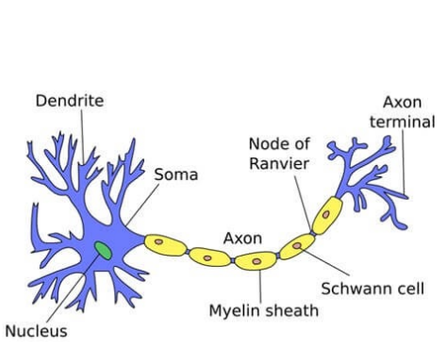
- It involves extracting **knowledge** from a human being and representing it in a computer-readable form.

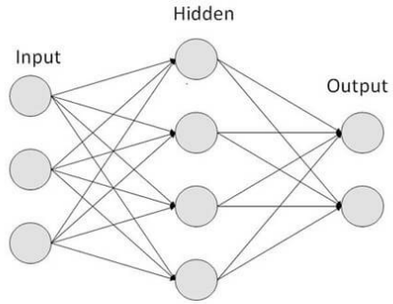
- We also need to develop a way to model **reasoning** inside a computer.



Bottom-Up Approach (Neural Networks)

- A bottom-up approach models the structure of the human brain,
  - consisting of a vast number of simple units called neurons.

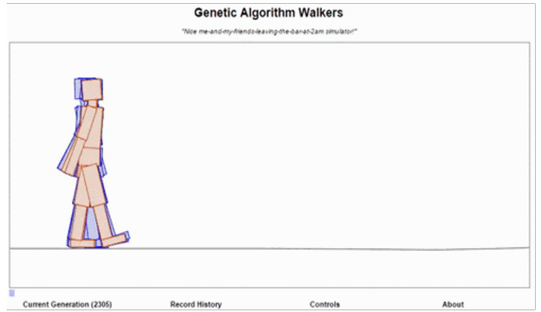


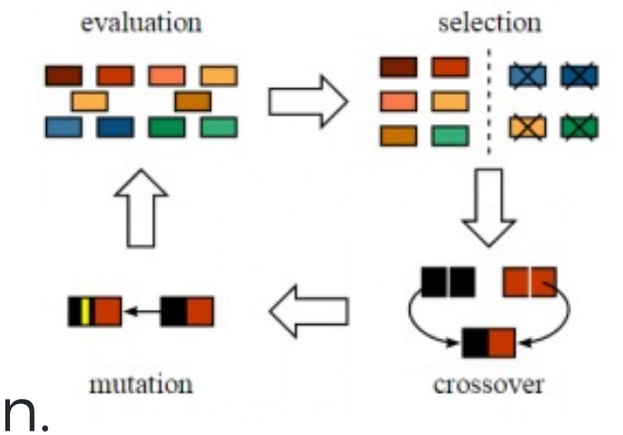


- Each neuron acts like a weighted average of its inputs
  - we can train a network of neurons to solve practical problems by providing training data.

Other Approaches to Intelligence

- An **Emergent**, **Synergetic** or **multi-agent** approach is based on the fact that complex, intelligent behaviour can be obtained by interacting with many simple agents.
  - Intelligence can emerge from more simple, reactive behaviour in the process of metasystem transition.





- An **Evolutionary** approach or **genetic algorithm** is an optimisation process based on the principles of evolution.

Brief History of AI

1950

Term "AI"

Chess play as Search

Isaak Asimov, 3 laws of robotics

Turing Test

1960

ELIZA talking bot

Tree Decision Making

Shakey

1970

AI Winter: Critical Feedback

Scruffy vs Neat AI

1980

Expert Systems

Revival of Connectionism

1990

Did we ask too much?

Computer learns to play games – Deep Blue

Semantic Web

2000

Everything needed a Face

iRobot

Google Self-Driving Car

Roomba

2010

IBM Watson wins Jeopardy

Voice Assistants by Google, Apple, Microsoft

> 2014

Eugene Goostman

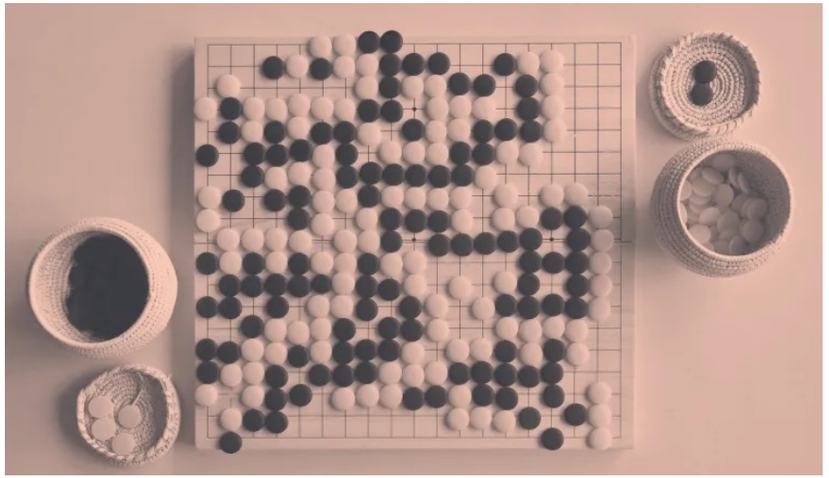
Human parity in Image Recognition & Voice Recognition

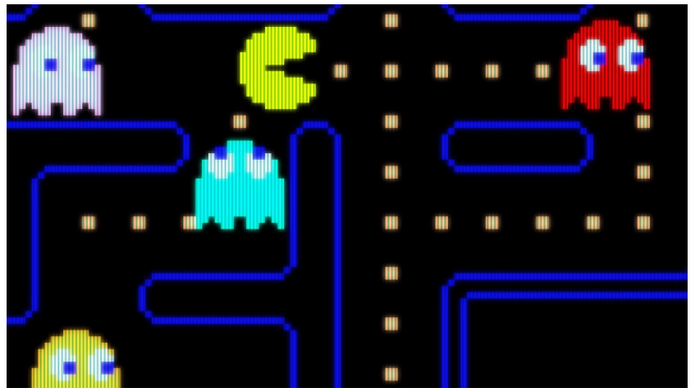
Alpha Go / Alexa

AI: Broken Into sub-fields

Breather…

- Do a little research on other games that AI has played





Chatbots– Passing the Turing Test

Turing Test Evolution

1966 — **2014** — **2021**

ELIZA

- Tell me about your family
- My father takes care of me
- Who else from your family takes care of you?
- My mother
- Your mother?

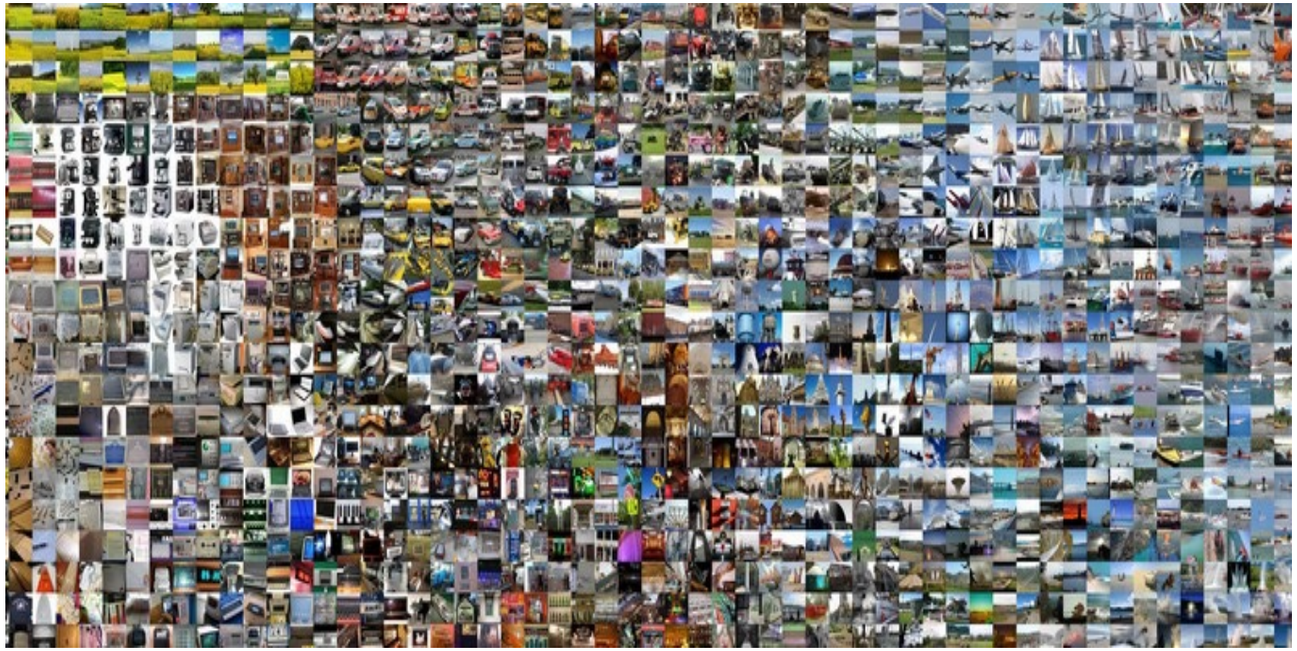
Eugene Goostman

GPT/Turing NLG

The best treatment against stress, according to British scientists, are kittens. In a recent research they found that 43% of people are likely to feel relaxed at a presence of a kitten…

Recent AI Advances - ImageNet

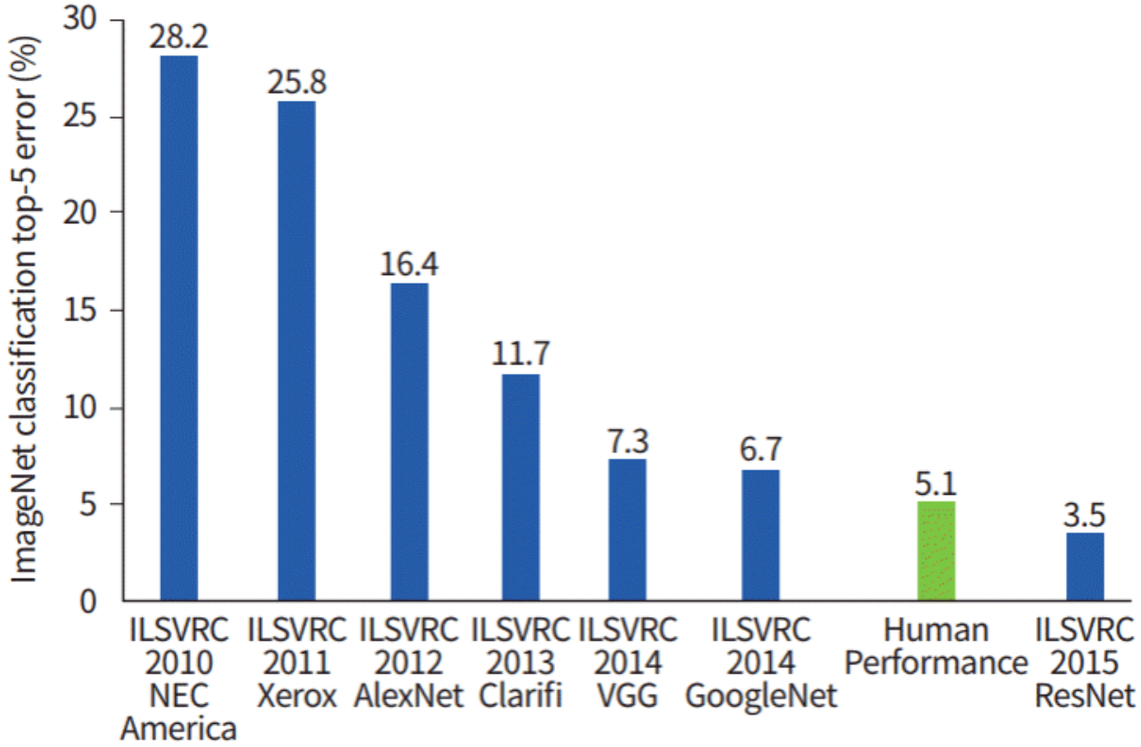
A vast collection of images called ImageNet, which contains around 14 million annotated images, gave birth to the ImageNet Large Scale Visual Recognition Challenge (**ILSVRC**).



Recent AI Advances – Neural Networks

In 2012, Convolutional Neural Networks were first used in image classification, which led to a significant drop in classification errors (from almost 30% to 16.4%).

In 2015, **ResNet** architecture from Microsoft Research achieved human-level accuracy.



Recent AI Advances – Neural Networks

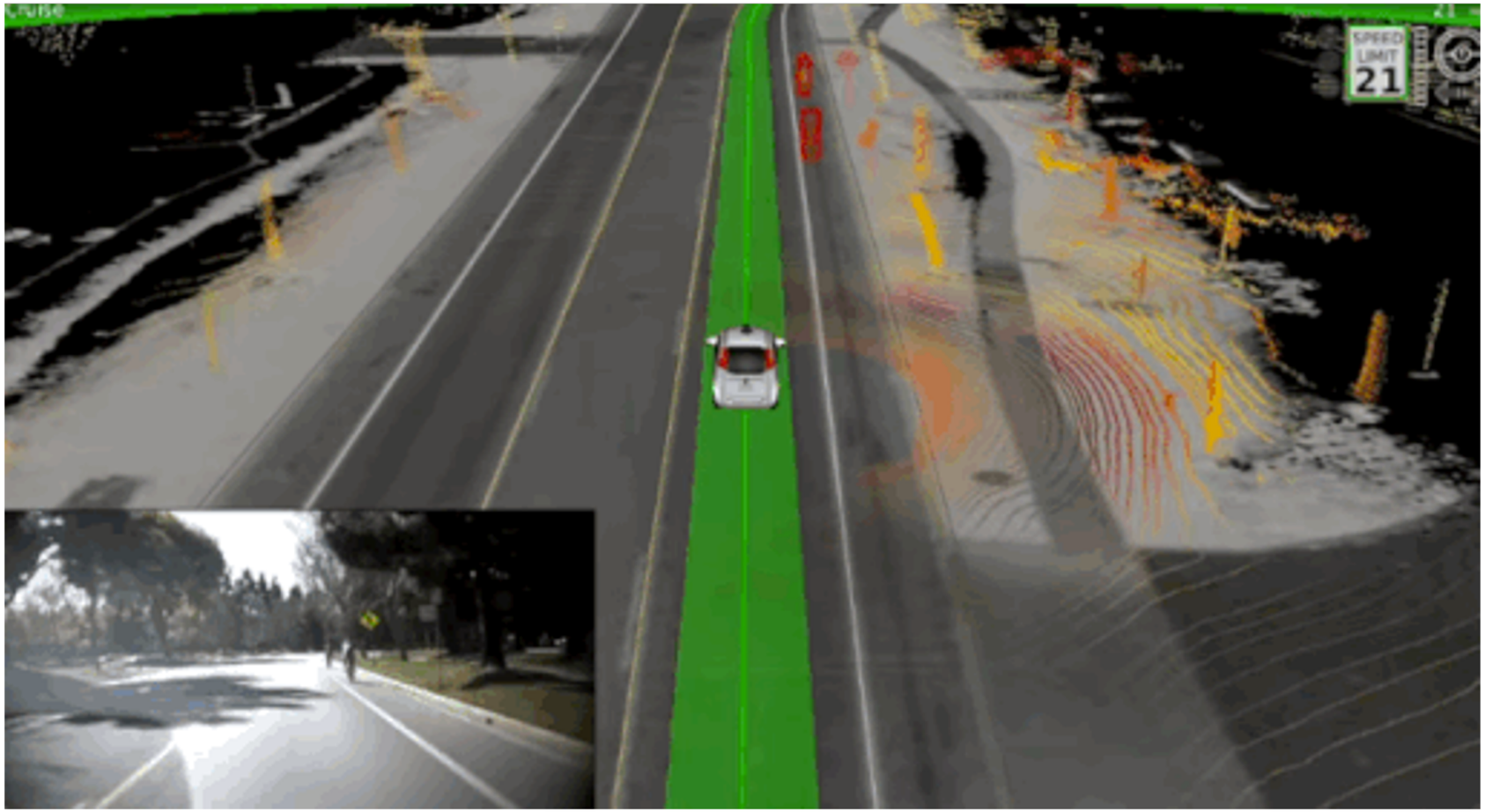
Since 2015, Neural Networks have demonstrated very successful behaviour in many tasks:

Year	Human Parity achieved
2015	Image Classification
2016	Conversational Speech Recognition
2018	Automatic Machine Translation (Chinese-to-English)
2020	Image Captioning

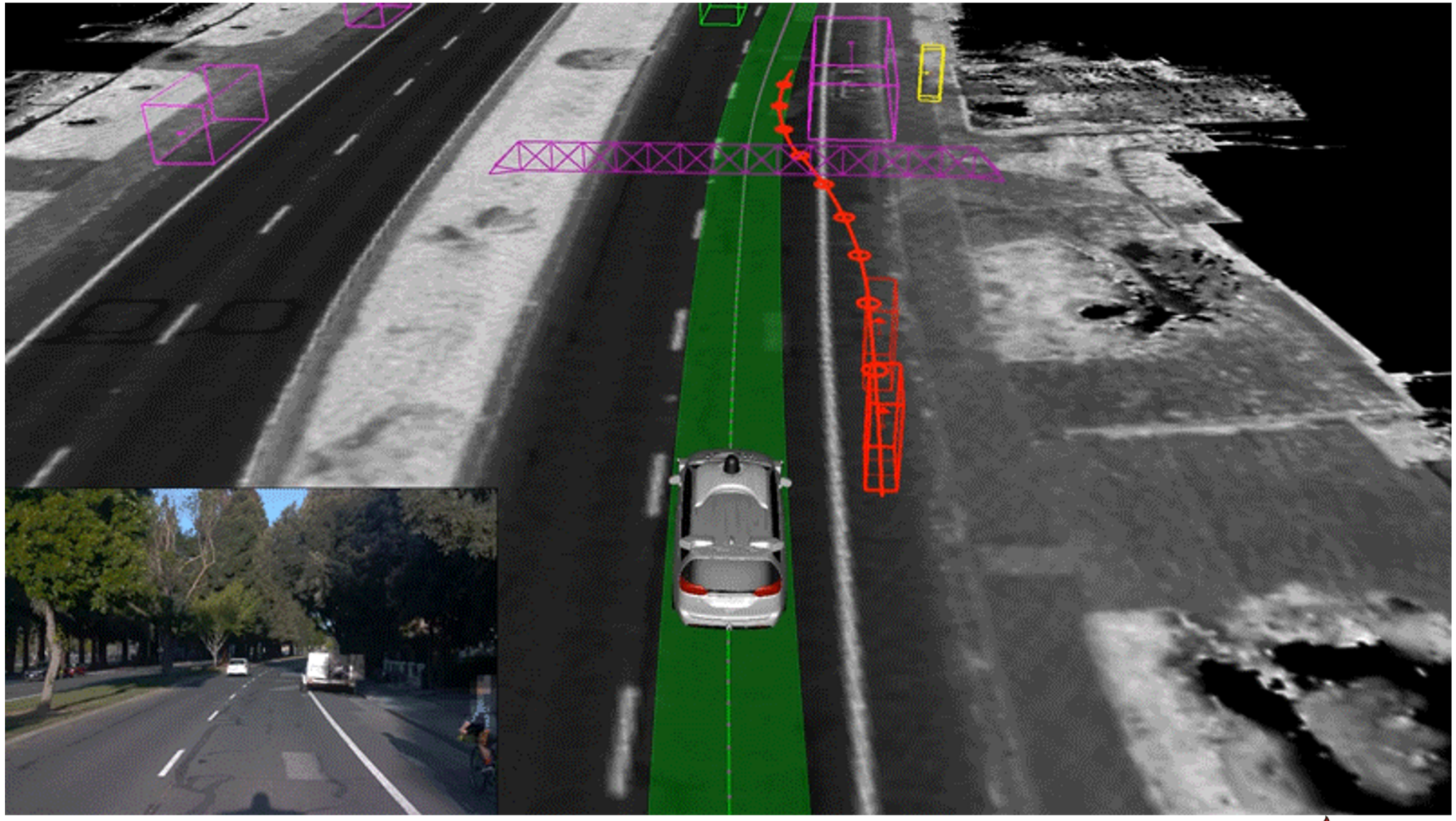
Recent AI Advances – Autonomous Driving

Self-driving cars have become possible primarily thanks to computer vision and deep learning.

Recent AI Advances – Autonomous Driving

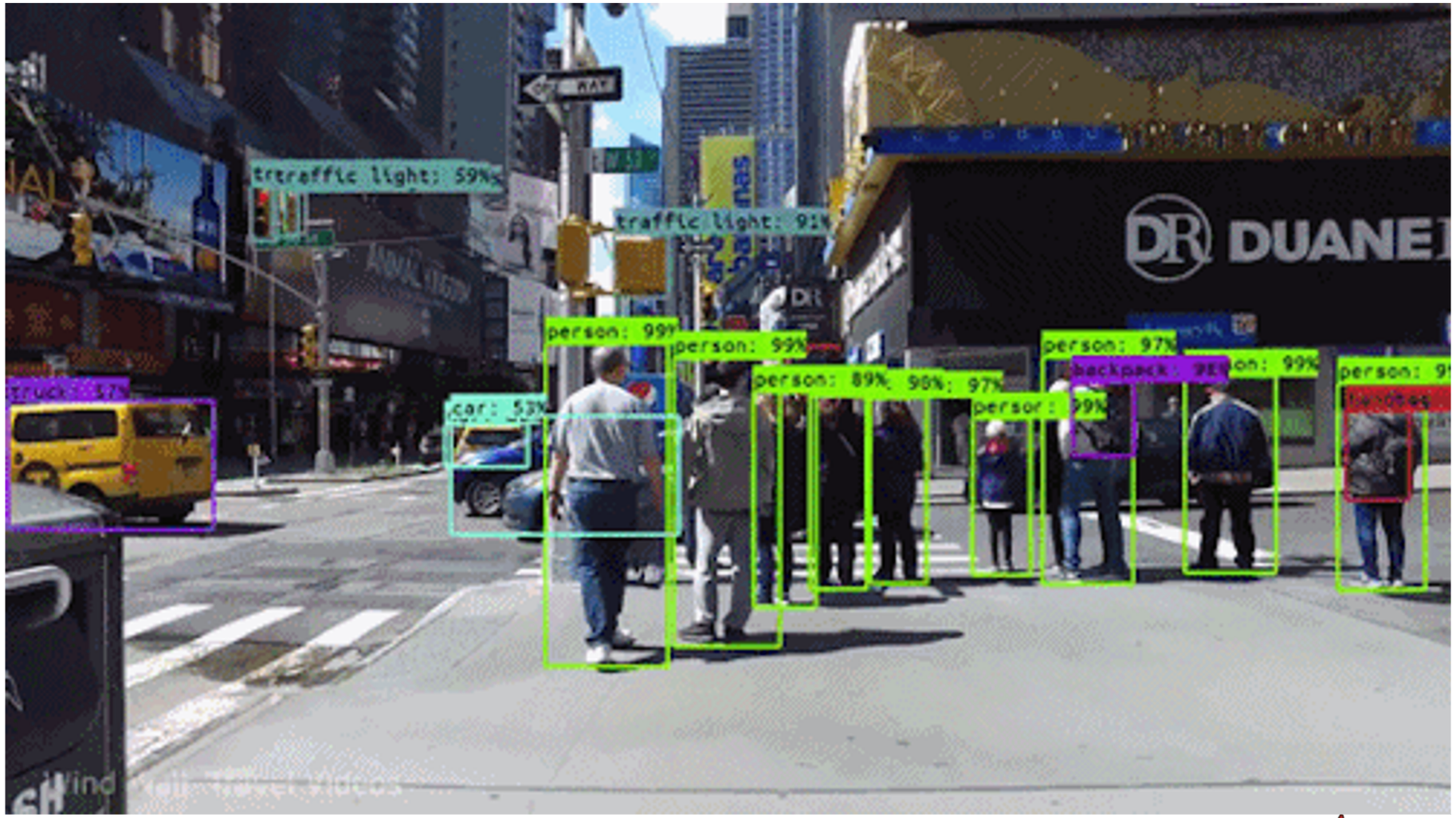


Recent AI Advances – Autonomous Driving



Recent AI Advances – Autonomous Driving

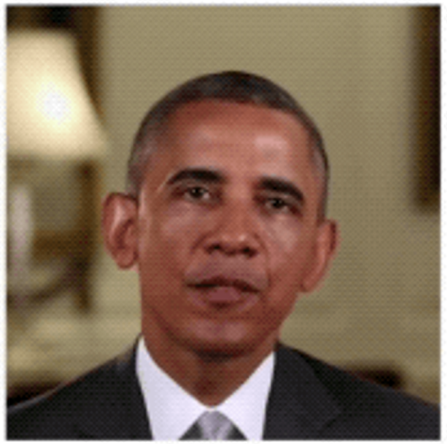
Recent AI Advances – Object Recognition



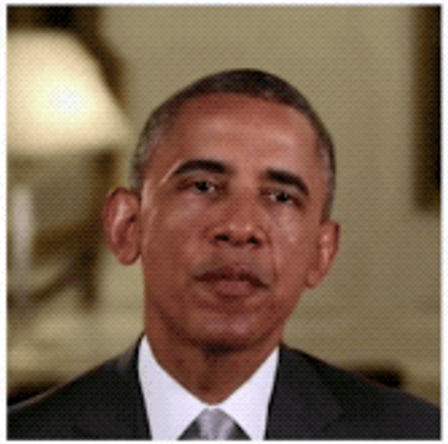
Recent AI Advances – GANs

Recent AI Advances - DeepFake

Source Sequence

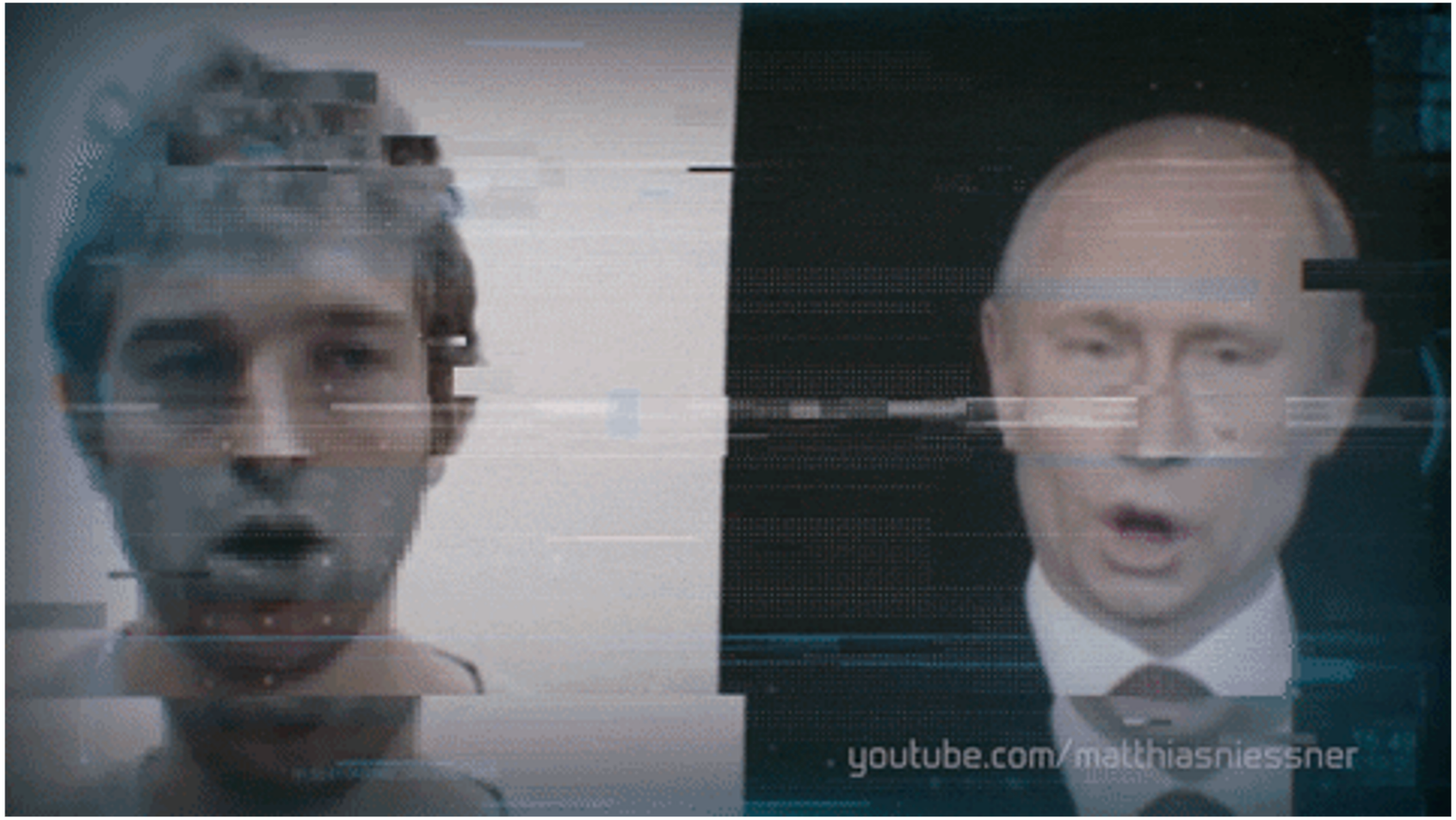


Our Reenactment (Full Head)



Averbuch-Elor et al. 2017

Recent AI Advances - DeepFake



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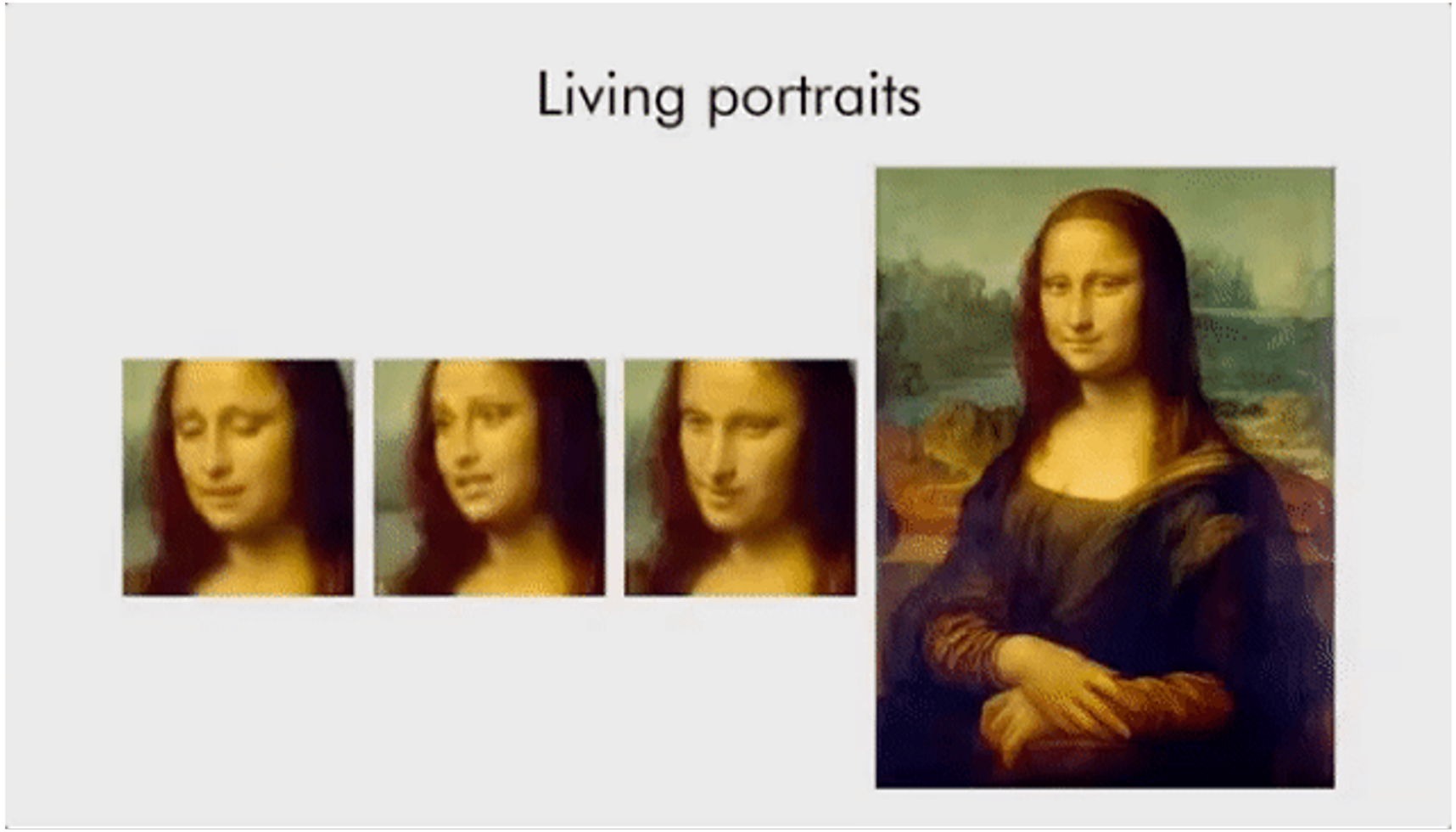
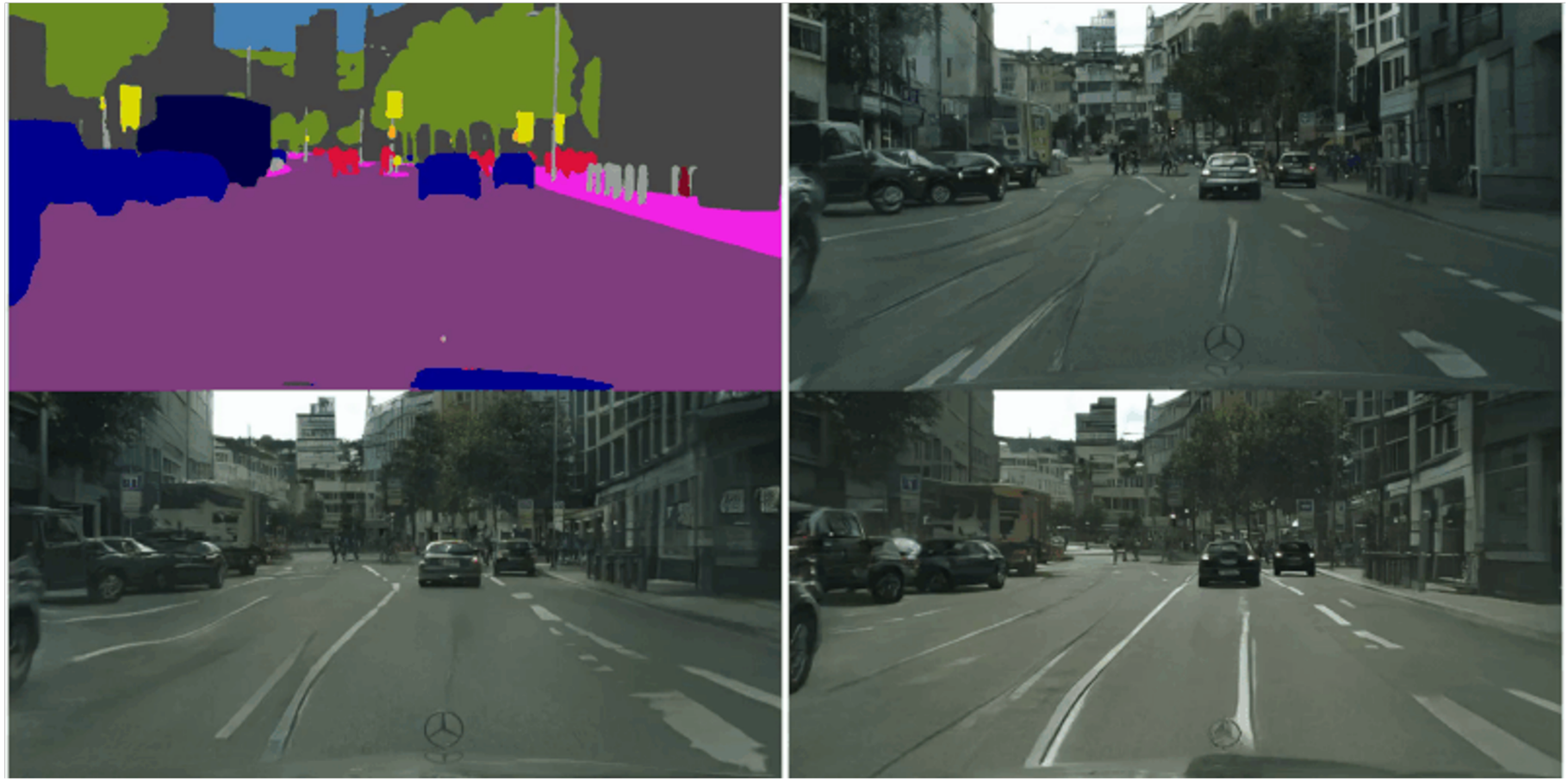


Recent AI Advances – Virtual Spaces

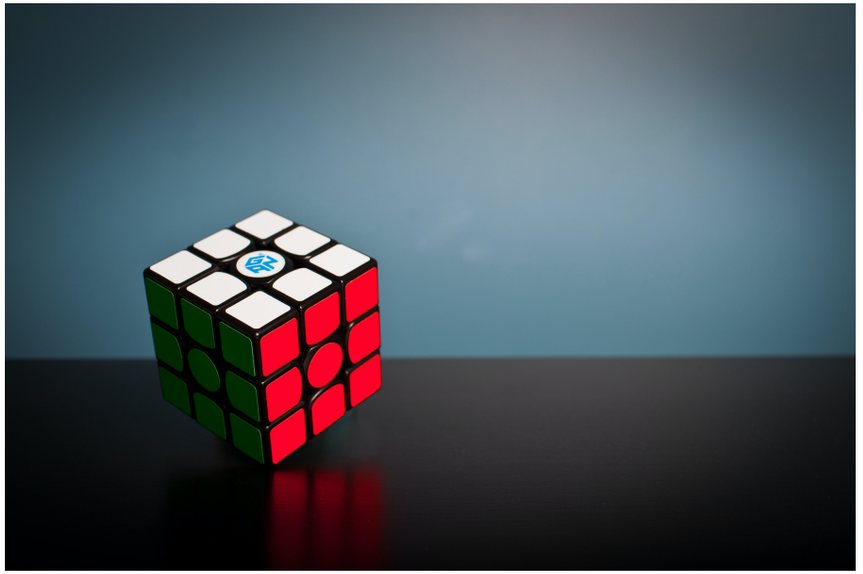


Activity

Do a tour of the internet to determine where, in your opinion, AI is most effectively used.

Is it in a navigation app, speech-to-text service or a video game?

Research how the system was built.



THANK YOU FOR YOUR TIME

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