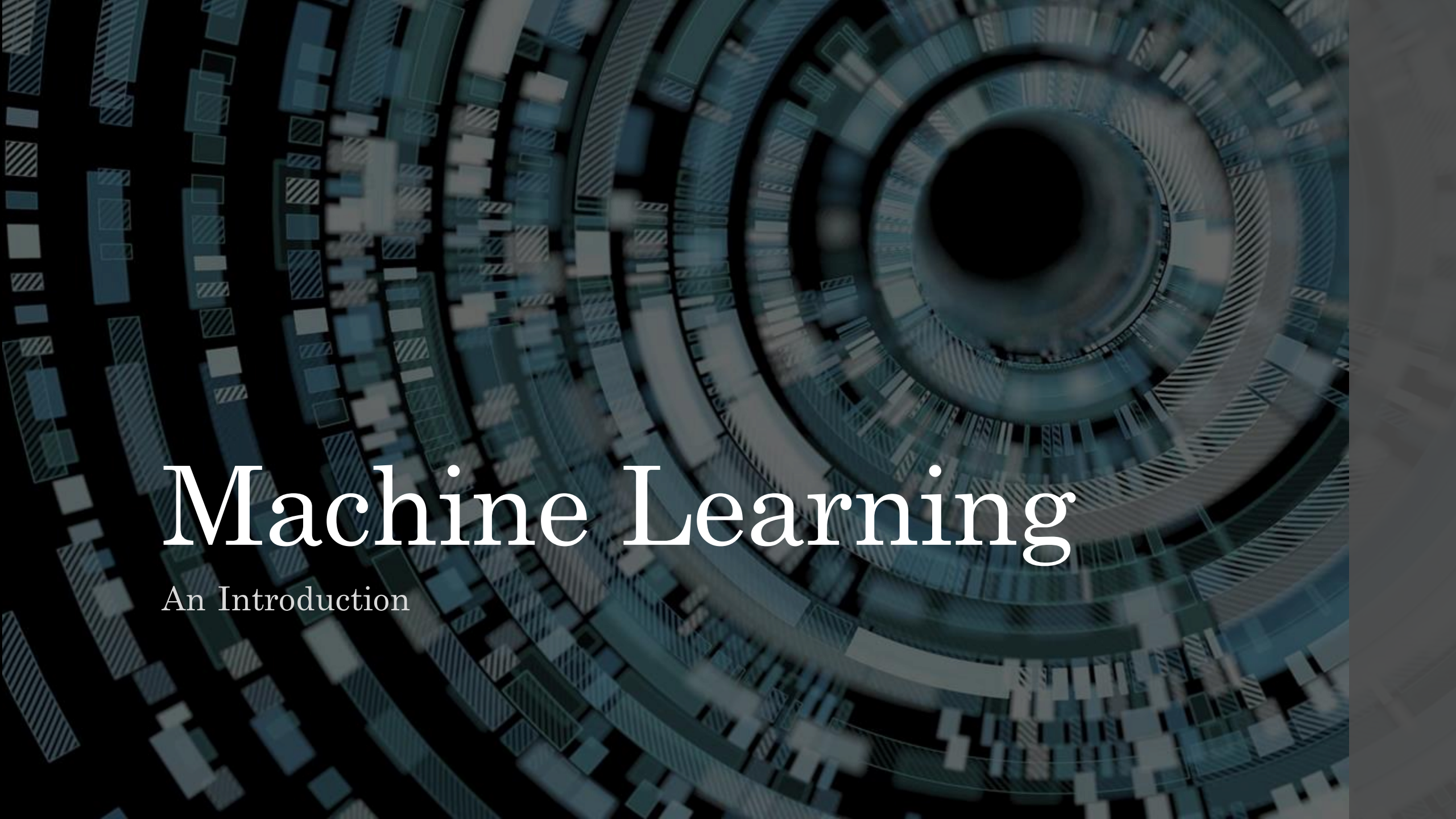


Machine Learning

An Introduction

What is **Artificial Intelligence**, **Machine Learning**, and **Deep Learning**?

Artificial Intelligence

- AI is the science of making things smart [1]
- AI is can be defined as the ability of a machine to perform cognitive functions we associate with human minds, such as perceiving, reasoning, learning, interacting with the environment, problem solving, and even exercising creativity [2]

1. https://goo.gl/5Wd2vy
2. https://www.mckinsey.com/business-functions/mckinsey-analytics/our-insights/an-executives-guide-to-ai

AI: Common Applications

Object recognition

Speech recognition

Language Translation

Creative (e.g., Style Transfer – Learning to draw an image in the style of an artist

Prediction

Natural Language Processing

Recommendation System

Chat bot

Machine Learning

- Machine Learning (ML) is a technique of learning from the data
- ML is a sub-field of AI that allows machines to learn from the data without being explicitly programmed
- ML allows users to input vast amounts of data into a computer algorithm, and then, lets the computer analyze the information to provide data-oriented predictions based only on the knowledge (rules) extracted from the data
- The efficient prediction (fast and accurate) of ML algorithms is a reason why ML has become so successful in many fields today

Ref: eBook_Machine_Learning_bg_guide.pdf

ML: Learning

- ML algorithms are designed in such a way that they can extract knowledge (rules) from any data. These rules are mappings (function) from input data to output data - questions to answers
- Once the code is written for an ML application, the same code can then be re-used for future applications (e.g., the code written to recognize human faces can also be used to recognize animal faces provided we supply new data consisting of animal faces) - very powerful
- ML algorithms can easily adapt to new data
- After learning, ML algorithms can accurately predict answers to the new questions (unseen data) - accurate prediction

Deep Learning

- Deep Learning is one of the key algorithms used in Machine Learning
- DL was used in AlphaGo, a Go-playing program developed by Google that defeated the top human player in 2016
- DL allows non-expert user to develop an expert level application
- E.g., Merck activity prediction challenge in 2012, where a deep neural network not only won the competition and outperformed Merck's internal baseline model, but did so without having a single chemist or biologist in their team

Ref: deep learning for computational chemistry.pdf

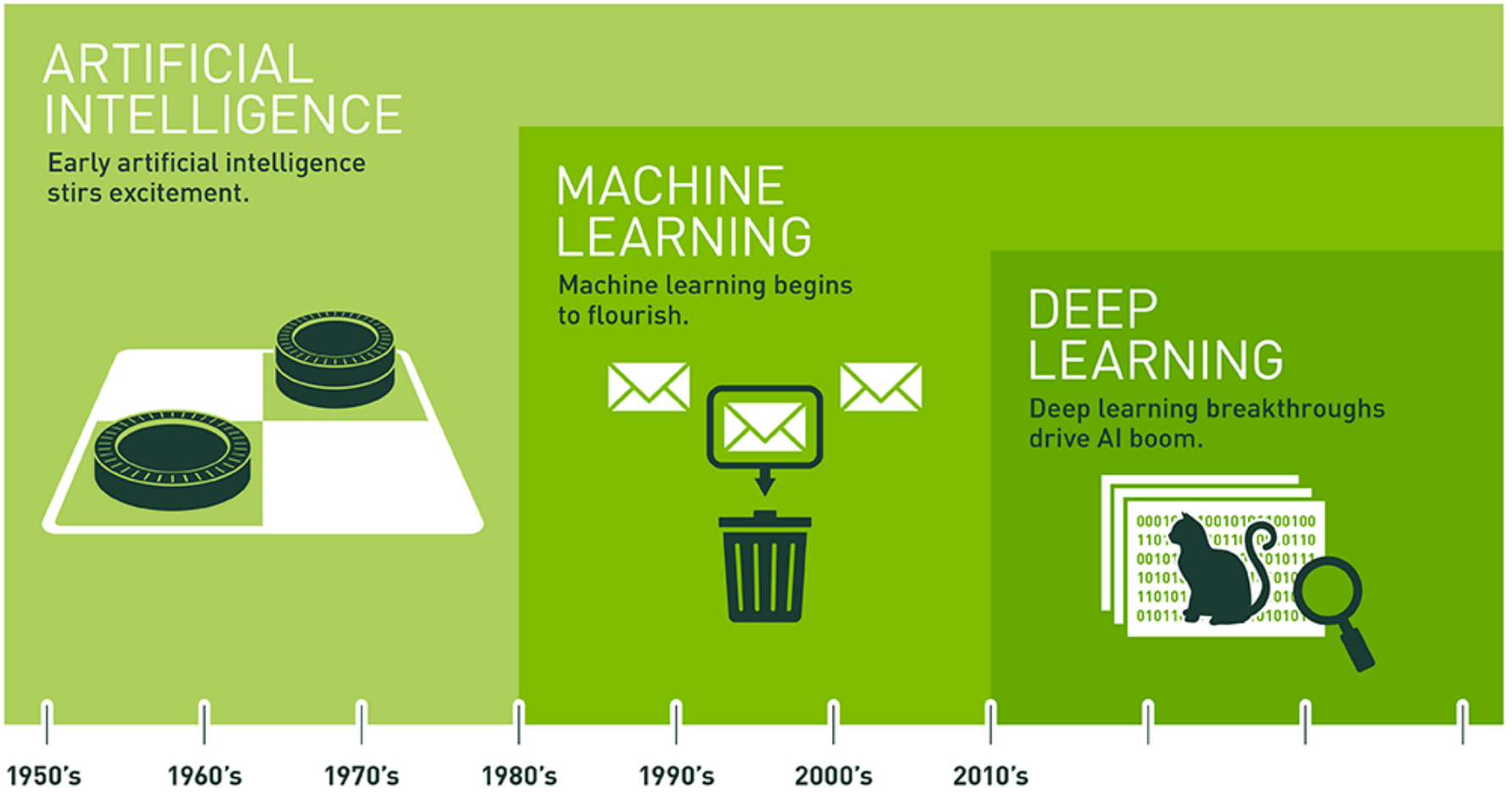
Deep Learning

- Deep learning algorithms use networks inspired from the neurons in our brain
- Deep learning powers many advanced applications today (e.g., face recognition, robotics, language translation etc.)

ML: Who can use?

- Surprisingly, anyone can use ML today
- You don't have to be an expert
- Only familiarity with a programming language (e.g., python) is needed, you don’t have to be expert in coding
- ML algorithms are already implemented (e.g., tensorflow, pytorch etc.)
- All you need is a data, that's it!

Summary



Ref: https://towardsdatascience.com/deep-learning-weekly-piece-the-differences-between-ai-ml-and-dl-b6a203b70698

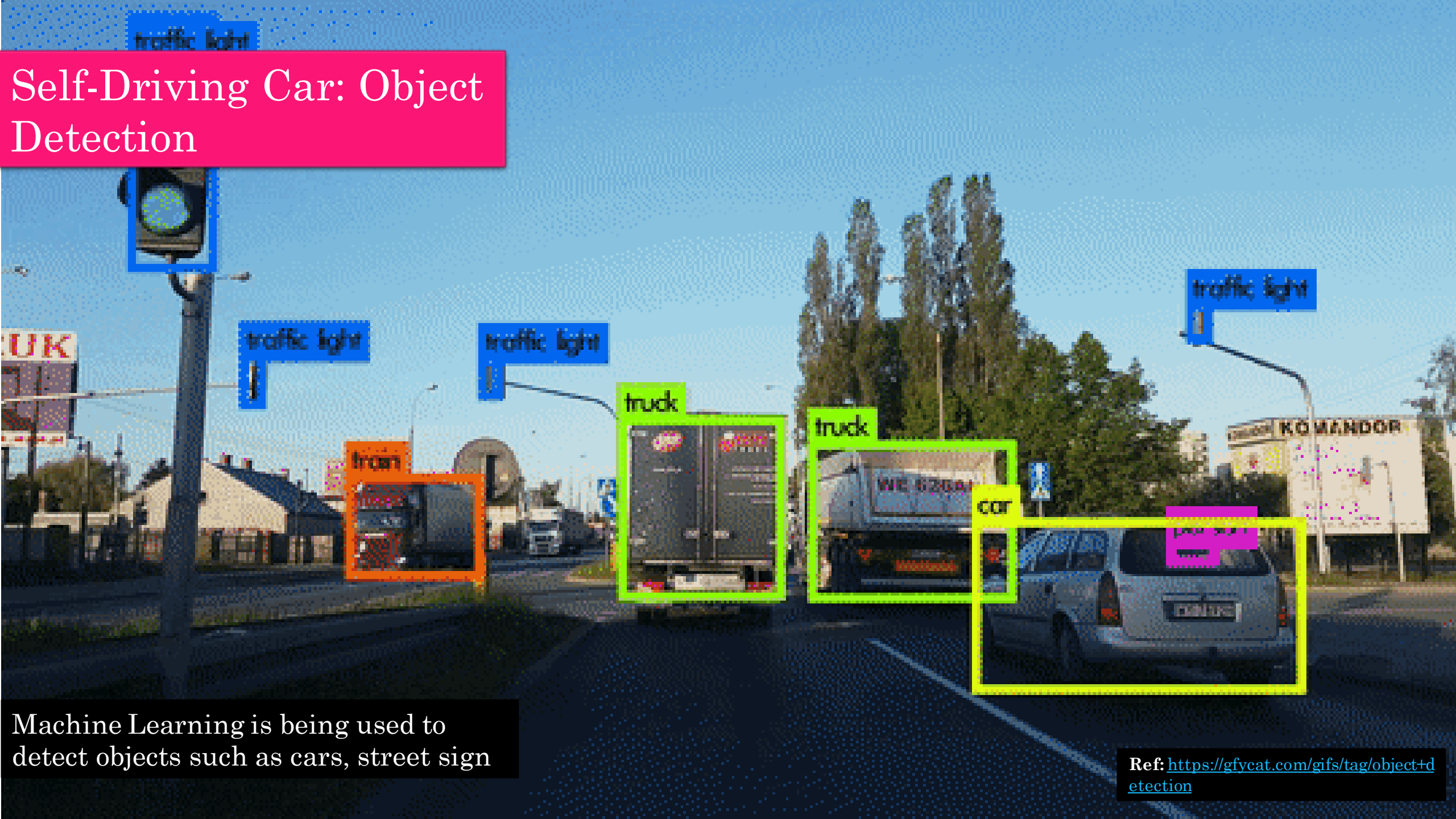
Some Applications

Google Lens

AI is a necessary part of Google's search in order to provide the most suitable results. In combination with your GPS, it recognizes business that you're passing in the street.

Ref: https://www.diyphotography.net/google-lens-will-turn-smartphones-camera-powerful-ai-ar-search-tool/

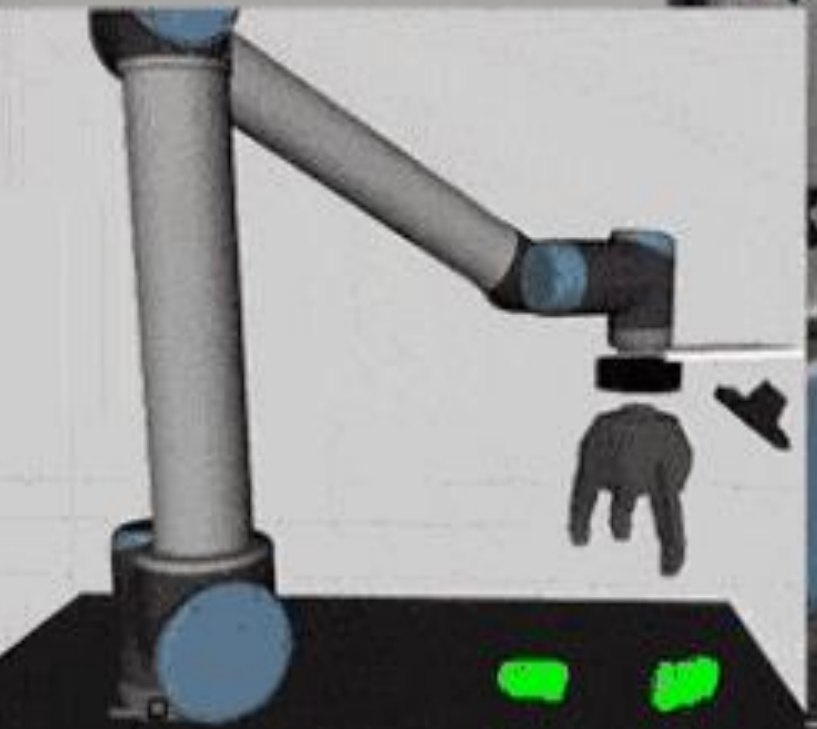
Self-Driving Car: Object Detection



Machine Learning is being used to detect objects such as cars, street sign

Ref: https://gfycat.com/gifs/tag/object+detection

Robotic Arm Manipulation



Achieved height counter

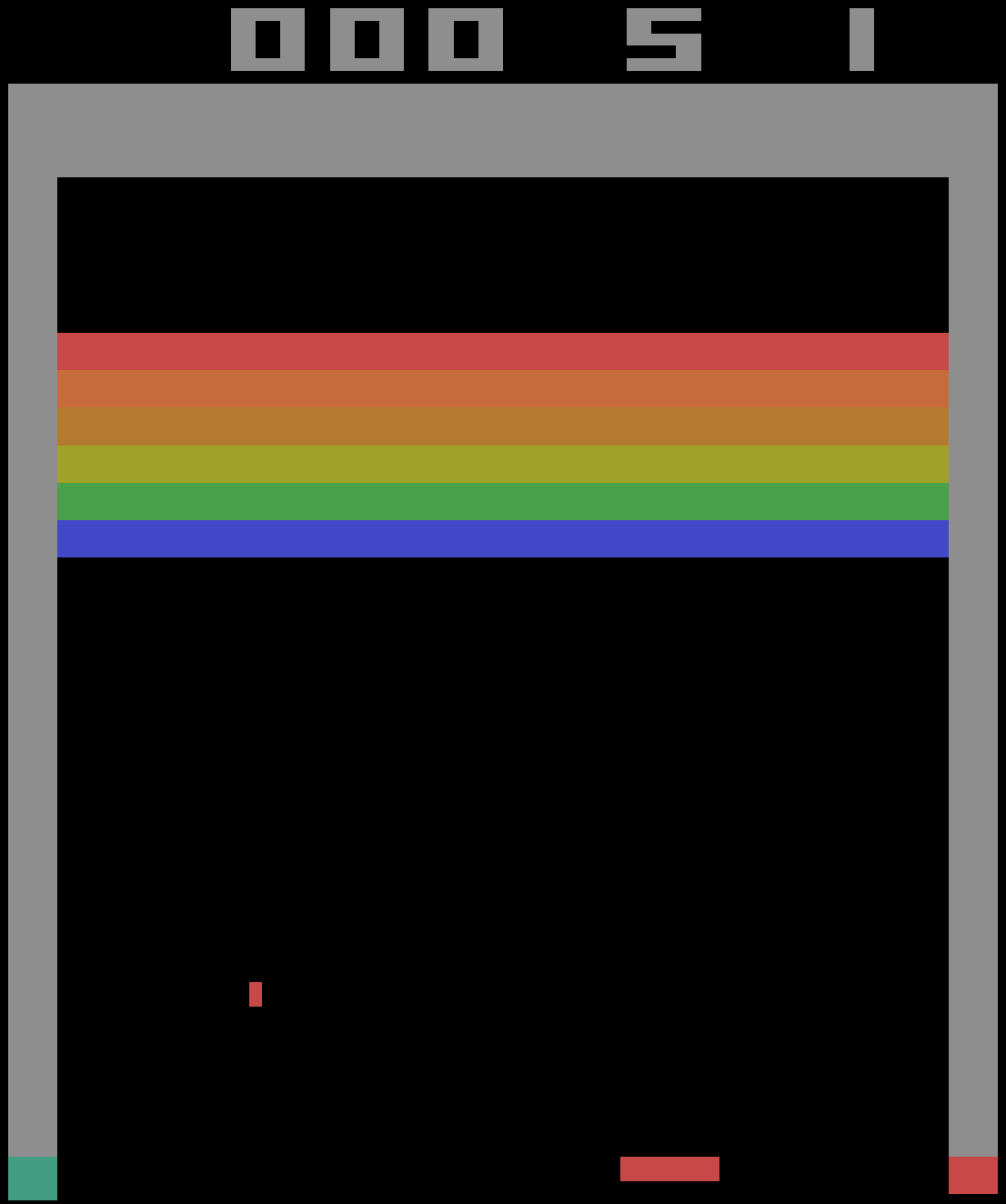
0 2 0

Reinforcement Learning is an aspect of Machine learning where an agent learns to behave in an environment, by performing certain actions and observing the rewards/results which it gets from those actions

15x

Ref: https://www.freecodecamp.org/news/a-brief-introduction-to-reinforcement-learning-7799af5840db/

Playing Games



Another example of Reinforcement Learning in which an agent learns to play 'breakout' game better than human

Ref: https://towardsdatascience.com/tutorial-double-deep-q-learning-with-dueling-network-architectures-4c1b3fb7f756