DATE : 25.03.2024

DT/NT : NT

LESSON : DEEP LEARNING

SUBJECT: Introduction to Deep Learning

BATCH : B223

TECHPRO EDUCATION

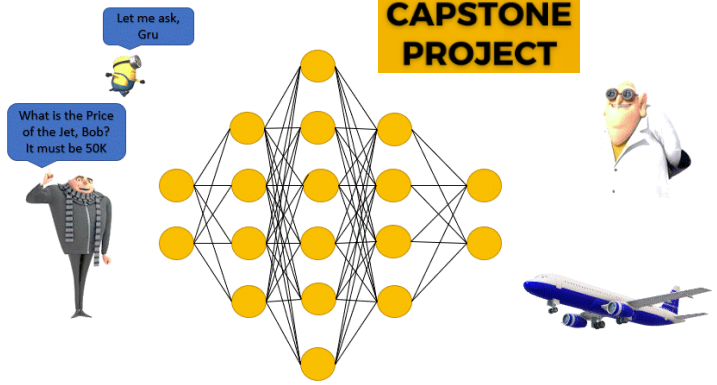
DEEP LEARNING

DEEP LEARNING

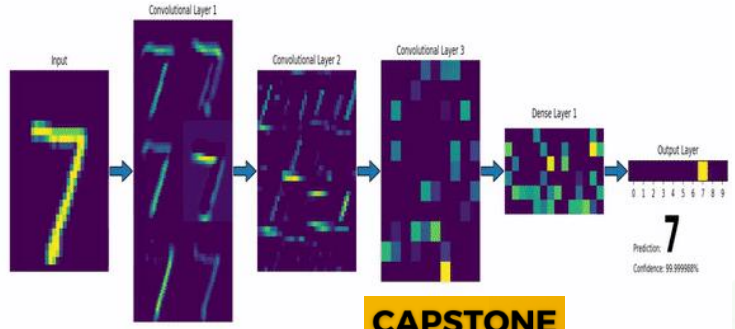
Kahoot!

TECHPRO EDUCATION

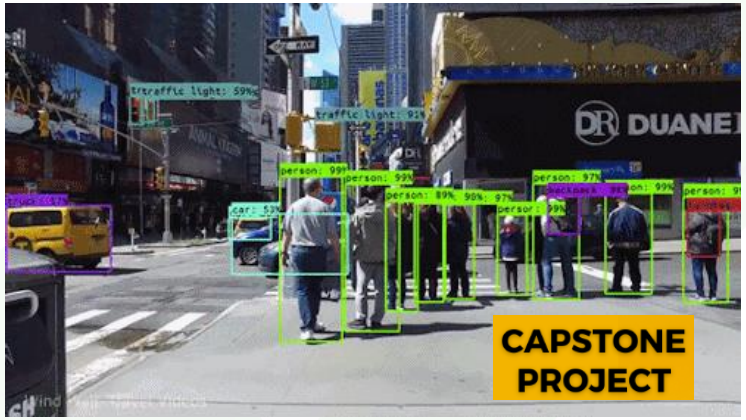
ANN



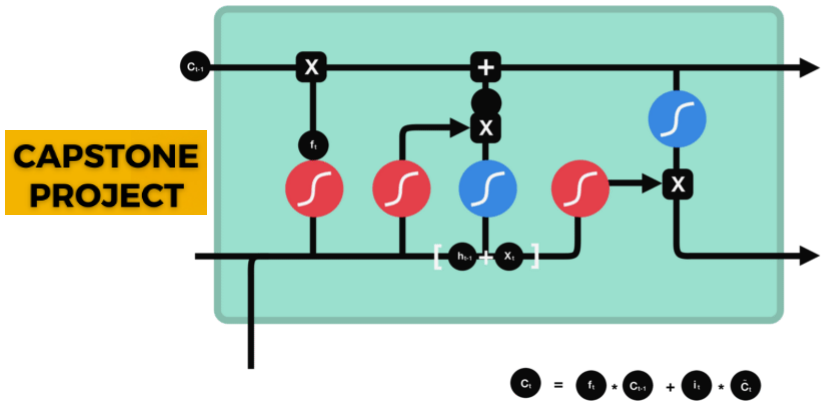
CNN



COMPUTER VISION

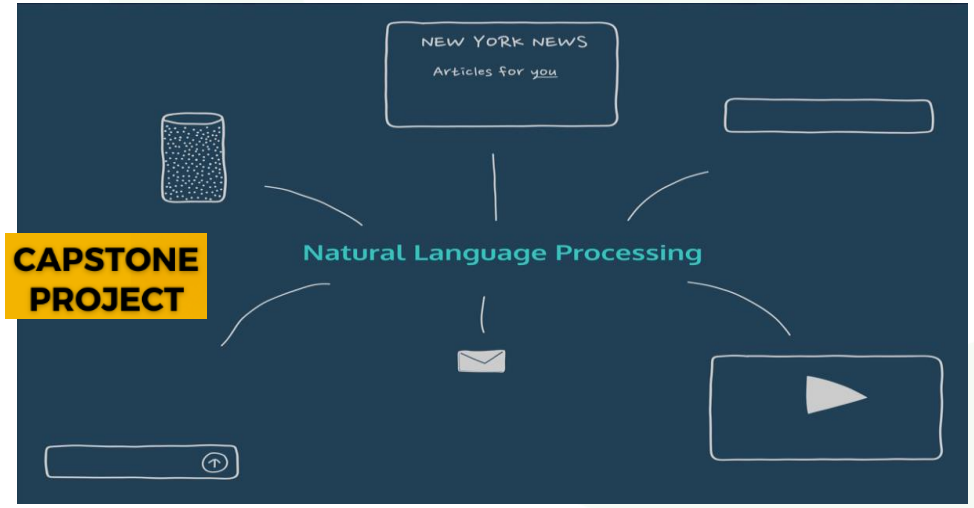


RNN+LSTM+GRU



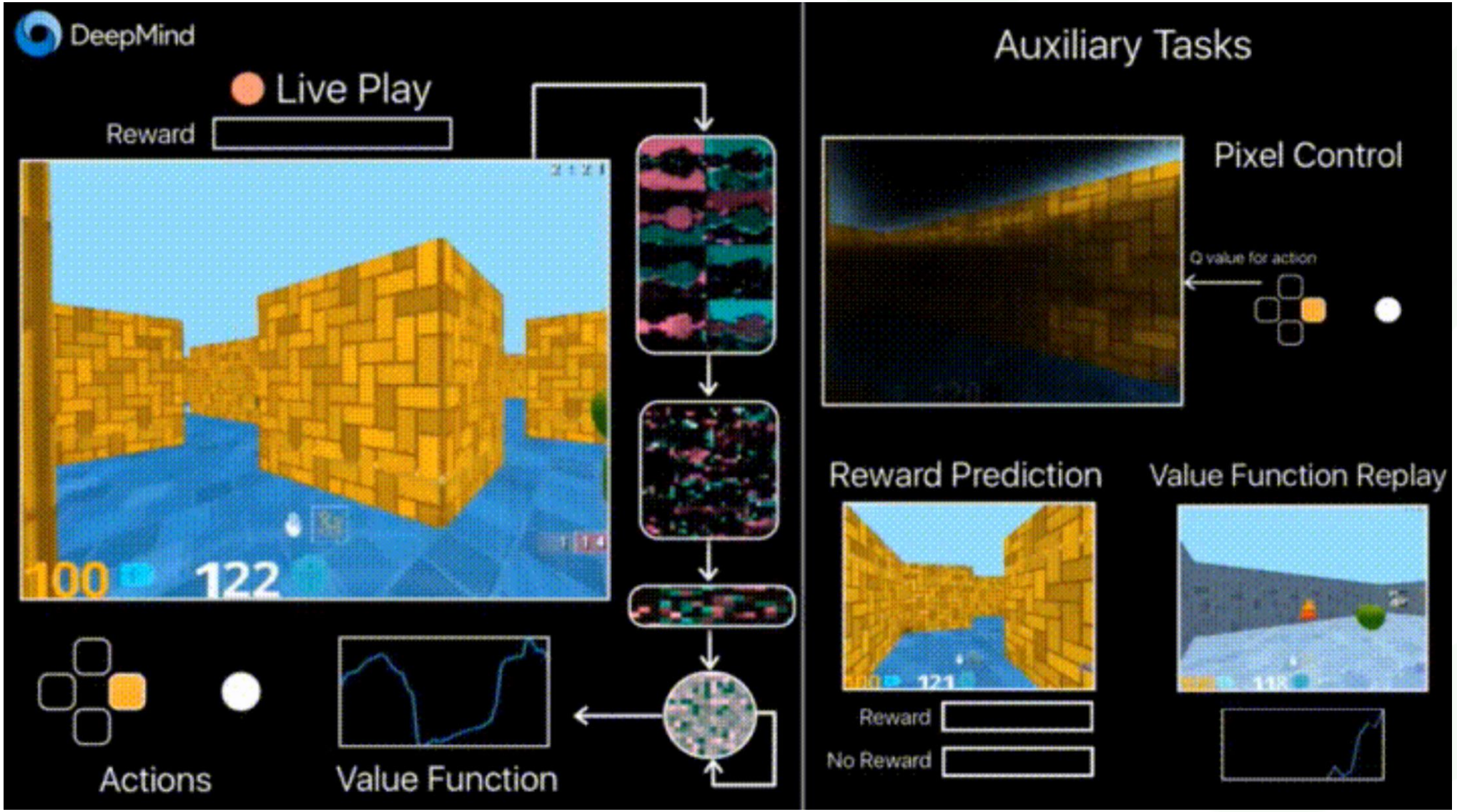
- previous cell state
- forget gate output
- input gate output
- candidate
- new cell state

NLP



WHY DEEP LEARNING?

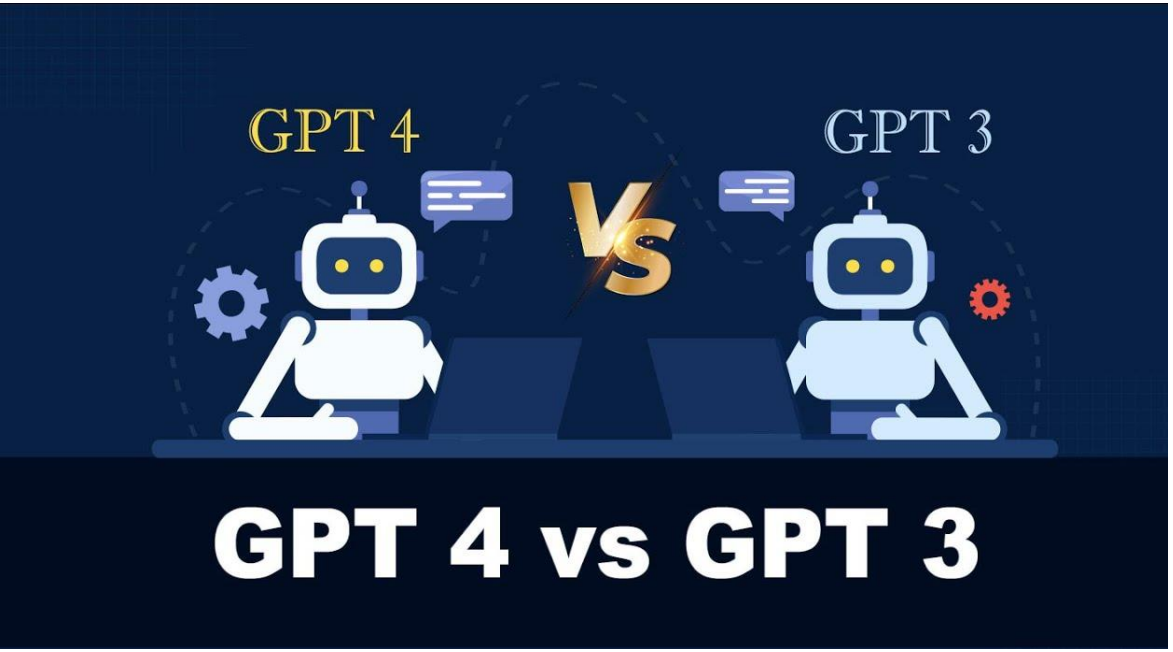
1997


DeepMind
Live Play
Reward
100
122
Actions
Value Function
Auxiliary Tasks
Pixel Control
Q value for action
Reward Prediction
121
Reward
No Reward
Value Function Replay
118

2016

AlphaGo

2017

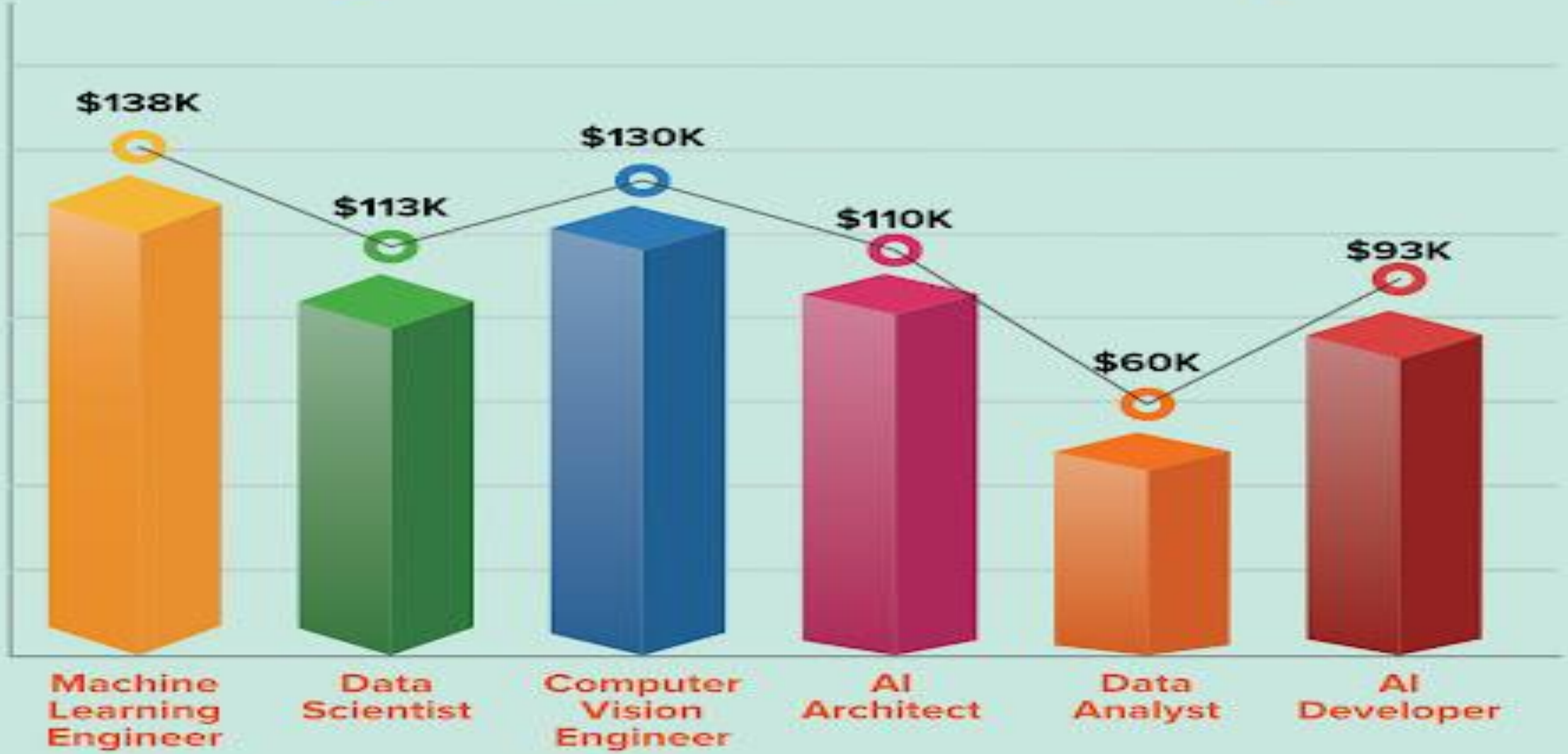

GPT 4
GPT 3
Vs
GPT 4 vs GPT 3


Open AI
DALL·E


DEVICOLOGY
OpenAI
Introducing
SORA
Text to Video AI

1. Machine Learning Engineer
2. Deep Learning Engineer
3. Computer Vision Engineer
4. Natural Language Processing Engineer
5. AI Research Scientist
6. AI Software Developer
7. AI Consultant
8. Data Scientist - AI/ML

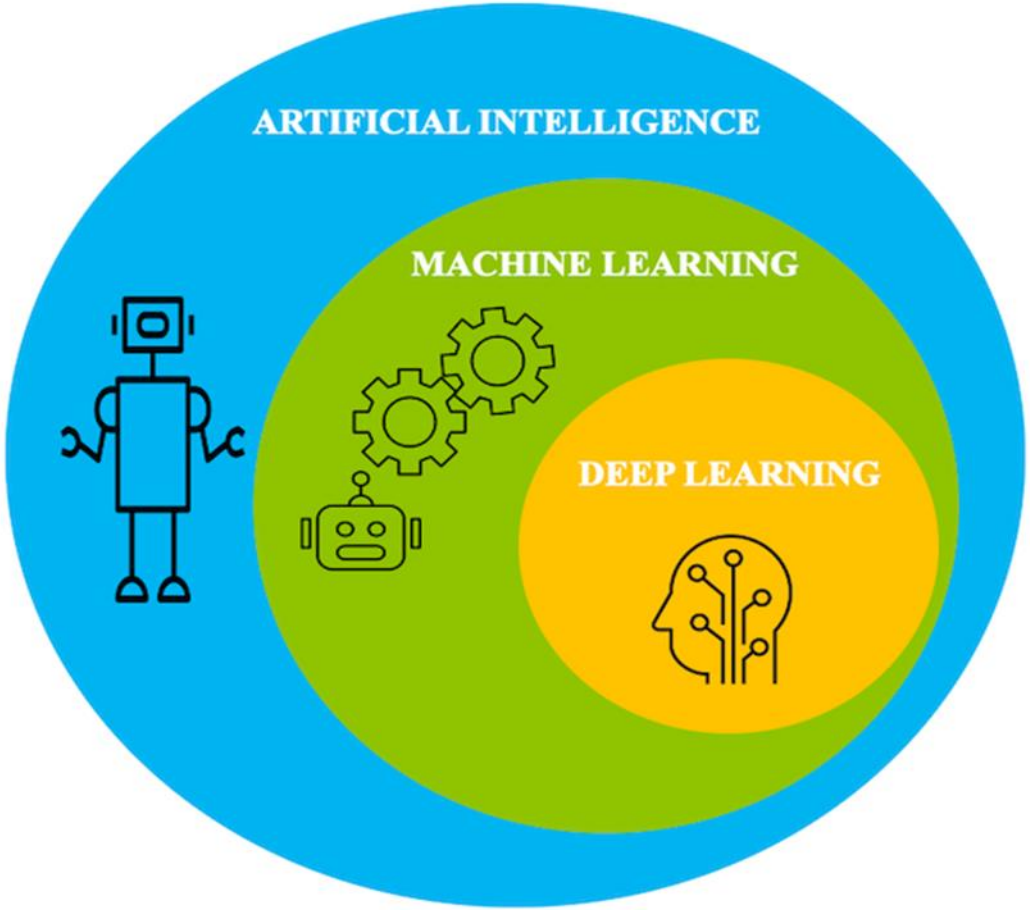
Average Salaries for AI Experts

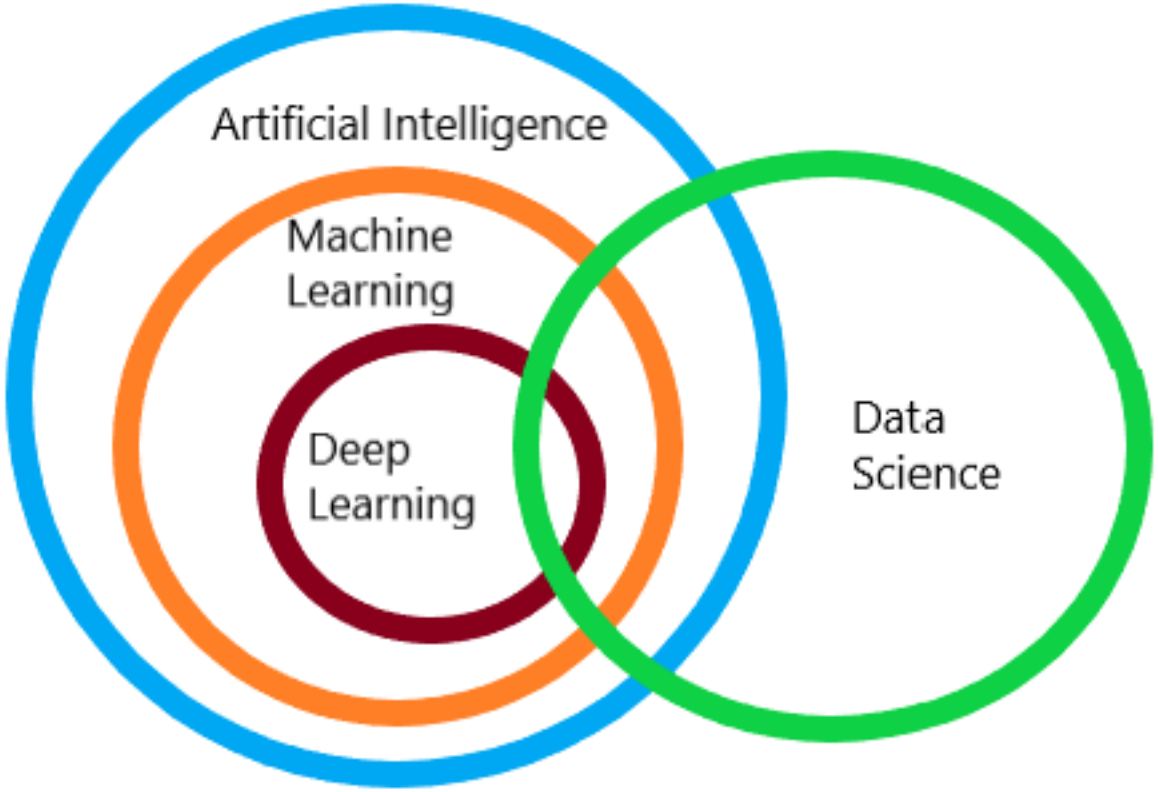


ncube

WHAT IS DEEP LEARNING?

DEEP LEARNING





DEEP LEARNING

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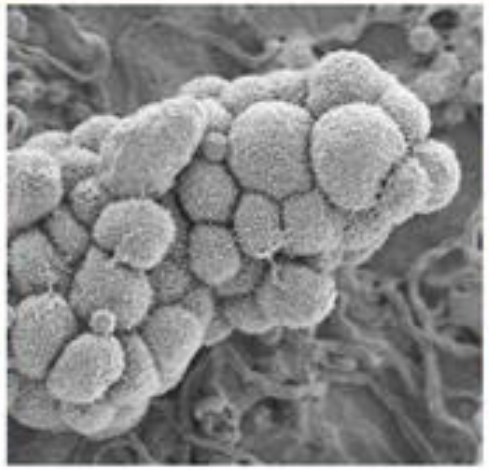
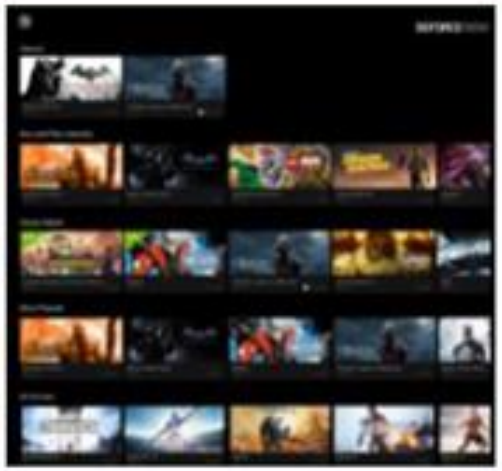
DEEP LEARNING EVERYWHERE

INTERNET & CLOUD

Image Classification
Speech Recognition
Language Translation
Language Processing
Sentiment Analysis
Recommendation

MEDICINE & BIOLOGY

Cancer Cell Detection
Diabetic Grading
Drug Discovery

MEDIA & ENTERTAINMENT

Video Captioning
Video Search
Real Time Translation

SECURITY & DEFENSE

Face Detection
Video Surveillance
Satellite Imagery

AUTONOMOUS MACHINES

Pedestrian Detection
Lane Tracking
Recognize Traffic Sign

DEEP LEARNING

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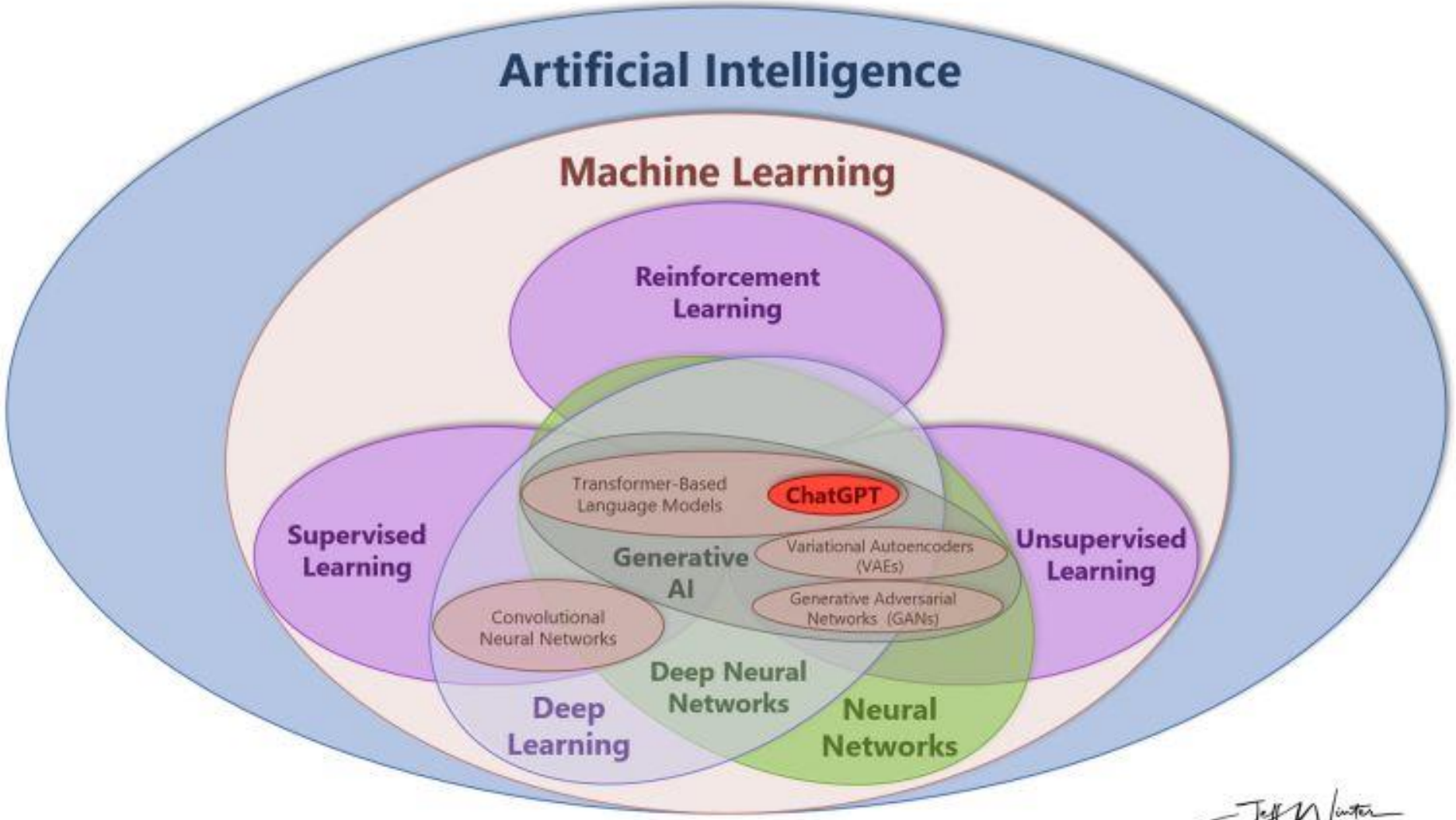
20 DEEP LEARNING Applications

1. Self Driving Cars
2. Entertainment
3. Visual Recognition
4. Virtual Assistants
5. Fraud Detection
6. Natural Language Processing
7. News Aggregation and Fraud News Detection
8. Detecting Developmental Delay in Children
9. Colourisation of Black and White images
10. Adding sounds to silent movies
11. Healthcare
12. Personalisations
13. Automatic Machine Translation
14. Automatic Handwriting Generation
15. Demographic & Election Predictions
16. Automatic Game Playing
17. Language Translations
18. Pixel Restoration
19. Photo Descriptions
20. Deep Dreaming

AI/MACHINE LEARNING/DEEP LEARNING



WHY DEEP LEARNING IS SO POPULAR

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Why Now?

Neural Networks date back decades, so why the resurgence?

1. Big Data

- Larger Datasets
- Easier Collection & Storage

IMAGENET

WIKIPEDIA

2. Hardware

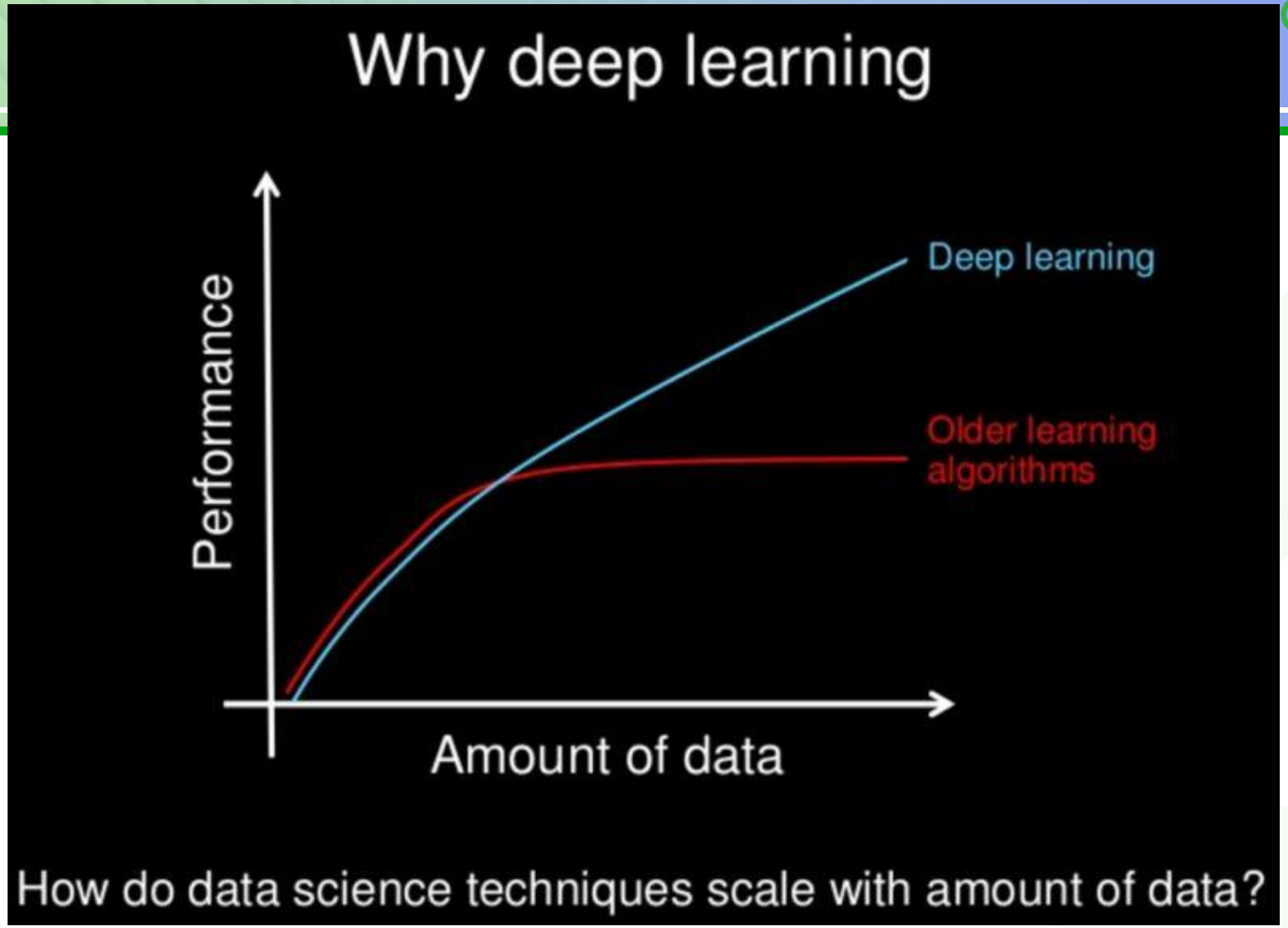
- Graphics Processing Units (GPUs)
- Massively Parallelizable

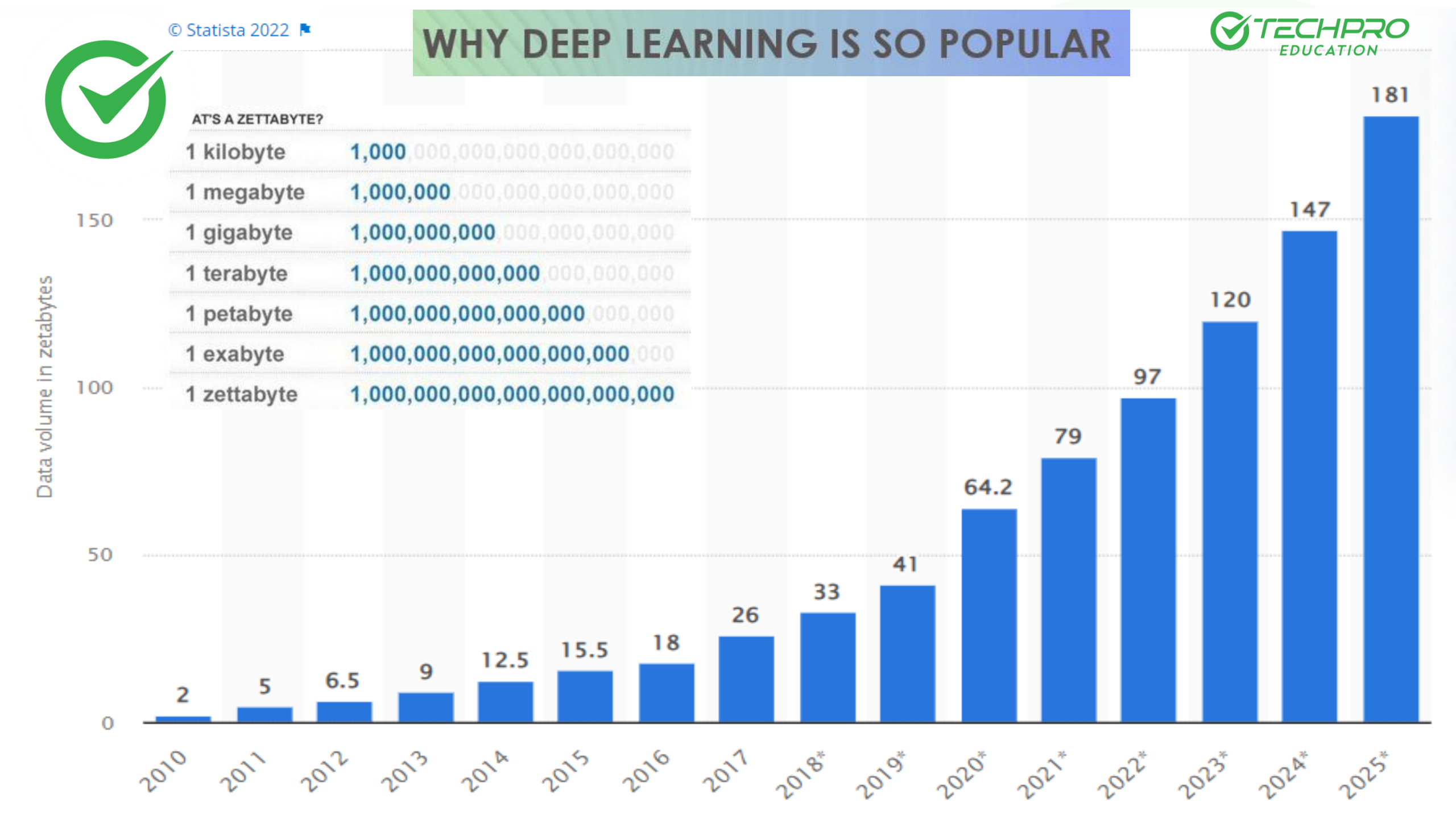
3. Software

- Improved Techniques
- New Models
- Toolboxes

TensorFlow

RAPIDLY INCREASING DATA


Why deep learning
Performance
Deep learning
Older learning algorithms
Amount of data
How do data science techniques scale with amount of data?


© Statista 2022
WHY DEEP LEARNING IS SO POPULAR
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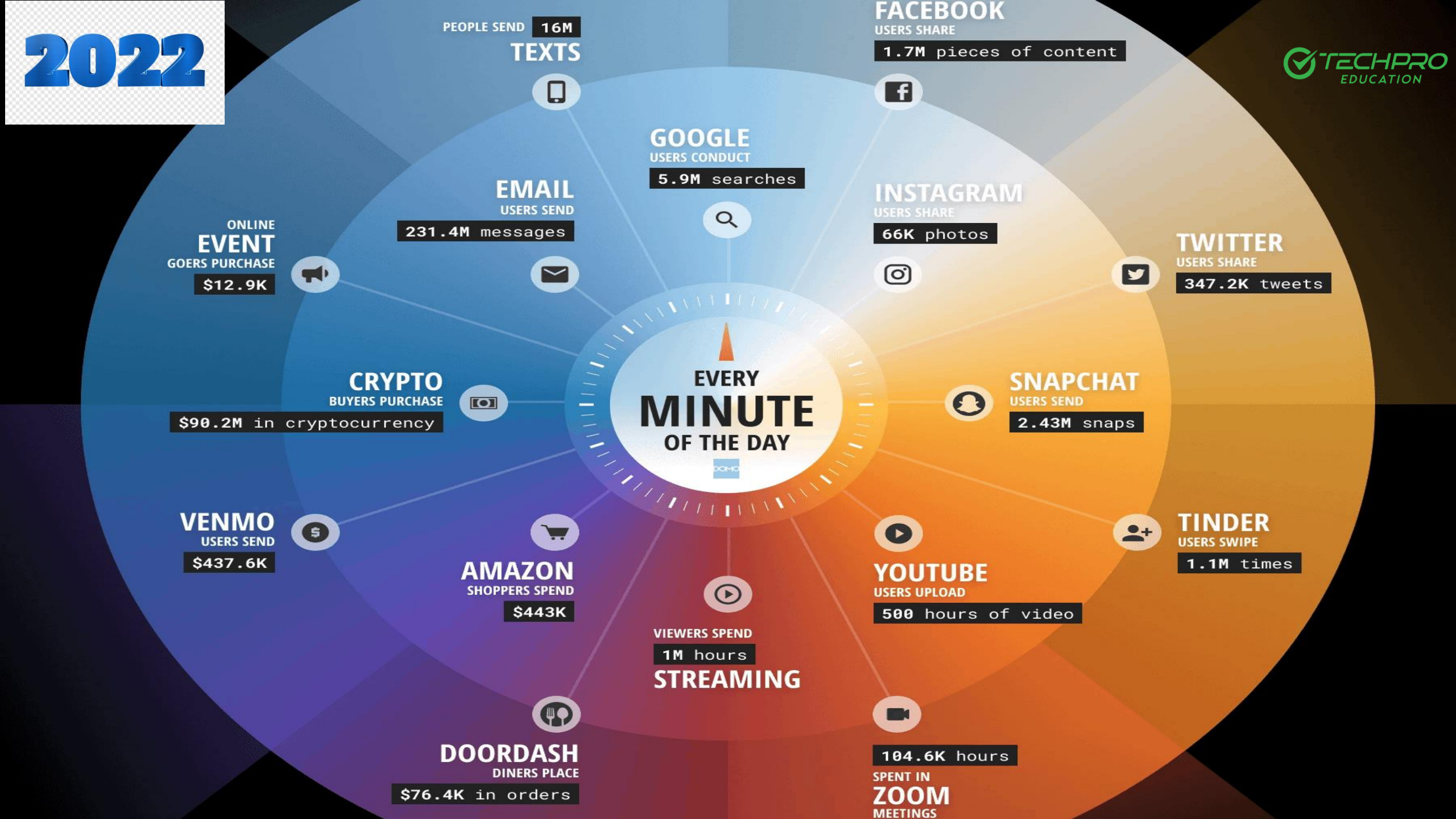
AT'S A ZETTABYTE?
1 kilobyte 1,000
1 megabyte 1,000,000
1 gigabyte 1,000,000,000
1 terabyte 1,000,000,000,000
1 petabyte 1,000,000,000,000,000
1 exabyte 1,000,000,000,000,000,000
1 zettabyte 1,000,000,000,000,000,000,000
Data volume in zetabytes
0
50
100
150
2
5
6.5
9
12.5
15.5
18
26
33
41
64.2
79
97
120
147
181
2010
2011
2012
2013
2014
2015
2016
2017
2018*
2019*
2020*
2021*
2022*
2023*
2024*
2025*

2022



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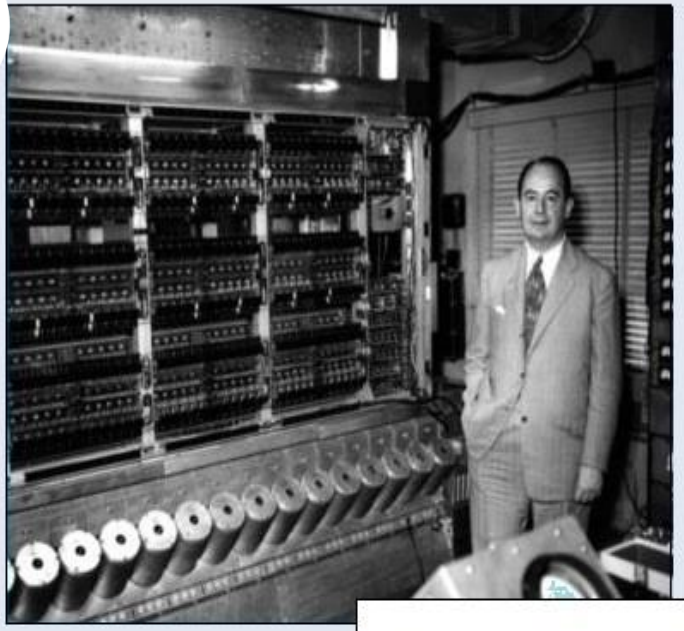
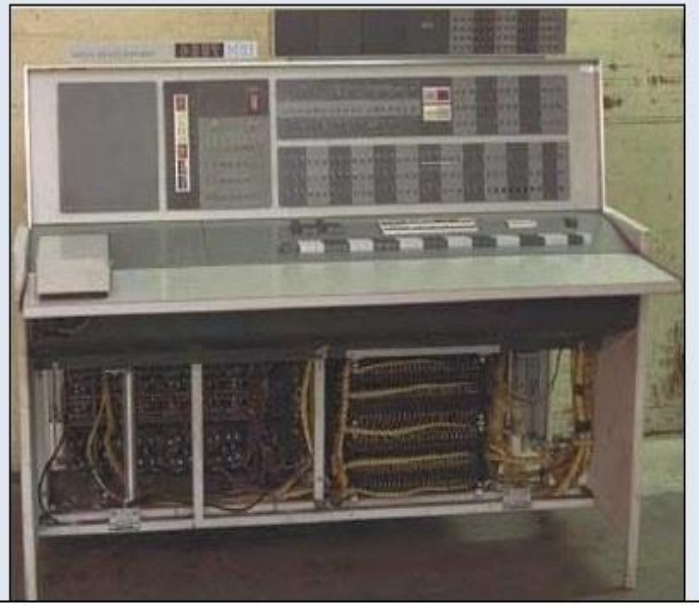
TECHNOLOGICAL ADVANCEMENTS IN HARDWARE





Generations and Future Computers

WHY DEEP LEARNING IS SO POPULAR

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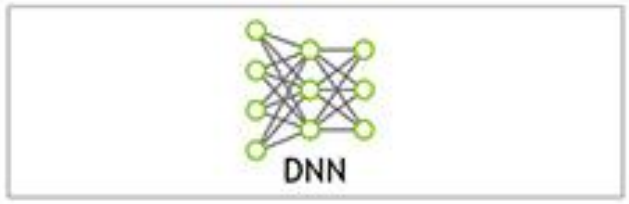
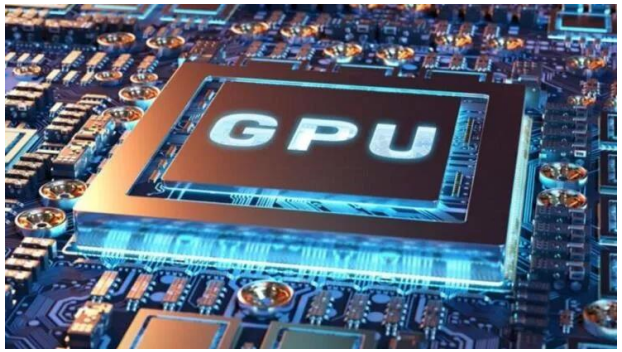
THE BIG BANG IN DEEP LEARNING



"The GPU is the workhorse of modern A.I."

POPULAR SCIENCE



GPU AND Deep Learning

GPU and Deep Learning:

A Combination That Works Miracles

WHY DEEP LEARNING IS SO POPULAR

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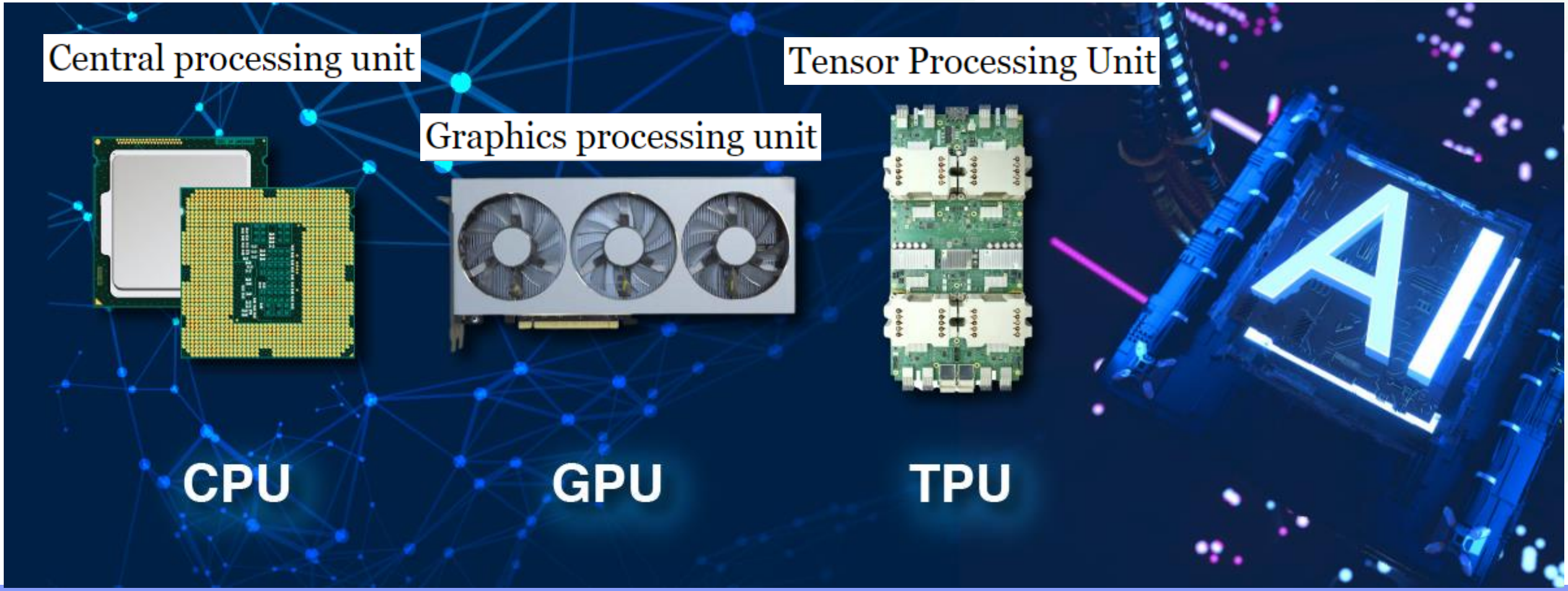
CPU
- Small models
- Small datasets
- Useful for design space exploration

GPU
- Medium-to-large models, datasets
- Image, video processing
- Application on CUDA or OpenCL

TPU
- Matrix computations
- Dense vector processing
- No custom TensorFlow operations



WHY DEEP LEARNING IS SO POPULAR

Tensor Processing Unit

CPU GPU TPU

WHY DEEP LEARNING IS SO POPULAR

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Why GPU Matters in Deep Learning?

```
X_train shape: (50000, 3, 32, 32)
50000 train samples
10000 test samples
Using real-time data augmentation.
Epoch 1/200
50000/50000 [==============================]  734s
Epoch 2/200
50000/50000 [==============================]  733s
Epoch 3/200
50000/50000 [==============================]  733s
Epoch 4/200
50000/50000 [==============================]  733s
```

Running time **without** GPU

VS

```
X_train shape: (50000, 3, 32, 32)
50000 train samples
10000 test samples
Using real-time data augmentation.
Epoch 1/200
50000/50000 [==============================]  27s
Epoch 2/200
50000/50000 [==============================]  27s
Epoch 3/200
50000/50000 [==============================]  27s
Epoch 4/200
50000/50000 [==============================]  27s
```

Running time **with** GPU

With GPU, the running time is 733/27=**27.1 times faster** then the running time without GPU!!!

TECHNOLOGICAL ADVANCEMENTS IN SOFTWARE

WHY DEEP LEARNING IS SO POPULAR

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Keras

Caffe

TensorFlow

PyTorch

PROMINENT FIGURES OR GURUS IN THE FIELD OF DEEP LEARNING


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Geoffrey Hinton

"The Godfather of deep learning"

deeplearning.ai presents

Heroes of Deep Learning

Ian Goodfellow

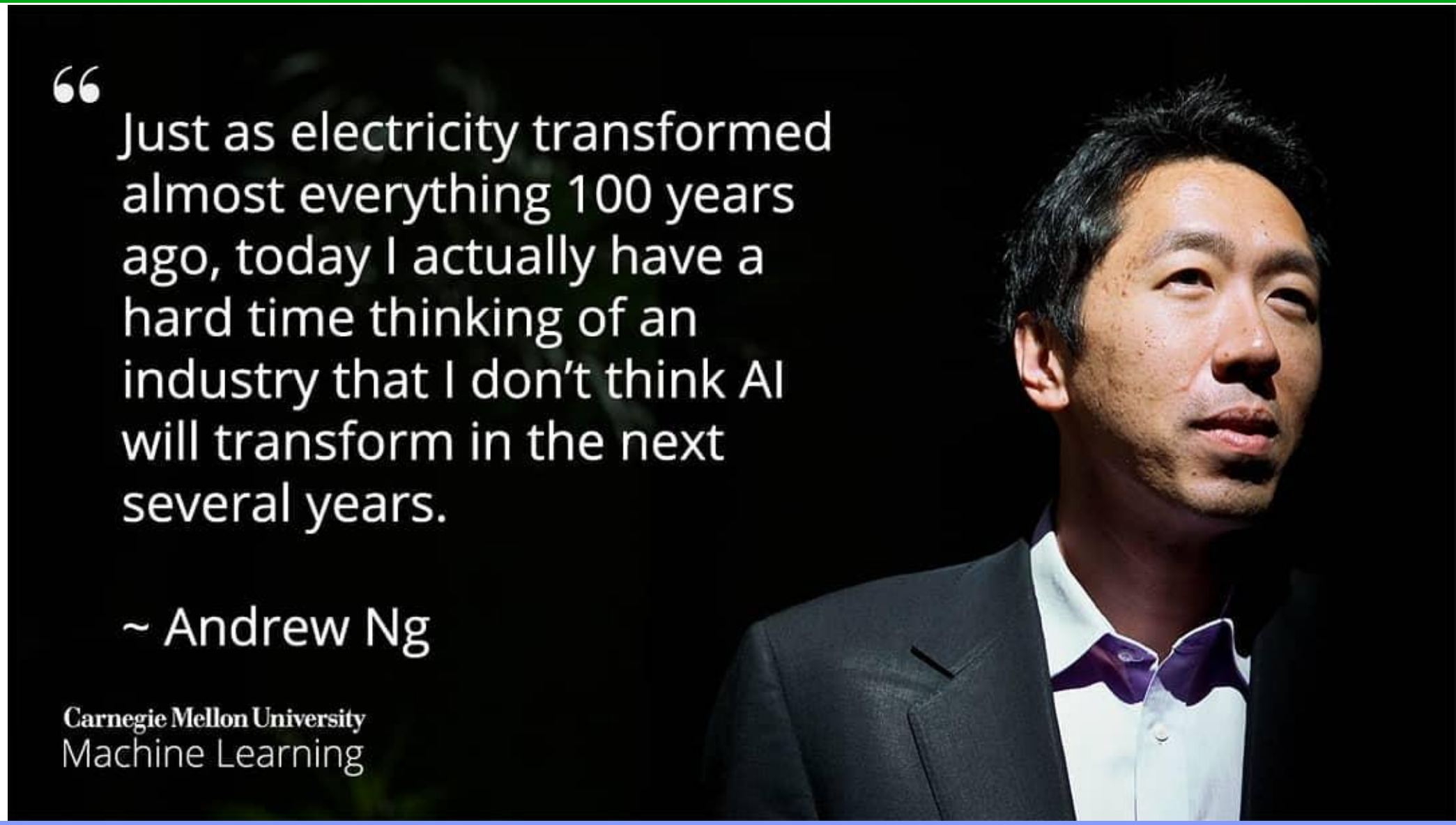
Research Scientist at Google Brain


Fei-Fei Li
Sequoia Professor of Computer Science at Stanford University
TECHPRO EDUCATION
FEI FEI LI

DEEP LEARNING

deeplearning.ai

Baidu 百度




CIM
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DEEP LEARNING HISTORY

DEEP LEARNING HISTORY

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Electronic Brain — 1943

Perceptron — 1957

ADALINE — 1960

XOR Problem — 1969

Golden Age

Dark Age ("AI Winter")

Multi-layered Perceptron (Backpropagation) — 1986

SVM — 1995

Deep Neural Network (Pretraining) — 2006

1940 1950 1960 1970 1980 1990 2000 2010

S. McCulloch – W. Pitts

F. Rosenblatt

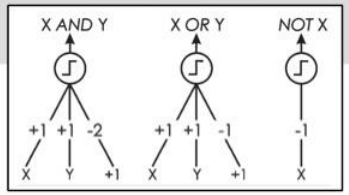
B. Widrow – M. Hoff

M. Minsky – S. Papert

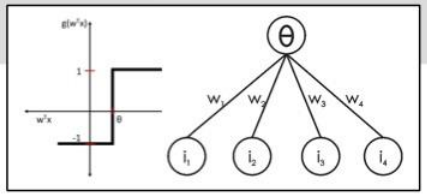
D. Rumelhart – G. Hinton – R. Wiliams

V. Vapnik – C. Cortes

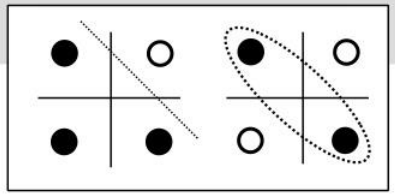
G. Hinton – S. Ruslan



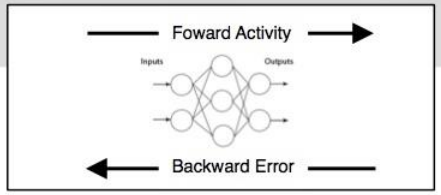
- Adjustable Weights
- Weights are not Learned



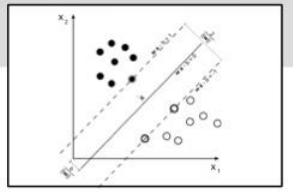
- Learnable Weights and Threshold



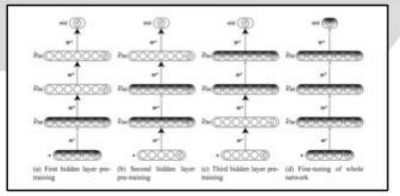
- XOR Problem



- Solution to nonlinearly separable problems
- Big computation, local optima and overfitting



- Limitations of learning prior knowledge
- Kernel function: Human Intervention



- Hierarchical feature Learning

DEEP LEARNING HISTORY

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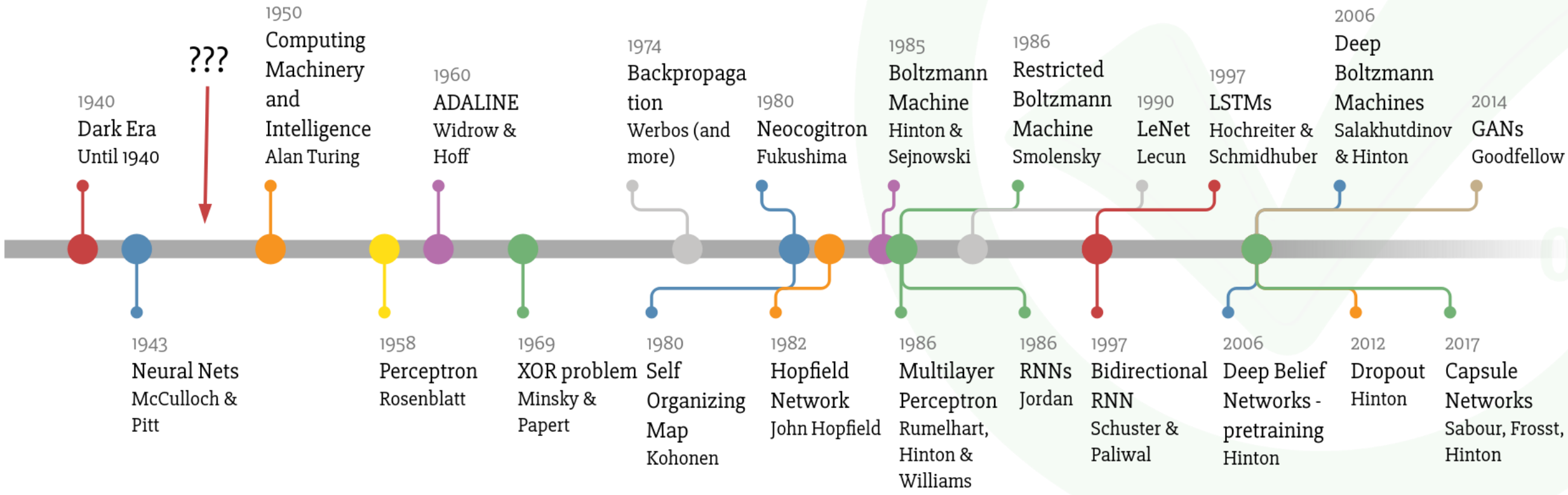
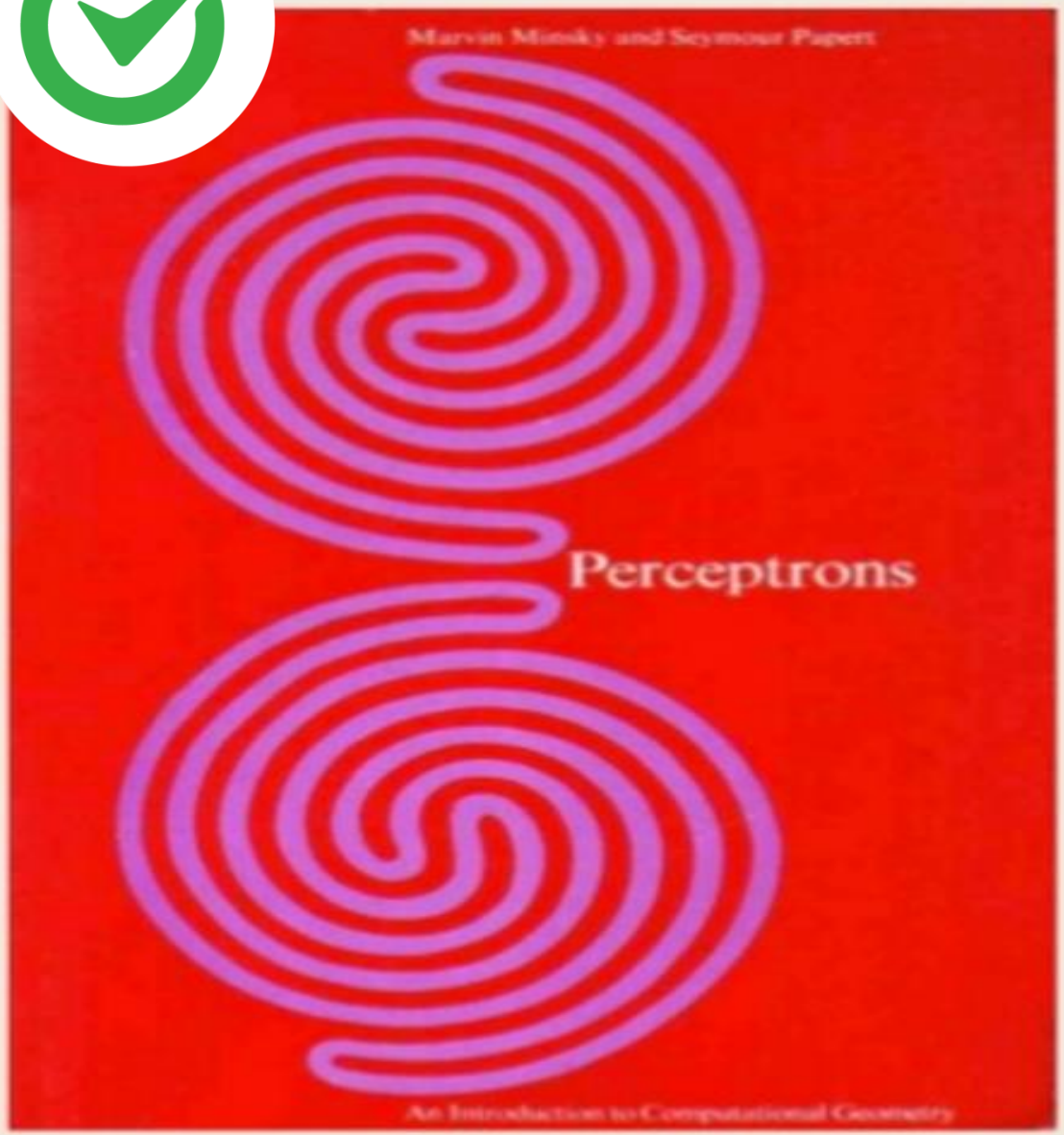
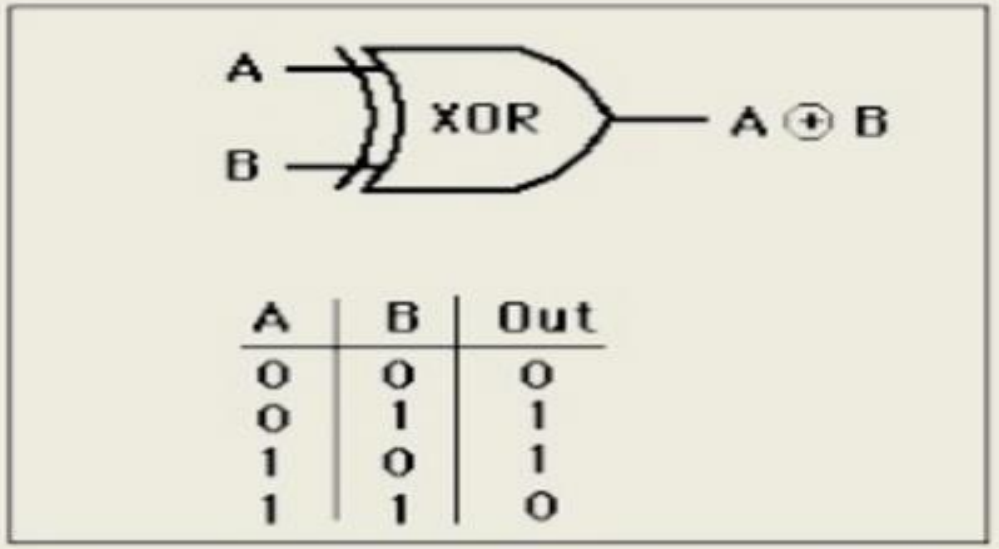
Deep Learning Timeline



1969: Perceptrons can't do XOR!



http://www.i-programmer.info/images/stories/BabBag/AI/book.jpg



A	B	Out
0	0	0
0	1	1
1	0	1
1	1	0

1969: Minsky and Papert proved that perceptrons cannot represent non-linearly separable target functions.

Minsky & Papert

https://constructingkids.files.wordpress.com/2013/05/minsky-papert-71-csolomon-x640.jpg