

**DATE : 07.10.2024**

**DT/NT : DT**

**LESSON : DEEP LEARNING**

**SUBJECT: INTRODUCTION TO  
DEEP LEARNING**

**BATCH : 250**

**DATA  
SCIENCE**



**TECHPRO  
EDUCATION**

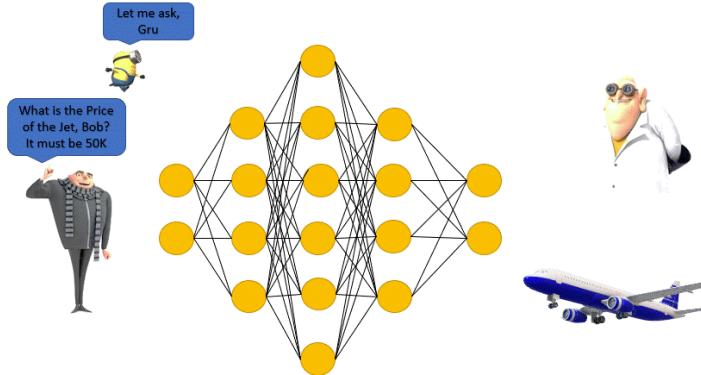
# DEEP LEARNING



# DEEP LEARNING

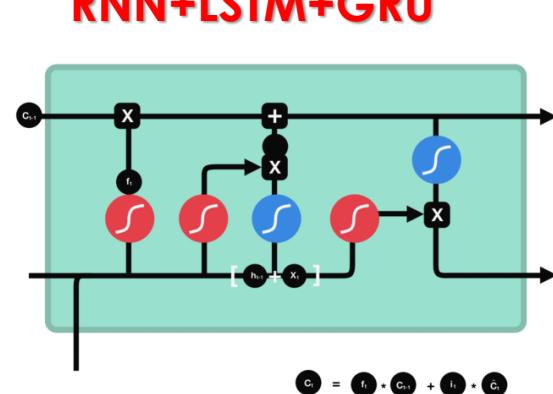
ANN

CAPSTONE  
PROJECT



# Kahoot!

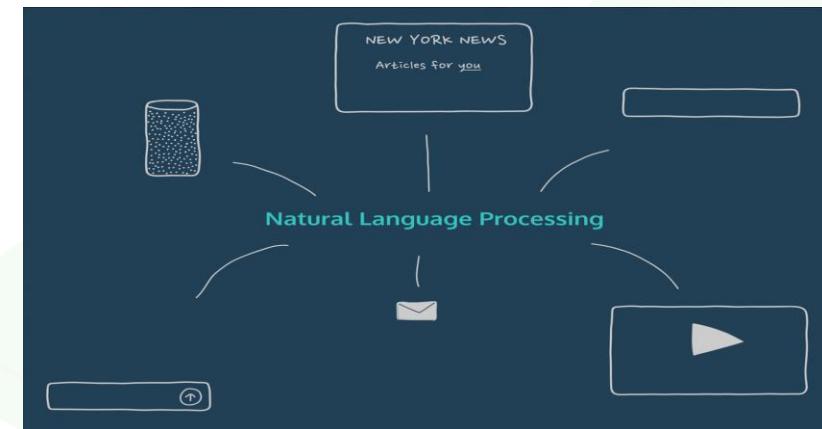
RNN+LSTM+GRU



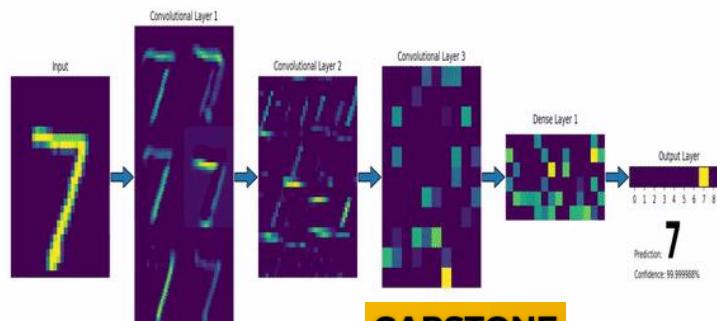
CAPSTONE  
PROJECT

NLP

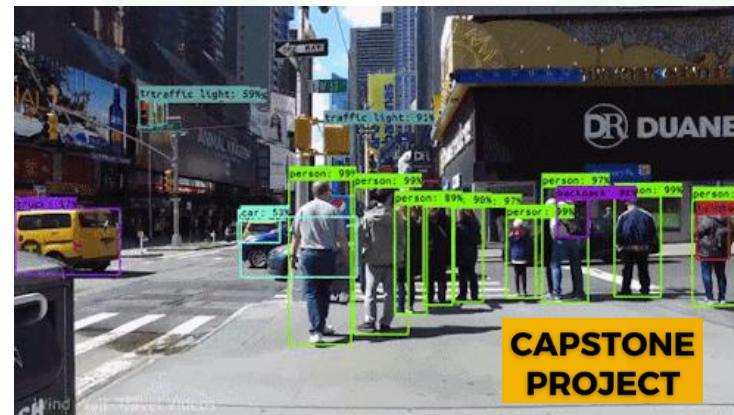
CAPSTONE  
PROJECT



CNN



COMPUTER VISION





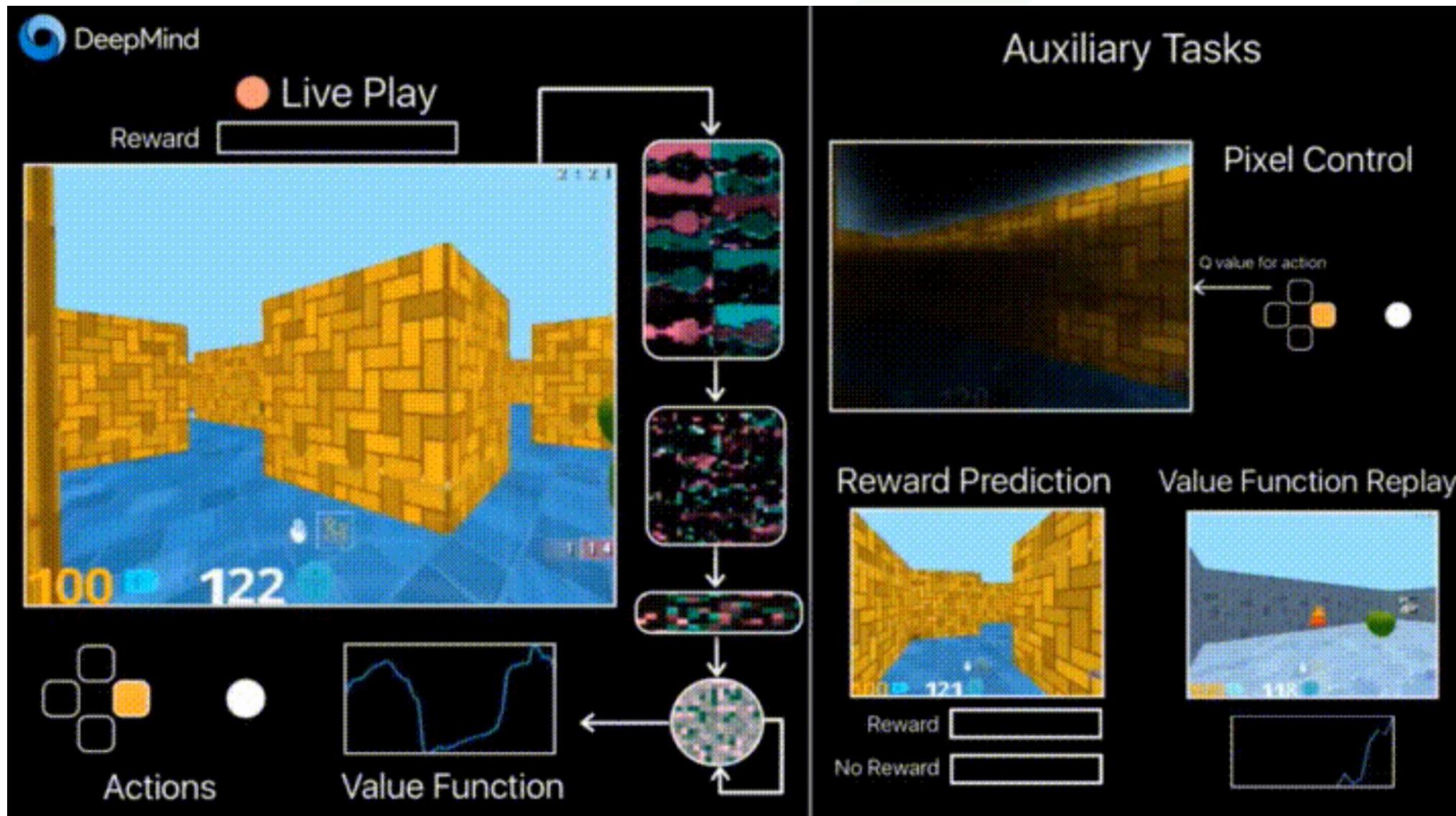
**WHY DEEP  
LEARNING?**

# DEEP LEARNING

1997



# DEEP LEARNING



# DEEP LEARNING

2016

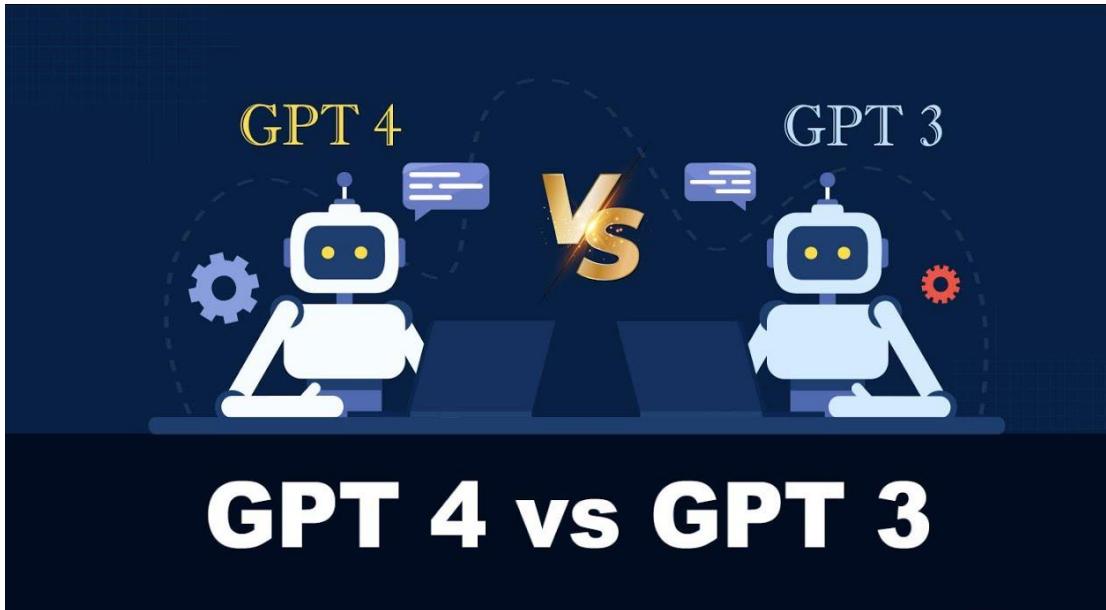


# DEEP LEARNING

2017



# DEEP LEARNING



# DEEP LEARNING

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



## DATA SCIENCE

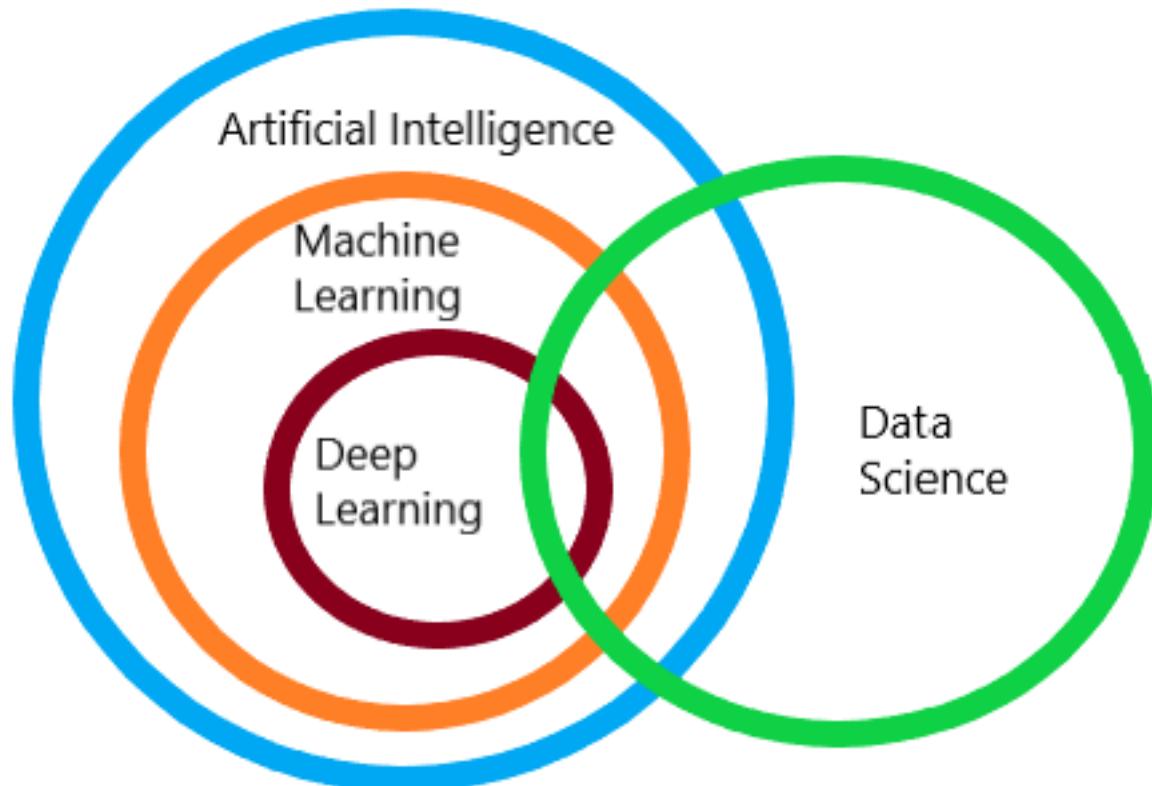
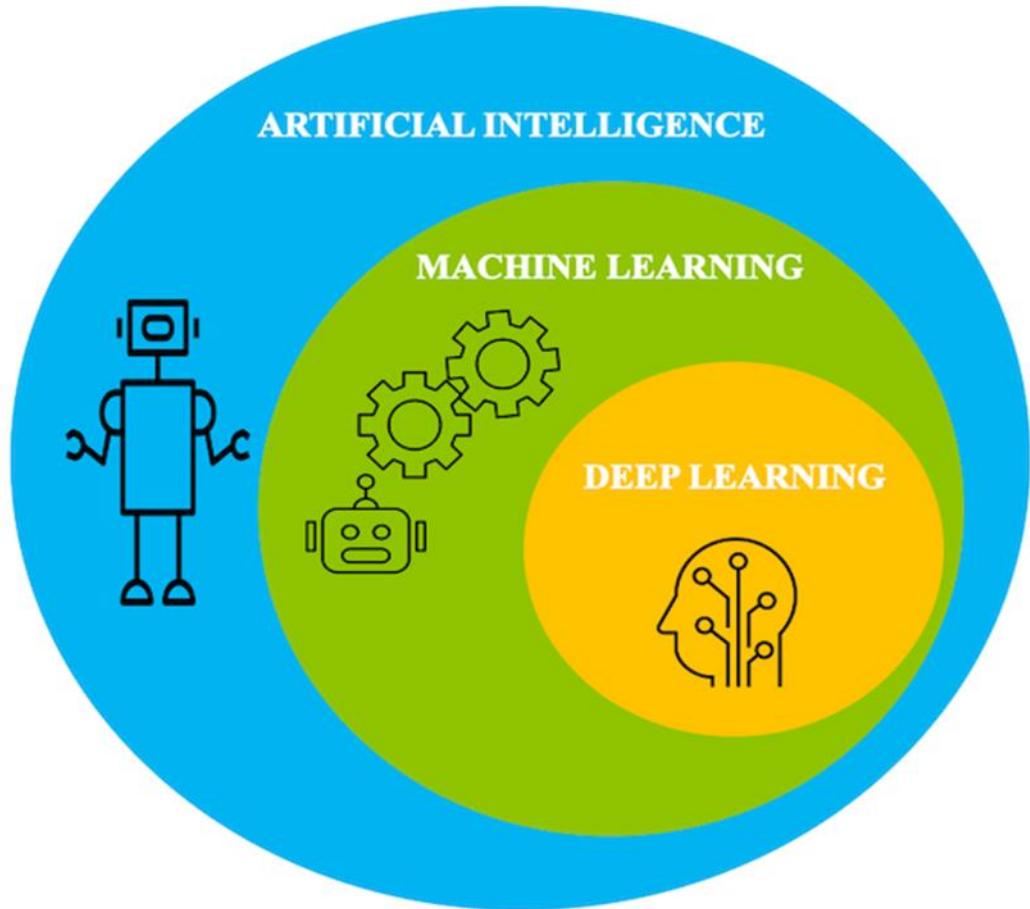


**14 Different  
Jobs with a  
Data Science  
Background**

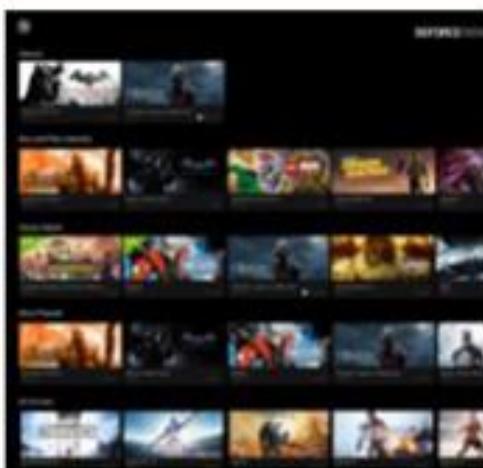
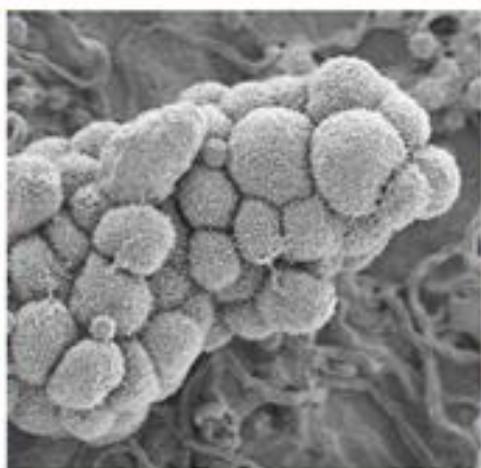


**WHAT IS DEEP  
LEARNING?**

# DEEP LEARNING



## 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



## 10 FASCINATING APPLICATIONS OF DEEP LEARNING



SELF-DRIVEN  
CARS



AUTOMATIC  
HANDWRITING  
GENERATION



PIXEL  
RESTORATION



COLOURISATION  
OF  
BLACK & WHITE  
IMAGES



DEEP  
DREAMING



DETECTION OF  
GROWTH DELAYS  
IN CHILDREN



DEMOGRAPHIC  
PREDICTION



SOUND  
ADDITION TO  
SILENT FILMS



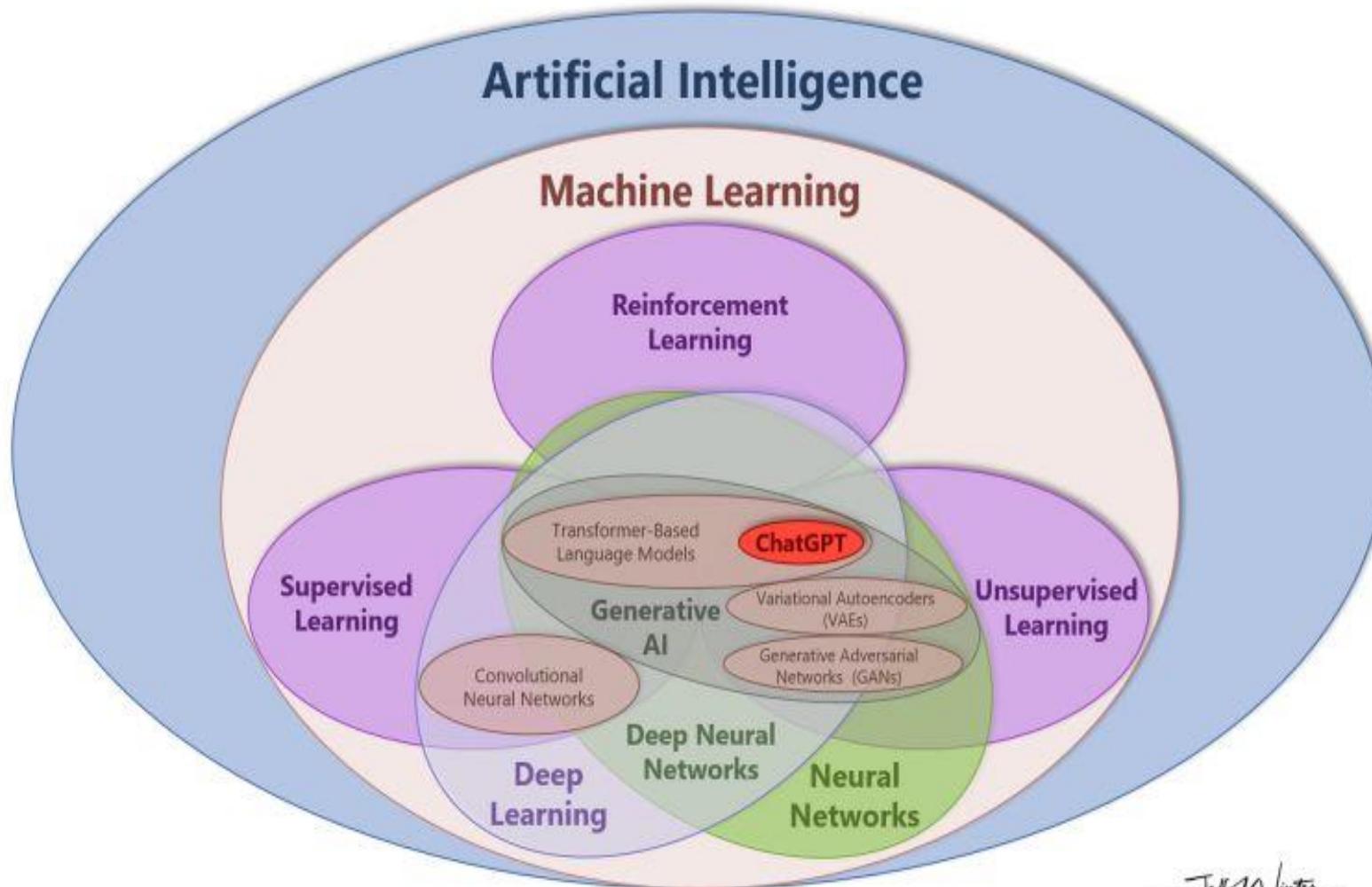
NEWS  
GENERATION



AUTOMATIC  
MACHINE  
TRANSLATION

## 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
  - Healthcare 11
  - Personalisations 12
  - Automatic Machine Translation 13
  - Automatic Handwriting Generation 14
  - Demographic & Election Predictions 15
  - Automatic Game Playing 16
  - Language Translations 17
  - Pixel Restoration 18
  - Photo Descriptions 19
  - Deep Dreaming 20



## Why Now?

Neural Networks date back decades, so why the resurgence?

### I. Big Data

- Larger Datasets
- Easier Collection & Storage



### 2. Hardware

- Graphics Processing Units (GPUs)
- Massively Parallelizable



### 3. Software

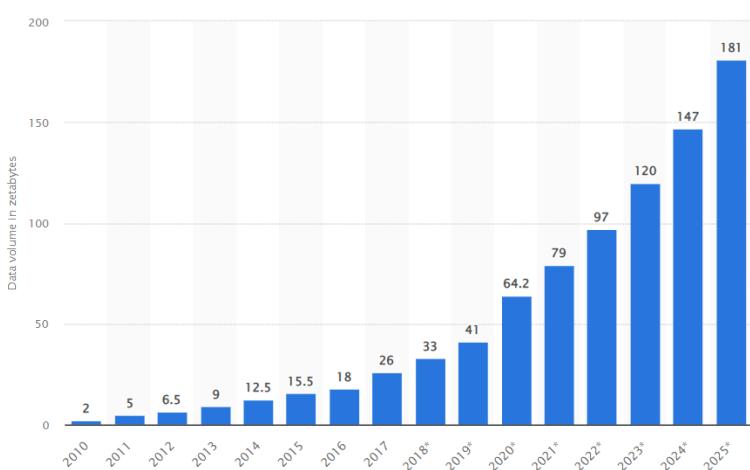
- Improved Techniques
- New Models
- Toolboxes



# RAPIDLY INCREASING DATA



# Deep Learning



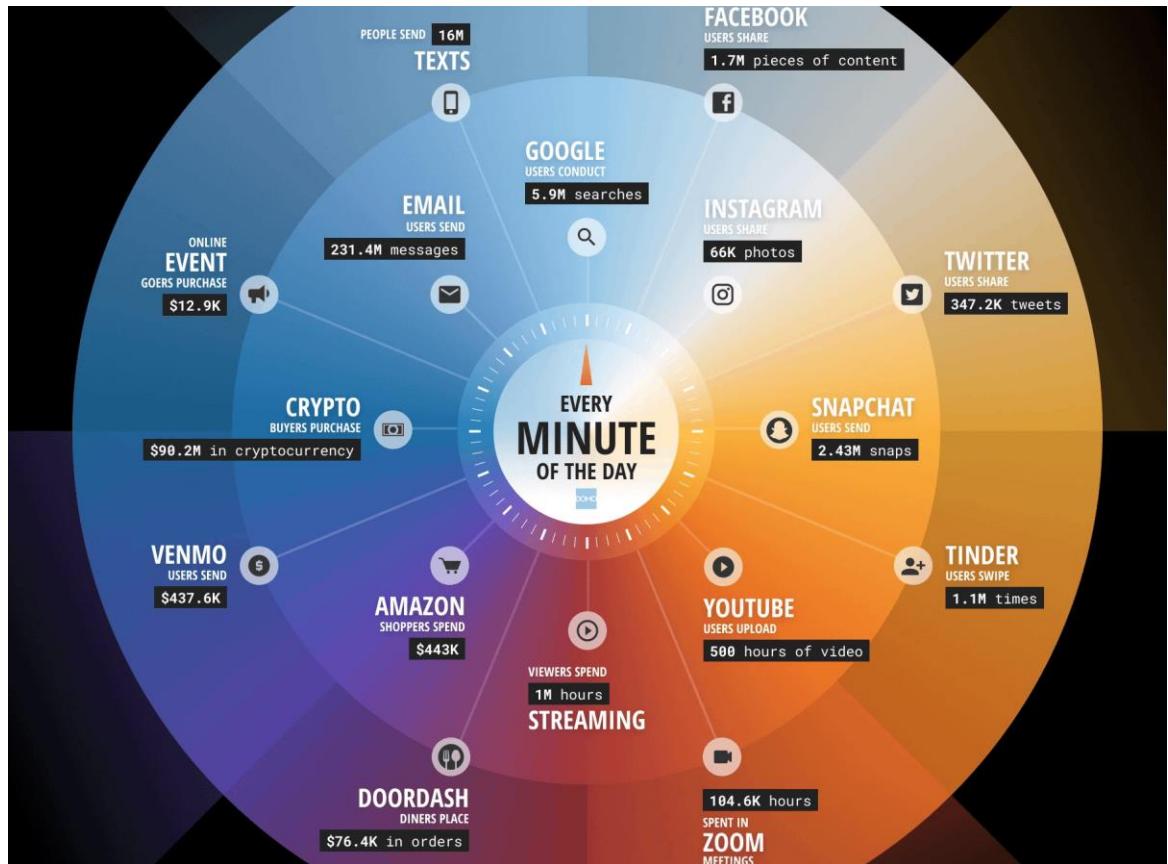
## WHAT'S A ZETTABYTE?

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1 megabyte	1,000,000,000,000,000,000
1 gigabyte	1,000,000,000,000,000,000
1 terabyte	1,000,000,000,000,000,000
1 petabyte	1,000,000,000,000,000,000
1 exabyte	1,000,000,000,000,000,000
1 zettabyte	1,000,000,000,000,000,000,000



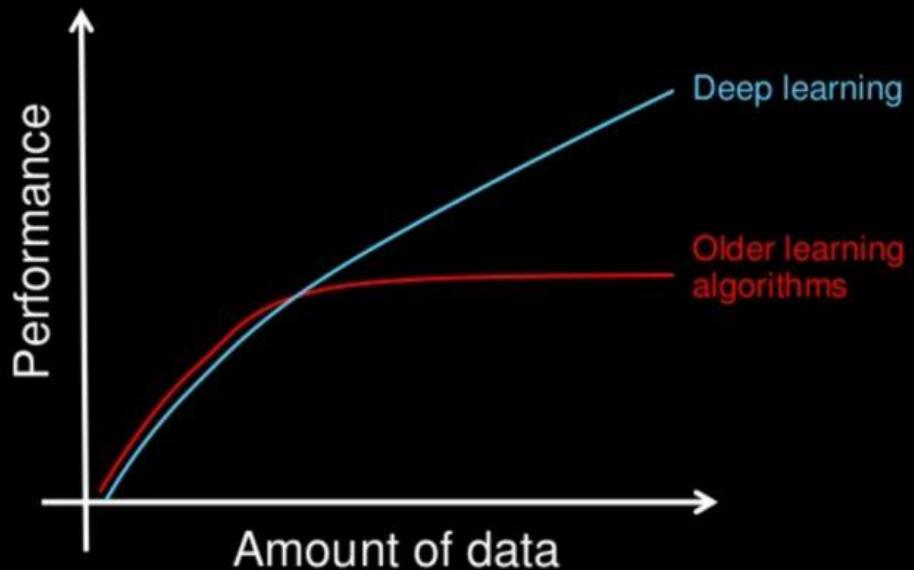
# 2022

# Deep Learning



# Deep Learning

Why deep learning

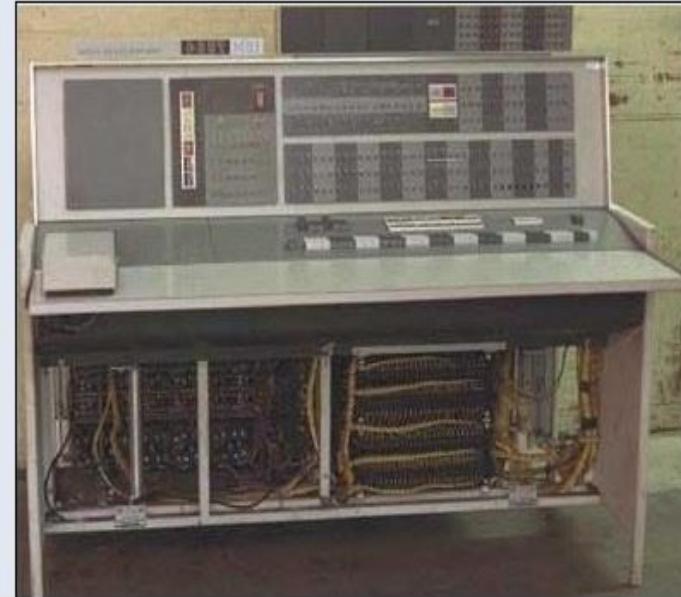
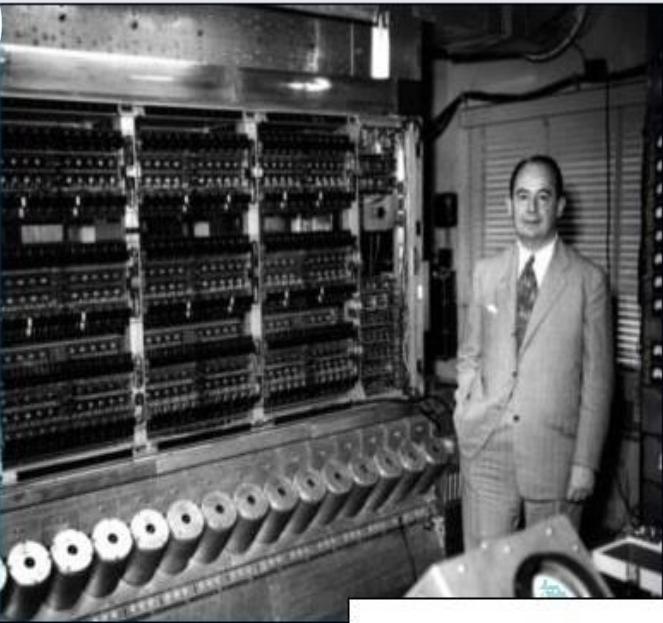


How do data science techniques scale with amount of data?





## TECHNOLOGICAL ADVANCEMENTS IN HARDWARE



# Generations and Future Computers



## THE BIG BANG IN DEEP LEARNING



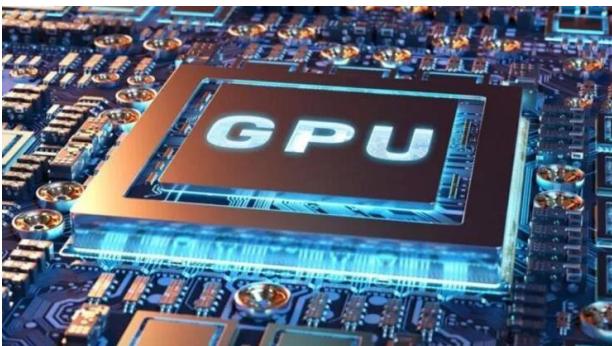
DNN



GPU

*“The GPU is the workhorse of modern A.I.”*

POPULAR  
SCIENCE

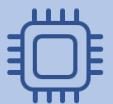


GPU AND Deep Learning



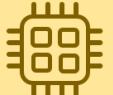
**GPU and Deep Learning:**  
A Combination That Works Miracles

# DEEP LEARNING



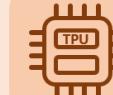
CPU

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



GPU

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



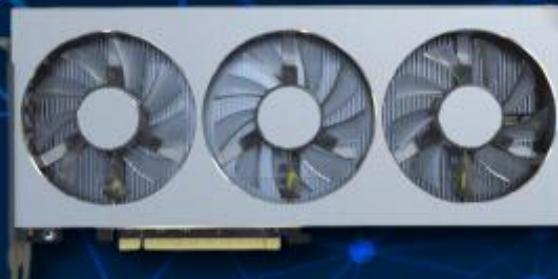
TPU

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

Central processing unit



Graphics processing unit



CPU

Tensor Processing Unit



TPU



GPU

# WHY DEEP LEARNING IS SO POPULAR



CPU



GPU



Tensor Processing Unit

TPU

# 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
```

734s

VS

Running time **without GPU**

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

27s

Running time **with GPU**

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



## TECHNOLOGICAL ADVANCEMENTS IN SOFTWARE



Keras

Caffe



TensorFlow

 PyTorch



**PROMINENT FIGURES OR  
GURUS IN THE FIELD OF  
DEEP LEARNING**



# Geoffrey Hinton

## “The Godfather of deep learning”





deeplearning.ai presents  
Heroes of Deep Learning

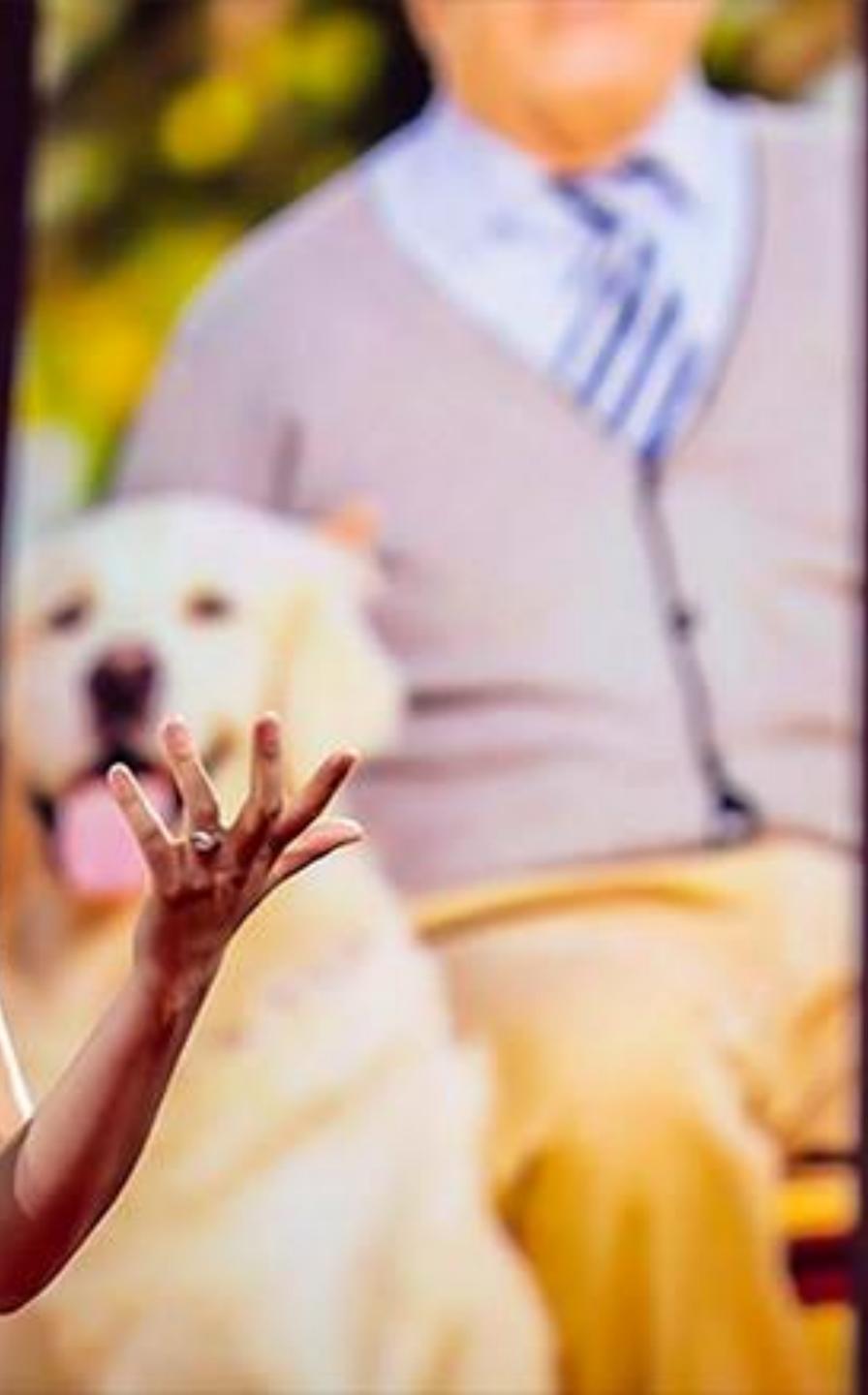
# Ian Goodfellow

Research Scientist at Google Brain



# Fei-Fei Li

Sequoia Professor of Computer  
Science at Stanford University



# DEEP LEARNING



deeplearning.ai



Carnegie Mellon University  
Machine Learning

“

Just as electricity transformed almost everything 100 years ago, today I actually have a hard time thinking of an industry that I don't think AI will transform in the next several years.

~ Andrew Ng





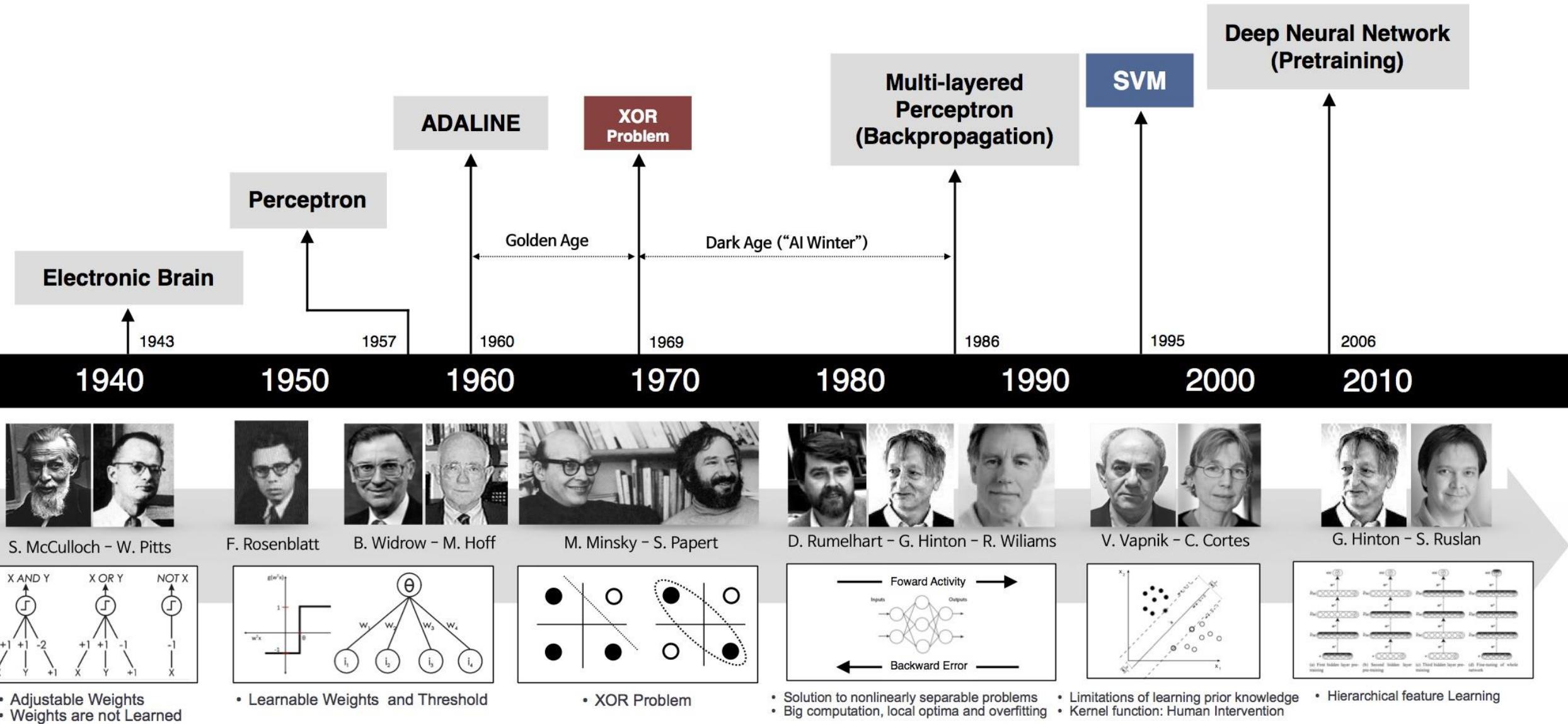
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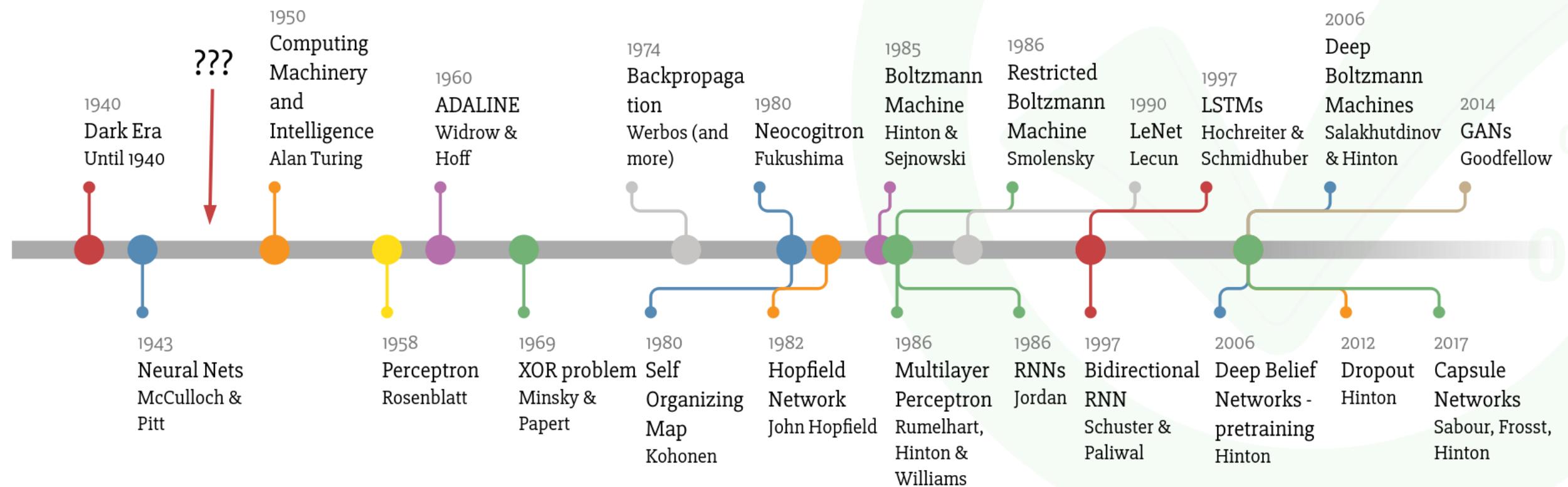
# DEEP LEARNING HISTORY

# DEEP LEARNING HISTORY



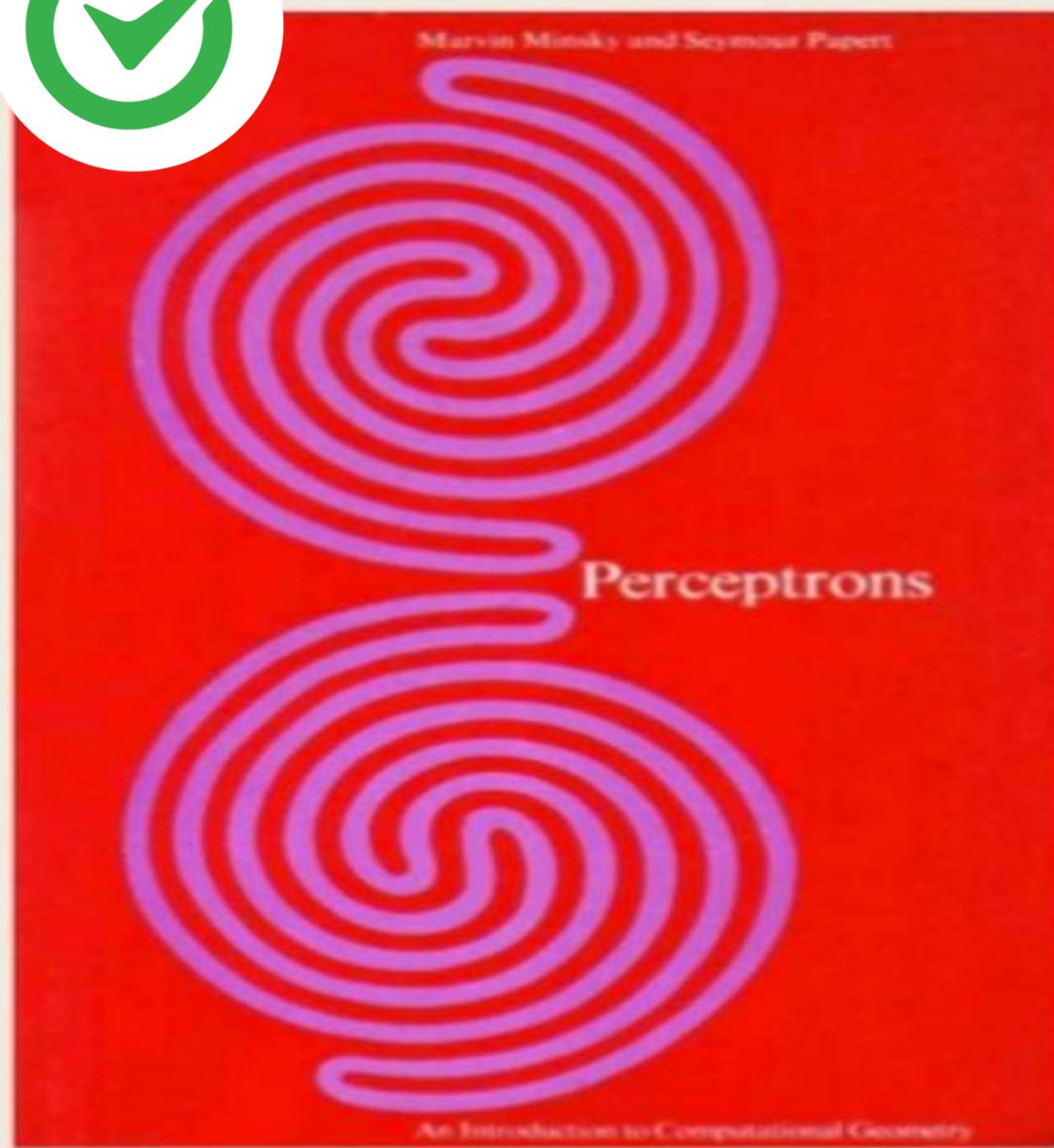
# DEEP LEARNING HISTORY

## Deep Learning Timeline

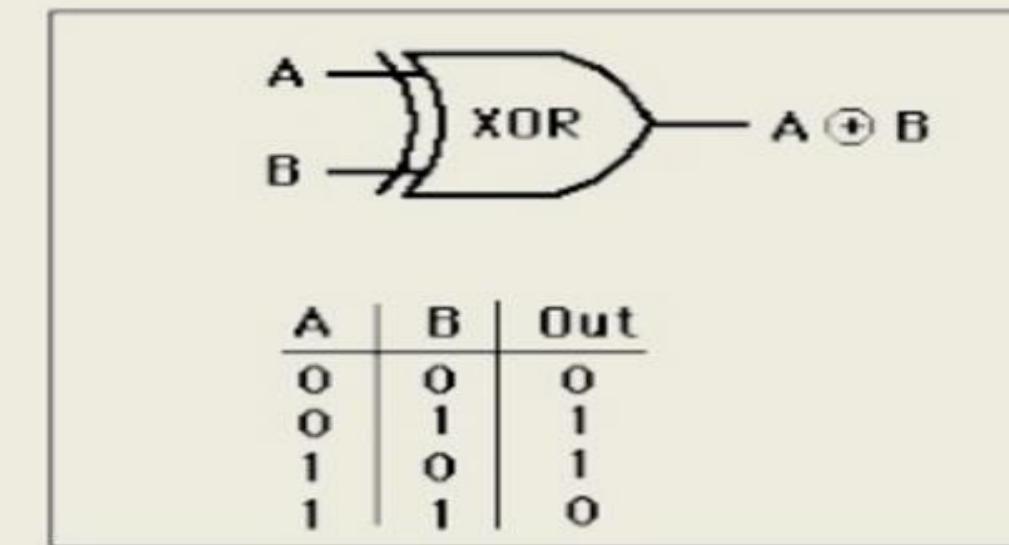




# 1969: Perceptrons can't do XOR!



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



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>