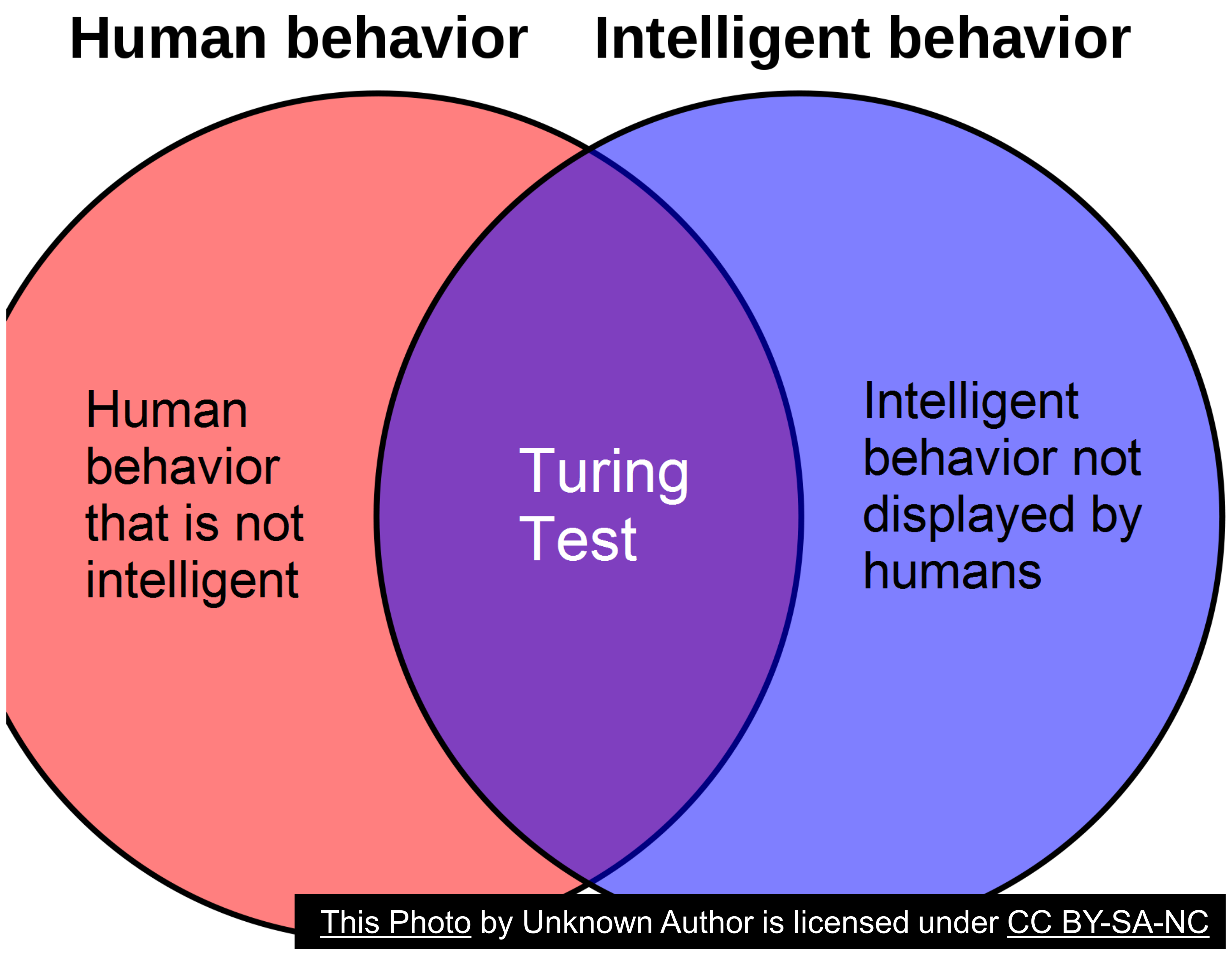
# Lecture 1.2
# AI Introduction

# Topics

- Introduction
- What is AI
- History of AI
- NVIDIA Jetson Developer Kits
- Deep Learning

# Learning Objectives

- Define artificial intelligence (AI)
- List examples of applications of AI
- Describe the different types of hardware implementations for AI computing
- Describe the difference between CPU and GPU processing
- Write and execute code and compare differences between CPU and GPUs



Human behavior

Intelligent behavior

Human behavior that is not intelligent

Turing Test

Intelligent behavior not displayed by humans

# What is AI?

# Artificial Intelligence (AI)

Artificial Intelligence is the emulation of human or biological behavior

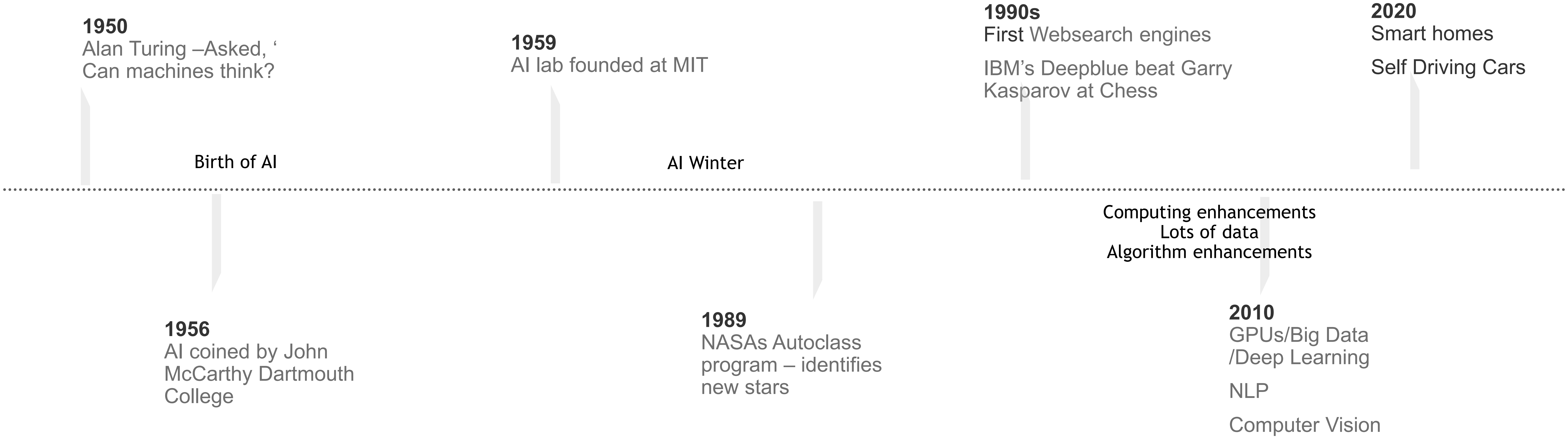
Real intelligence that is generated artificially

Derived from study of computational agents that act intelligently (http://artint.info/2e/html/ArtInt2e.Ch1.S1.html )

# Evolution of AI

# History of AI

Hobbes (1588-1679) – thinking was symbolic reasoning like talking out loud or working out an answer with pencil and paper



**1950**
Alan Turing –Asked, ‘
Can machines think?

Birth of AI

**1956**
AI coined by John McCarthy Dartmouth College

**1959**
AI lab founded at MIT

AI Winter

**1989**
NASAs Autoclass program – identifies new stars

**1990s**
First Websearch engines

IBM’s Deepblue beat Garry Kasparov at Chess

Computing enhancements
Lots of data
Algorithm enhancements

**2010**
GPUs/Big Data /Deep Learning

NLP

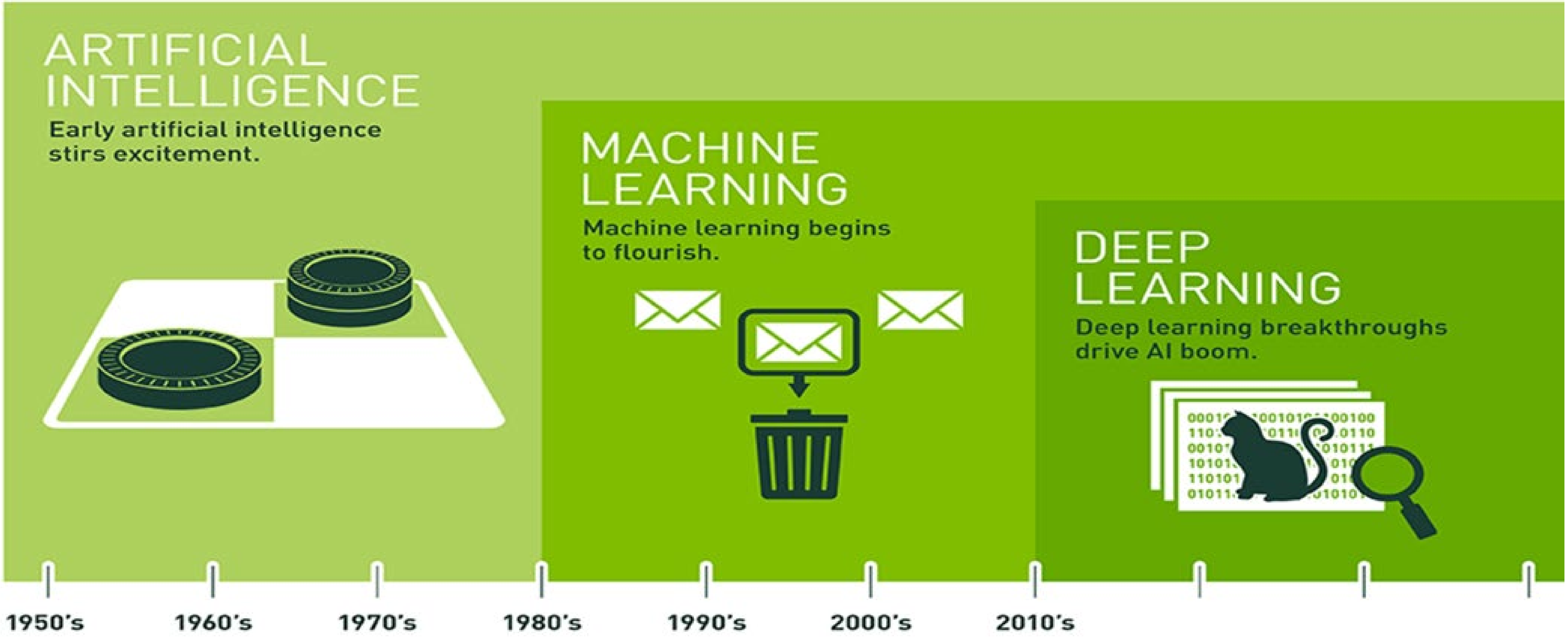
Computer Vision

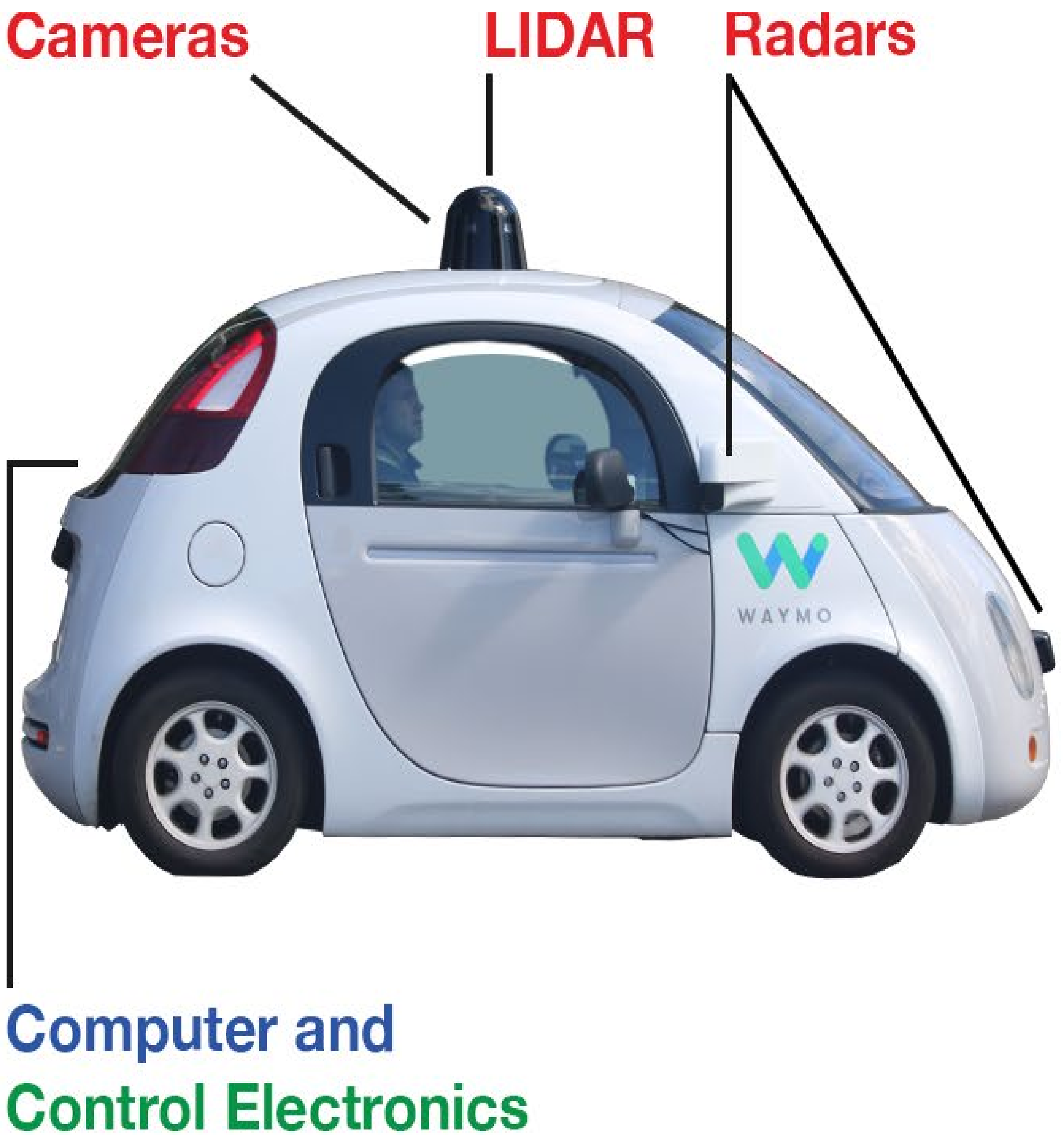
**2020**
Smart homes

Self Driving Cars

https://aitopics.org/misc/brief-history
http://artint.info/2e/html/ArtInt2e.Ch1.S2.html

# Evolution of AI


ARTIFICIAL INTELLIGENCE
Early artificial intelligence stirs excitement.
MACHINE LEARNING
Machine learning begins to flourish.
DEEP LEARNING
Deep learning breakthroughs drive AI boom.
1950's
1960's
1970's
1980's
1990's
2000's
2010's

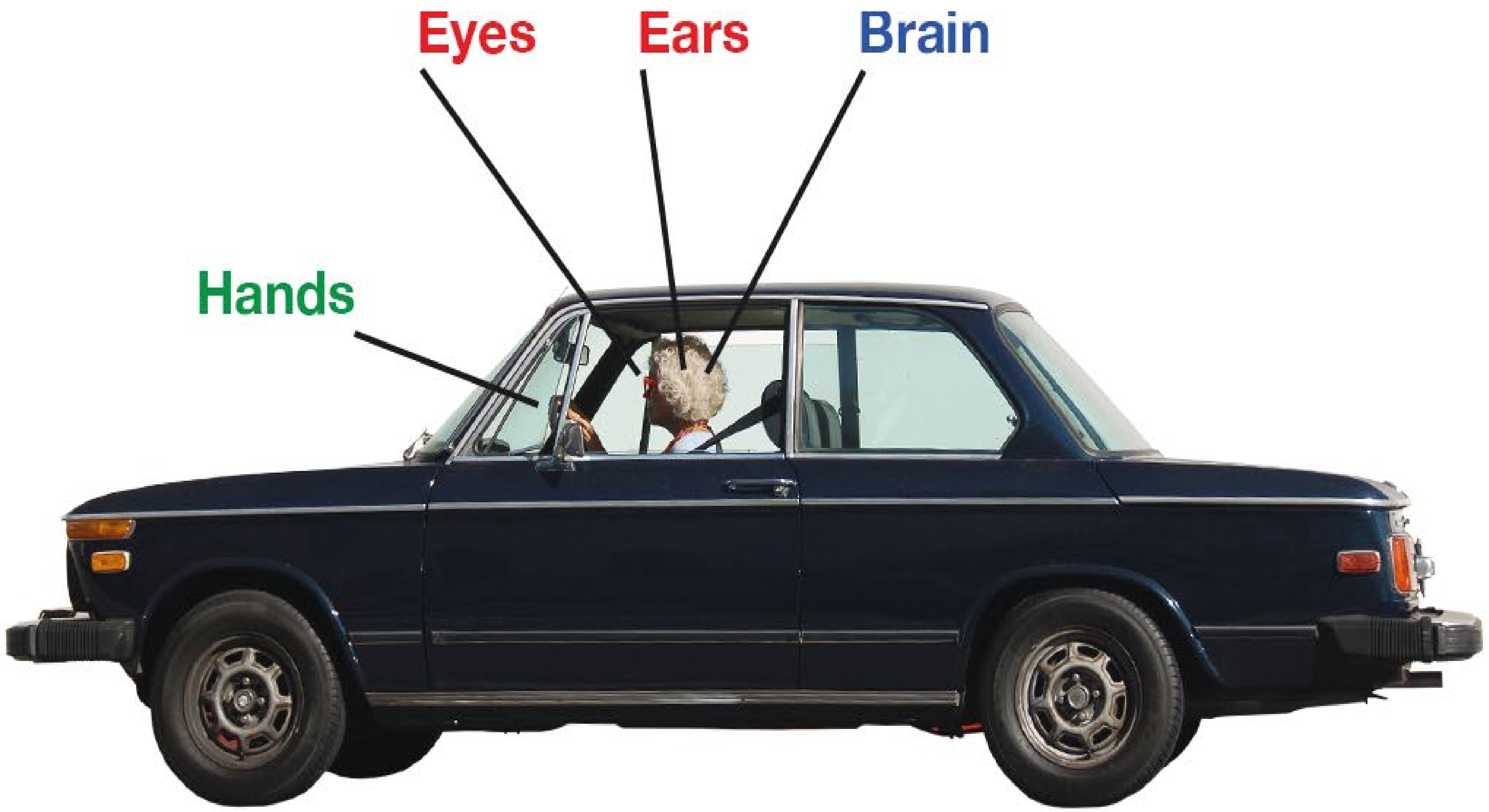


Cameras

LIDAR

Radars

Computer and
Control Electronics



Eyes

Ears

Brain

Hands

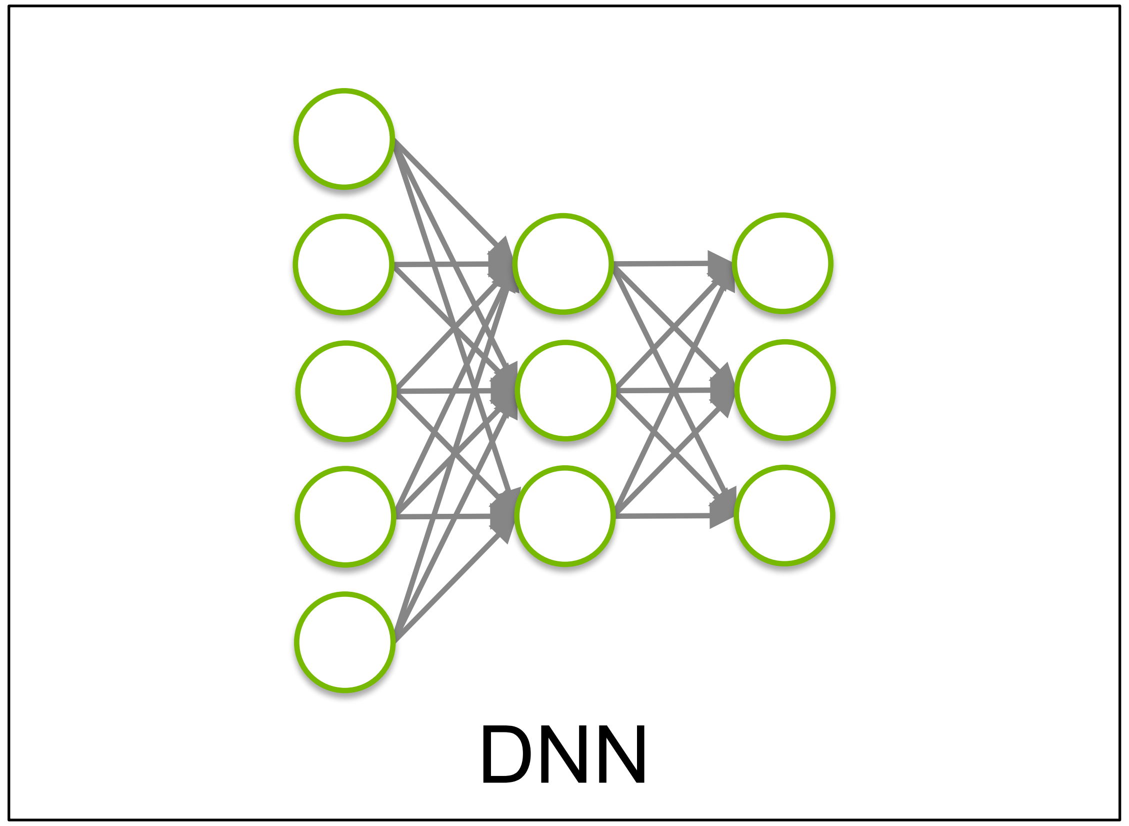
# Applied AI

Put AI into practice for real world applications

# Real World Applications of AI

- Self Driving Cars
- Facial Recognition for Identification
- Deposit Checks through Mobile Apps
- Robotic Floor Cleaners
- Network Intrusion
- Loan risk models
- Recommendation engines for shopping product and movie recommendations
- Email spam detection

# THE BIG BANG IN MACHINE LEARNING



DNN

GPU

BIG DATA

WIRED

# Framework and Hardware for Class

Much of what we will do in this course involves using Deep Learning to process images and text.

Deep Learning is computationally intensive and benefits from using GPUs to run some of those operations in parallel, especially for Image and Natural Language processing.

Rather than require expensive GPU laptops, we will use the Jetson Nano

We will use Python to code applications that use CUDA enabled libraries and deep learning framework

# GPU Programming Languages

| | |
|---|---|
| Numerical analytics | MATLAB, Mathematica, LabVIEW |
| Fortran | CUDA Fortran |
| C | CUDA C |
| C++ | CUDA C++ |
| Python | PyCUDA, OpenCV CUDA, Numba, NumbaPro, RAPIDS |
| F# | Alea.cuBase |

# NVIDIA CUDA

Development environment and ecosystem to enable GPU applications

Integrates with programming languages, GPU libraries and deep learning frameworks

https://developer.nvidia.com/cuda-toolkit

# Deep Learning Concepts

**Deep Learning** – Machine Learning that leverages Neural Networks with many layers

**Reinforcement Learning** – reward-based algorithm with the intent that actions will result in greater cumulative reward https://en.wikipedia.org/wiki/Reinforcement_learning

**Federated Learning** – machine learning technique enables the training of models across devices without exchanging the data https://en.wikipedia.org/wiki/Federated_learning

# Deep Learning – Neural Networks

AlexNet https://en.wikipedia.org/wiki/AlexNet – Deep Convolutional Neural Network

Resnet https://en.wikipedia.org/wiki/Residual_neural_network – Residual Neural Network

Numerous types of Neural Networks. Helpful info on neural network architecture can be found at https://www.asimovinstitute.org/author/fjodorvanveen/

# Popular GPU Frameworks

CAFFE https://caffe.berkeleyvision.org/

MXNet https://mxnet.apache.org/versions/1.7.0/

Tensorflow https://www.tensorflow.org/

PYTORCH https://pytorch.org/

# Python – GPU Enabled Libraries

Tensorflow GPU https://www.tensorflow.org/install/gpu

Numba http://numba.pydata.org/ highly performance optimized C code that can be run from within Python that is designed to work with Numpy arrays and functions.

PyCuda https://pypi.org/project/pycuda/

RAPIDS https://rapids.ai/ - new GPU data science library that is modeled to provide similar look and feel of Panda and Scikit Learn libraries. It is currently not supported on the Nano

OpenCV CUDA https://opencv.org/platforms/cuda/