An overview of Machine Learning - intuition and status quo

Video of Talk -
https://goo.gl/EvGuKD

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Machine Learning

•Consider entities (variables) *x* and *y.* Let the values they assume be x_i and y_i

• **Assumption** : we have reason to believe *y* depends on *x,* or mathematically – there exists a function *f* such that $y = f(x)$,

• **Problem** : We don't know *f.*

• **Solution** : Find a function *g* which approximates *f,* i.e. for any sample $g(x_i) \sim y_i$

AI v/s Machine Learning v/s Deep Learning?

Artificial Intelligence — When Machines can act intelligently like humans.

Machine Learning — A mathematical framework often used to solve tasks within Artificial Intelligence (among other uses).

Deep Learning — A specific technique within Machine Learning.

Outcome v/s Tools

Why is Machine Learning so ubiquitous?

- We understand the world by understanding cause and effect relationships.
- Mathematically, functions allow us to define such cause-effect relationships. Most times, this function is NOT known. And machine learning lets us approximate this function!

Machine Learning is a tool that lets us approximate cause and effect relationships!

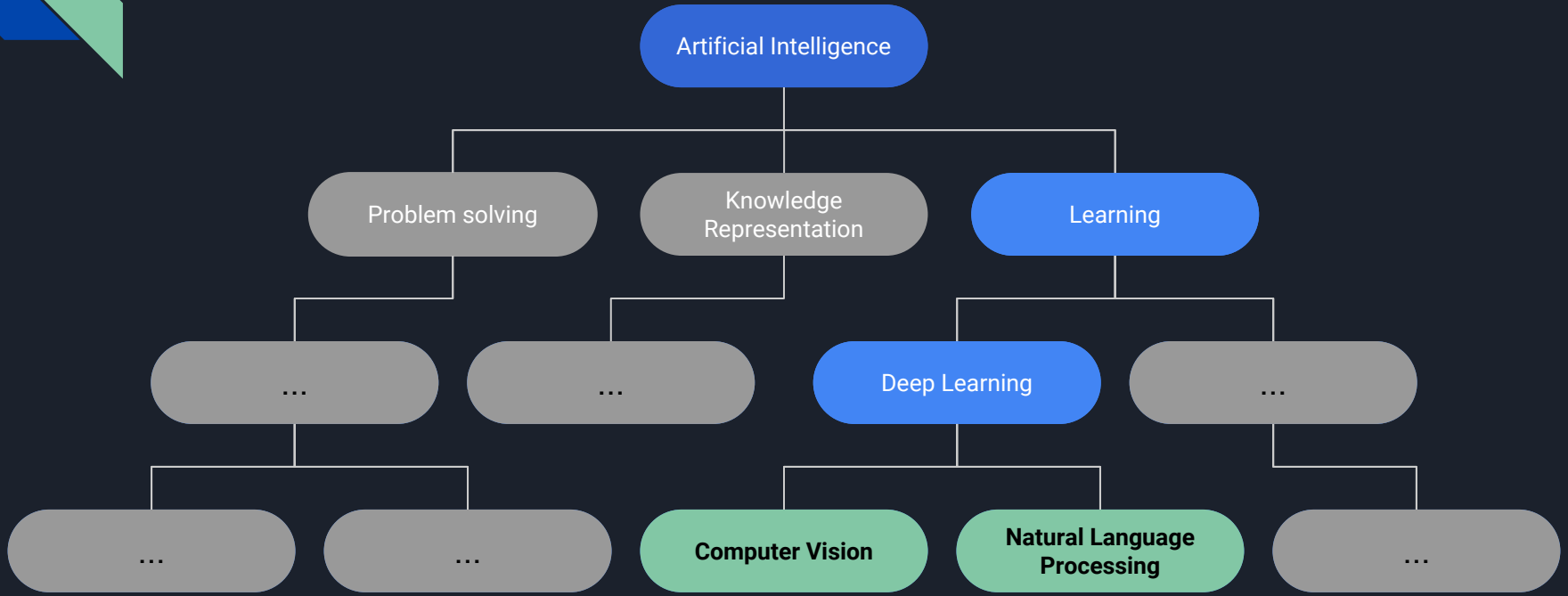
Artificial Intelligence

The whole is greater than the sum of the parts (Gestalt Psychology)

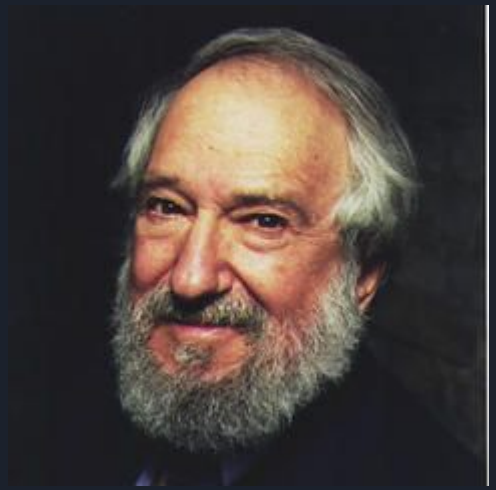
Intelligence is more than the individual tasks.

A Machine must do infinitely many tasks like humans do, and all at the same time, before we can call them intelligent.

Subfields of AI (incomplete)

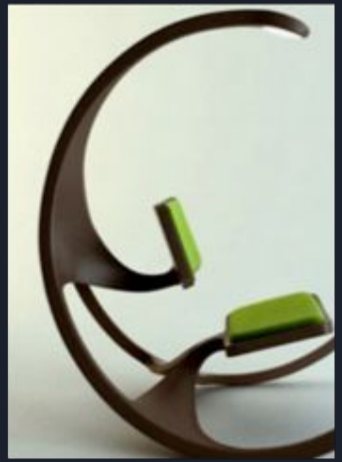


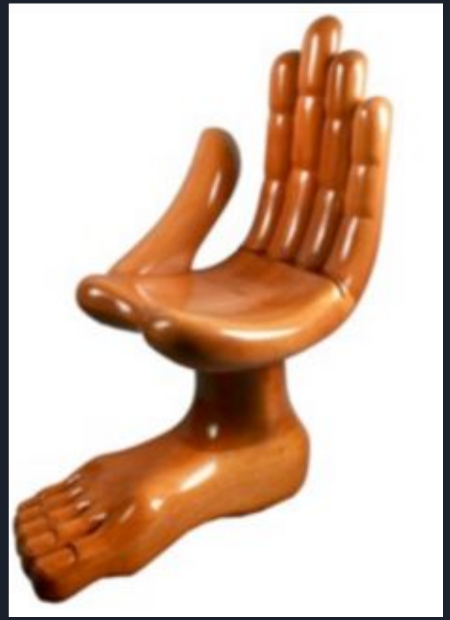
What makes computer vision SO hard?



But… aren't these also chairs? :/

- Shape definitely doesn't seem to work
- Maybe, it's a surface on the ground that we sit on?





Pics: Zoya Bylinskii

Challenge 1: help a robot recognize a chair

Pics: Zoya Bylinskii

Surface on the ground used to sit?

Naah, this does doesn't work either – None of these are chairs!

Pics: Zoya Bylinskii

What we see v/s What a computer sees

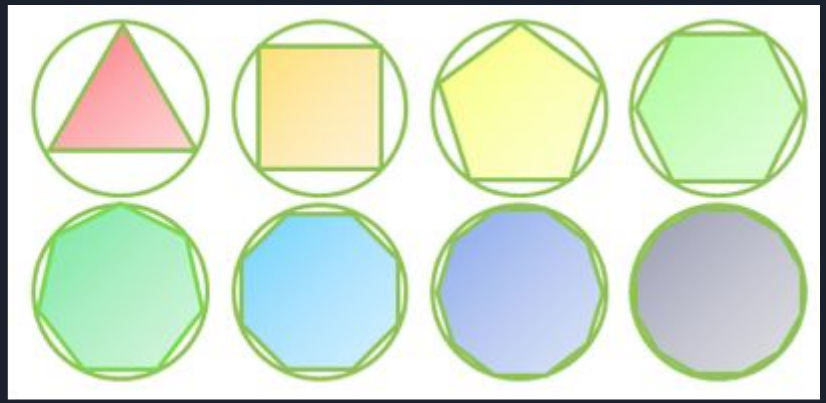
Making sense of Pixel Values

V/S

0	3	2	5	4	7	6	9	8
3	0	1	2	3	4	5	6	7
2	1	0	3	2	5	4	7	6
5	2	3	0	1	2	3	4	5
4	3	2	1	0	3	2	5	4
7	4	5	2	3	0	1	2	3
6	5	4	3	2	1	0	3	2
9	6	7	4	5	2	3	0	1
8	7	6	5	4	3	2	1	0

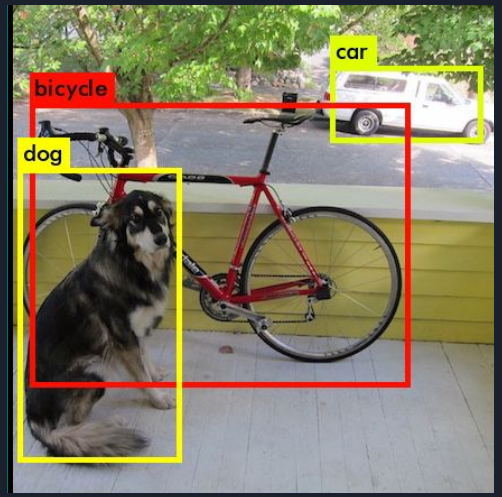
Solution - Deep Learning

- A technique within M.L. to learn complicated functions.
- They are neural network models with lots of layers – Deep Models.
- Each layer is a simple function approximator, but together combined they can approximate complicated functions!



An overview of Computer Vision Problems

Object Detection :



Level :
Average

78% for 20 objects.

YOLO https://arxiv.org/abs/1612.08242
Faster RCNNhttps://arxiv.org/abs/1506.01497

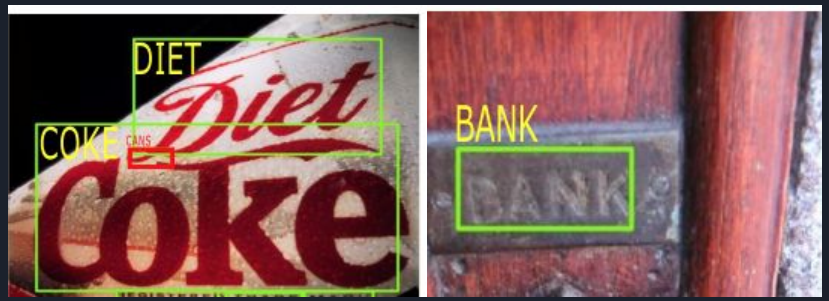
Face Detection

Level :
Solved

98.5%

Facenet - https://arxiv.org/abs/1503.03832
Deepface - https://www.cs.toronto.edu/~ranzato/publications/taigman_cvpr14.pdf
https://arxiv.org/pdf/1703.10818.pdf

Scene Text Recognition



Level : average
~ 85% for their data
~ 55% on my own data

Semantic Segmentation

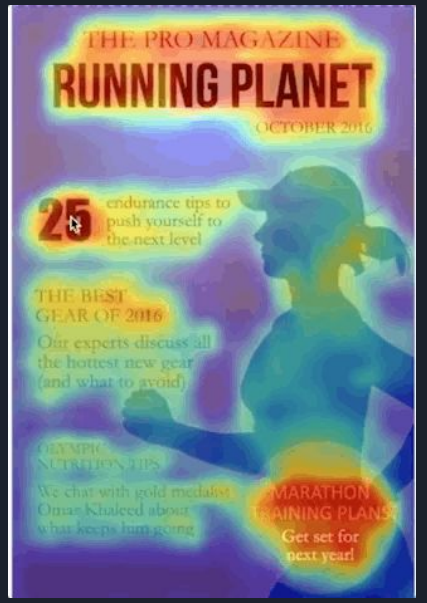
LEVEL : Hard
~ 30%

Saliency

Level : Hard

Visual Importance

Level : Hard



Natural Language Processing

Text Classification

Level : easy

Sentence :
The indian prime minister is Narendra Modi
Category : Politics

Sentence:
Federer is a great tennis player.
Category : Sports

Text Summarization

Level : Very hard

Sentence :

russian defense minister ivanov called sunday for the creation of a joint front for combating global terrorism

Summary :
russia calls for joint front against terrorism

Question Answering

Level : Very hard

One of the most famous people born in Warsaw was Maria Skłodowska-Curie, who achieved international recognition for her research on radioactivity and was the first female recipient of the Nobel Prize. Famous musicians include Władysław Szpilman and Frédéric Chopin. Though Chopin was born in the village of Żelazowa Wola, about 60 km (37 mi) from Warsaw, he moved to the city with his family when he was seven months old. Casimir Pulaski, a Polish general and hero of the American Revolutionary War, was born here in 1745.

What was Maria Curie the first female recipient of?
Ground Truth Answers: Nobel Prize | Nobel Prize | Nobel Prize

What year was Casimir Pulaski born in Warsaw?
Ground Truth Answers: 1745 | 1745 | 1745

Who was one of the most famous people born in Warsaw?
Ground Truth Answers: Maria Skłodowska-Curie | Maria Skłodowska-Curie | Maria Skłodowska-Curie

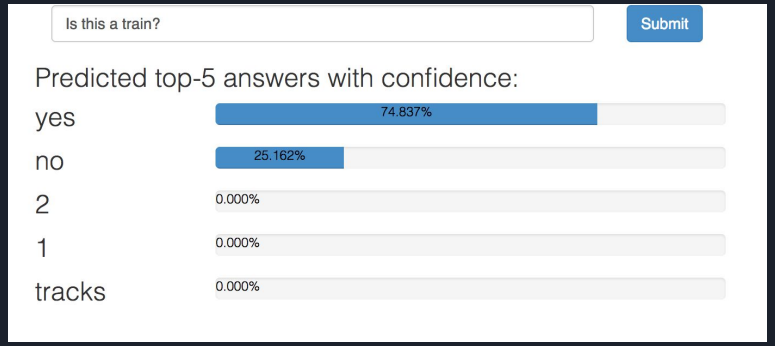
Who was Frédéric Chopin?
Ground Truth Answers: Famous musicians | musicians | Famous musicians

How old was Chopin when he moved to Warsaw with his family?
Ground Truth Answers: seven months old | seven months old | seven months old

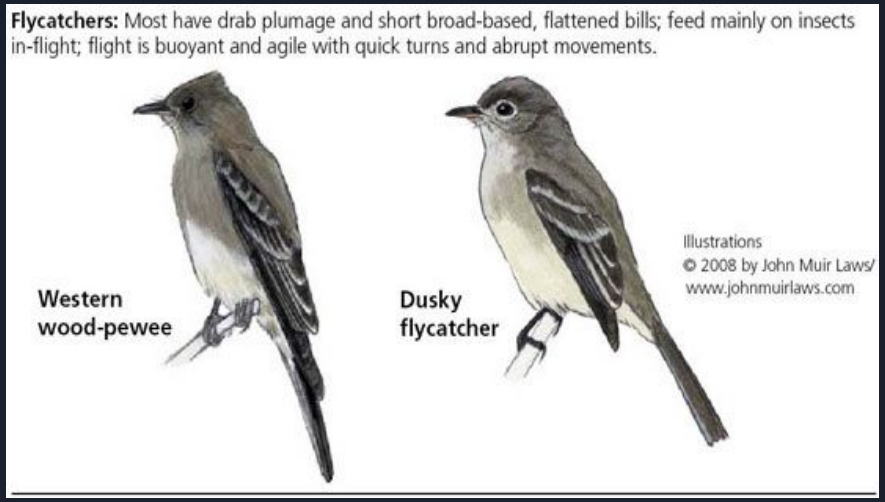
Mixing the two!

VQA

Is this a train?



Zero shot Learning



Computer Vision for Infographics

Conclusion

- Machine learning is not as revolutionary as it is ubiquitous. Tool for Cause – effect relationship approximation.
- Machine Learning ≠ Deep Learning ≠ Artificial Intelligence
- Be weary of things being blown out of proportion in the news. Spend 5 minutes reading the original research paper if you are interested.

So far, we have made powerful tools that can do very complicated tasks. They are powerful, and can be misused, but are tools without intelligence nonetheless. Fear the misuse, not the tool themselves.


ASIAN

Good Resources to Get started with coding

tiny demo if you just want intuition - https://teachablemachine.withgoogle.com/

In depth tutorial on Machine learning and Deep Learning - https://goo.gl/mube7u

Specific Coding Tutorials -

Image Classification - https://goo.gl/E2hR4i

General introduction to PyTorch - https://github.com/jcjohnson/pytorch-examples

Text Classification - https://github.com/Shawn1993/cnn-text-classification-pytorch

Sentiment analysis - https://einstein.ai/research/learning-when-to-skim-and-when-to-read

Thank you!

Slides - https://goo.gl/2NZSRt

Me - https://goo.gl/zyycR8

Video of Talk - https://goo.gl/C8ZoDV