



Introduction to Deep Learning

Video 2: Deep Learning Epochs

In Air

1943

Birth of the Artificial
Neuron

1950s

1960s

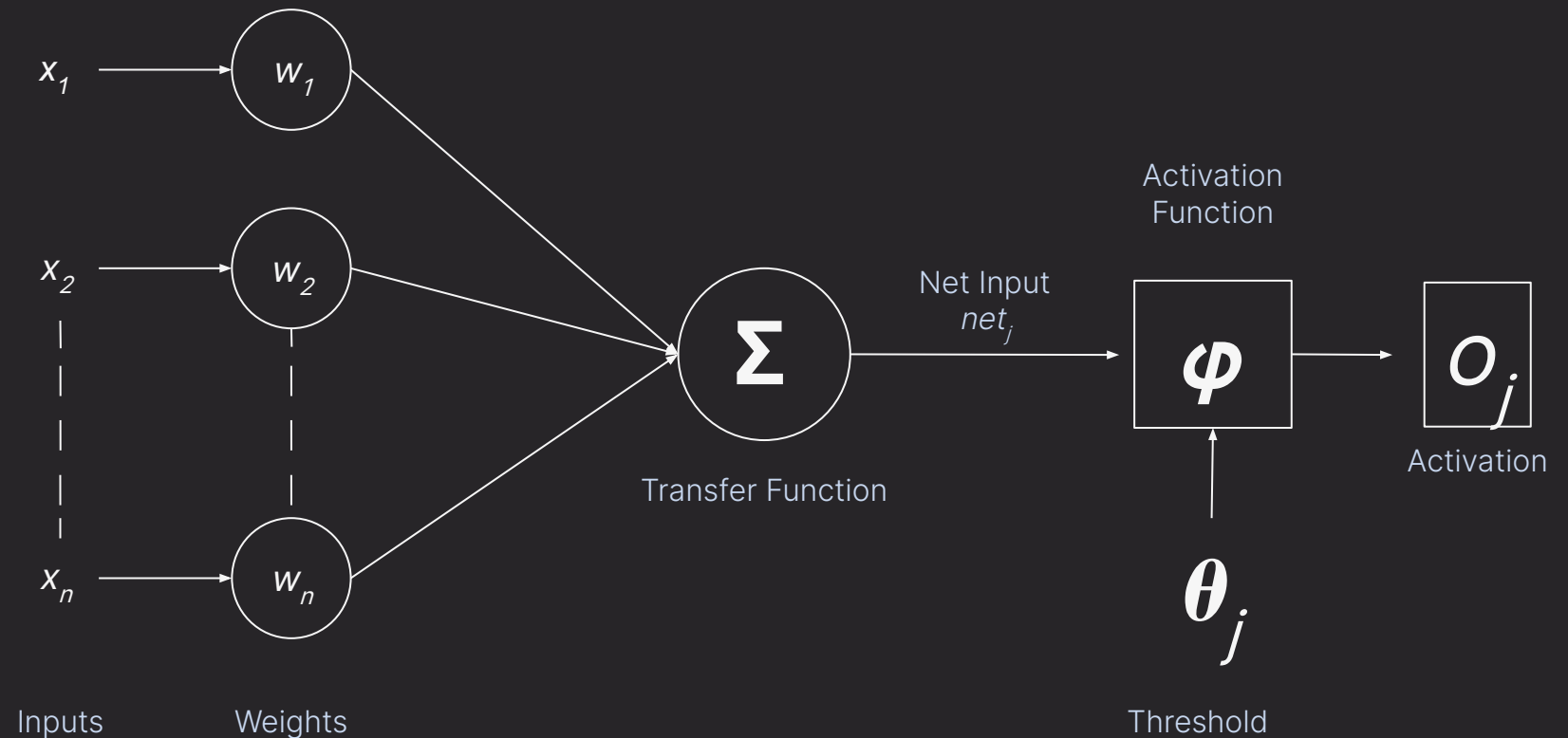
1970s

1980s

1990s

⋮

- Walter Pitts and Warren McCulloch introduced the first artificial neuron.

**The First Artificial Neuron**

1943

1950s

The Perceptron Era

1957 |  Designed Perceptron

1960s

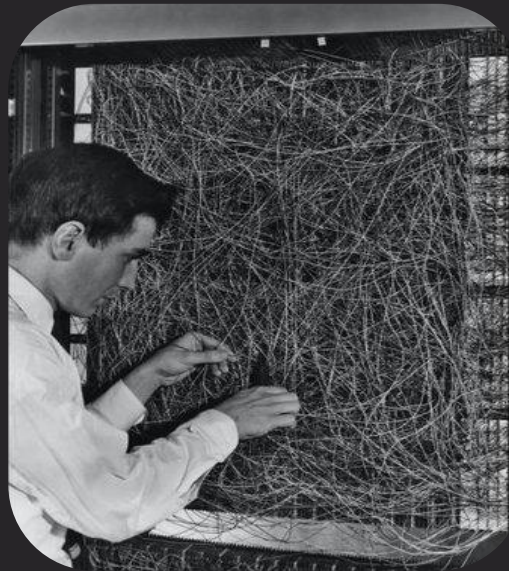
1970s

1980s

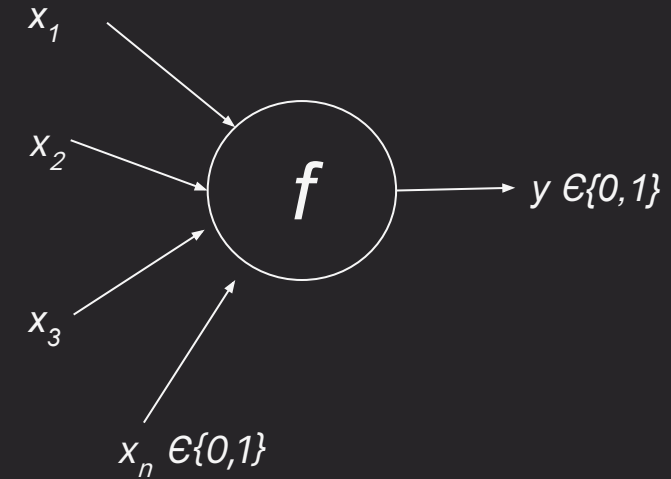
1990s

⋮

- Frank Rosenblatt conceived perceptrons for binary classification.



Frank Rosenblatt



The First Perceptron

1943

1950s

1960s

The Fall of
Perceptron1969  XOR Gate Problem Solved

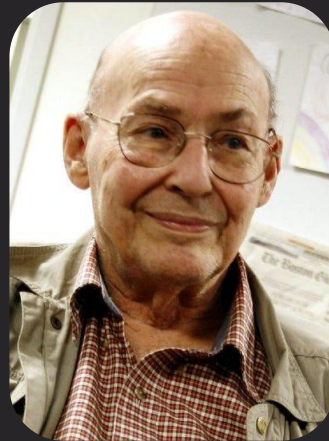
1970s

1980s

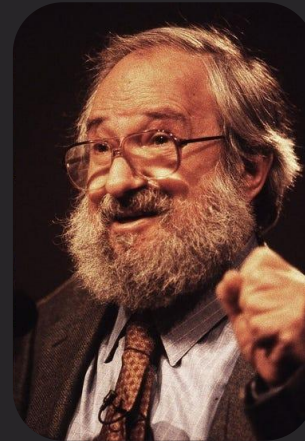
1990s

⋮

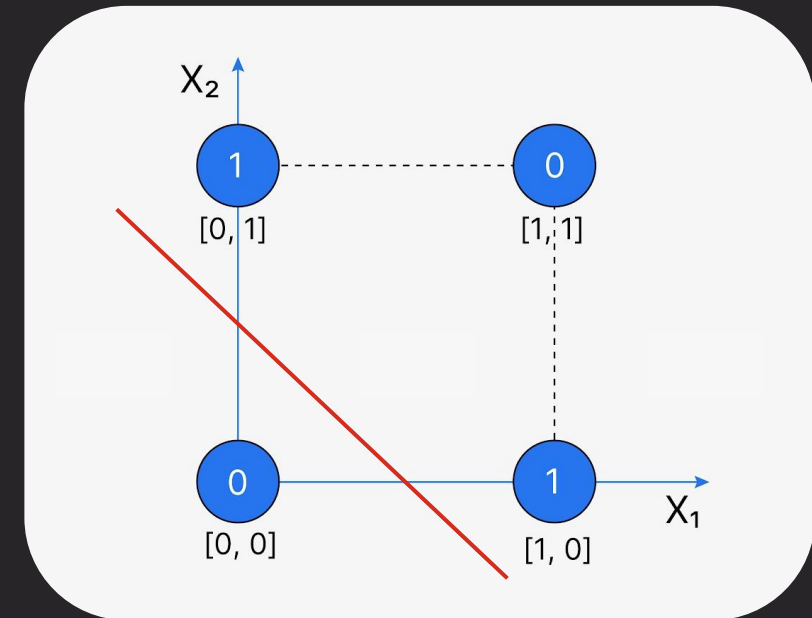
- Highlighted a perceptron's inability to solve the XOR gate problem



Marvin Minsky



Seymour Papert



XOR Gate

1943

1950s

1960s

The Fall of
Perceptron1969  XOR Gate Problem Solved

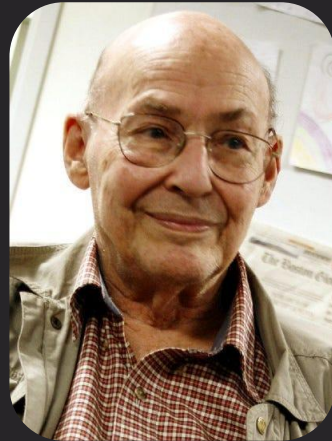
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1980s

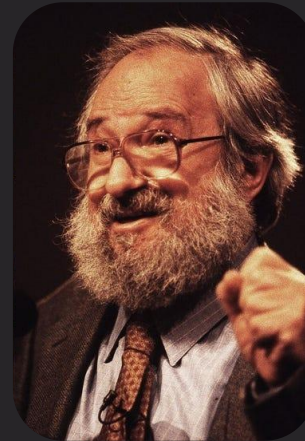
1990s

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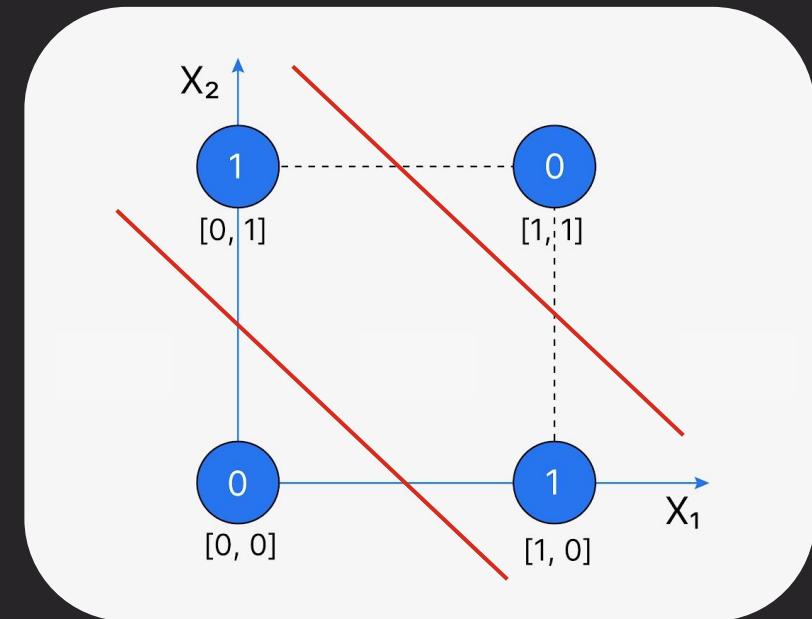
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Marvin Minsky



Seymour Papert



XOR Gate

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1960s

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The AI Winter

1980s

1990s

⋮

AI Winter: Period of reduced funding, interest and progress in the field of AI.

1943

1950s

1960s

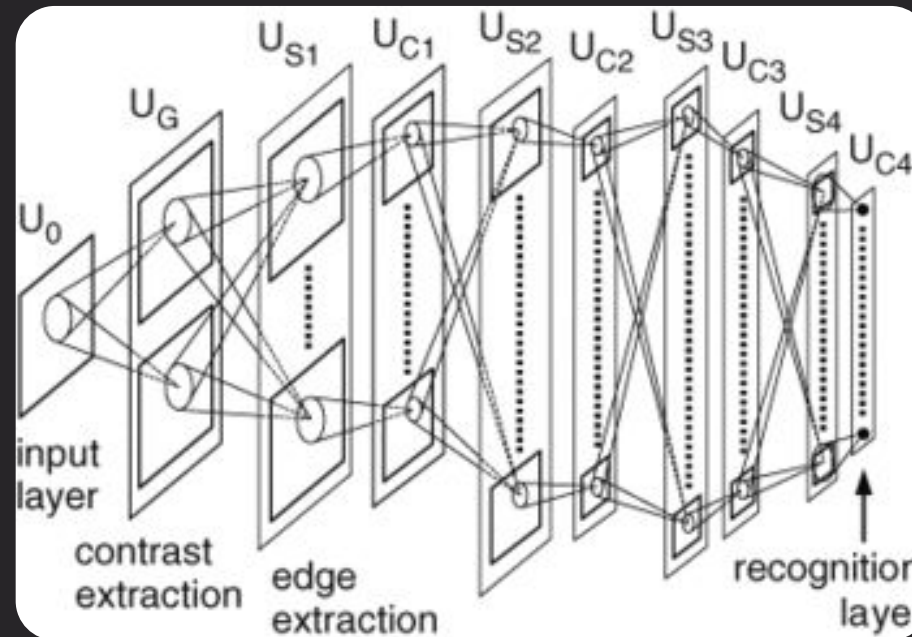
1970s

1980s

The Rise of CNNs

1990s

- Kunihiro Fukushima came up with **Neocognitron**; a neural network to identify visual characters (specially handwritten).



Neural Networks for Visual Recognition

1943

1950s

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Backpropagation

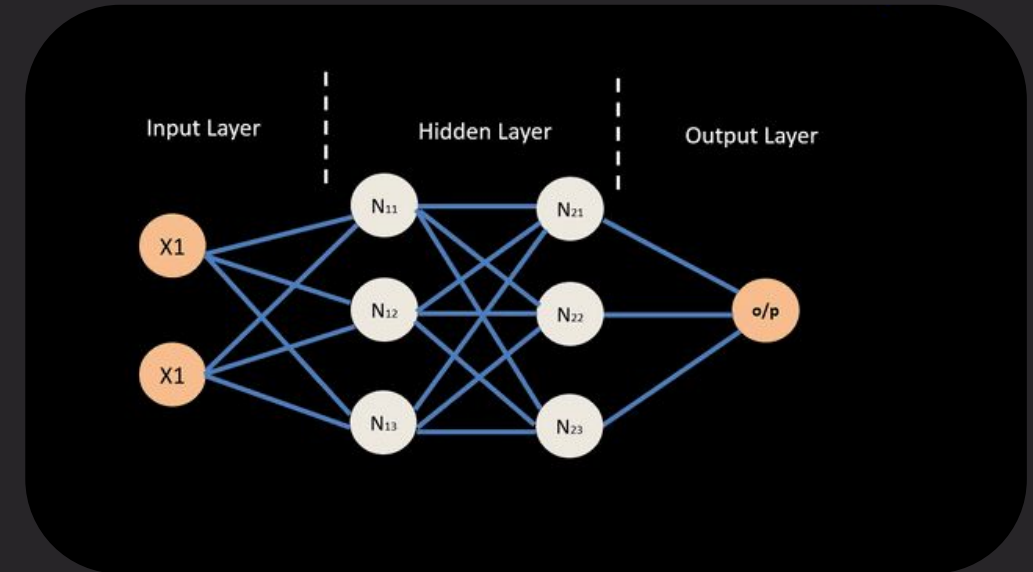
1989 | First Back Propagation Model

1990s

- Geoffrey Hinton's team successfully implements backpropagation in neural networks.



Geoffrey Hinton



Working of Backpropagation

1943

1950s

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1970s

1980s

1990s

Data Boom Starts

- Faster computation and large data are essential for successful multilayer neural networks.
- The internet and processing units have enabled the creation and sharing of large data since the 1990s.



1943

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Earliest CNN Model

1993 ◀ LeCun trains first CNN

- Yann LeCun's early CNN recognized handwritten digits, advancing computer vision.



Yann LeCun



One of the Earliest CNN

1990s

2000s

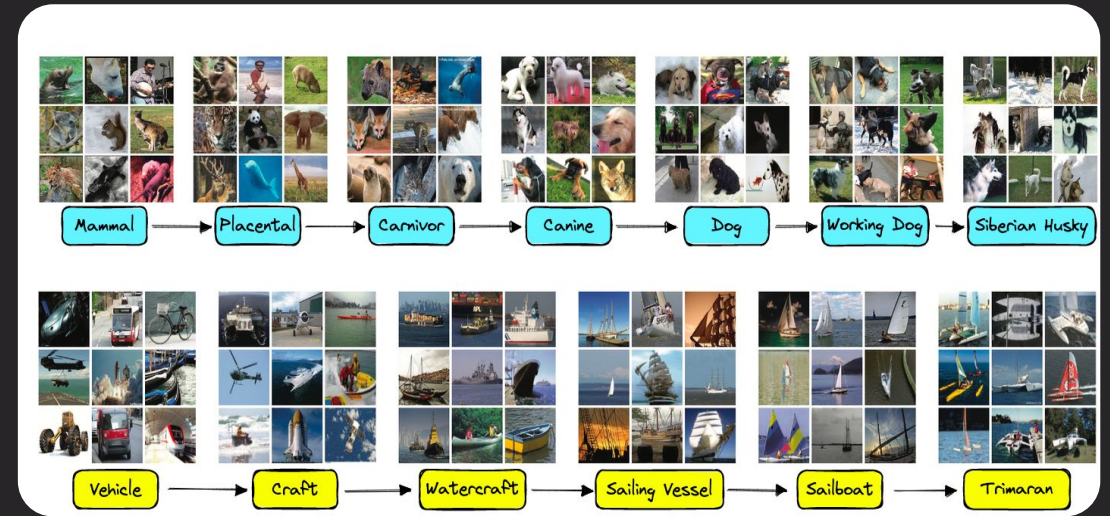
Unstructured
Data Boom

2009 | ImageNet

2010s



Fei-Fei Li



ImageNet - Free database for labeled images

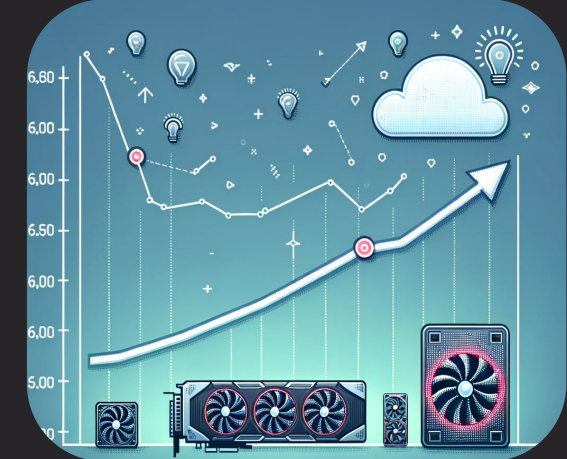
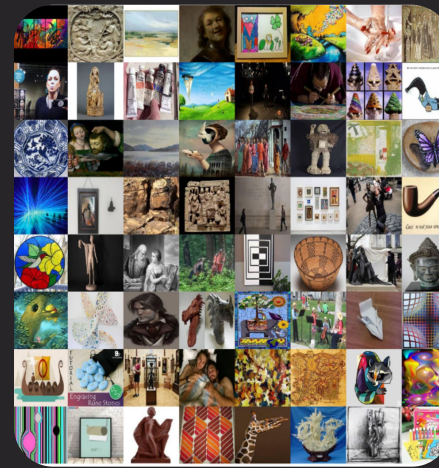
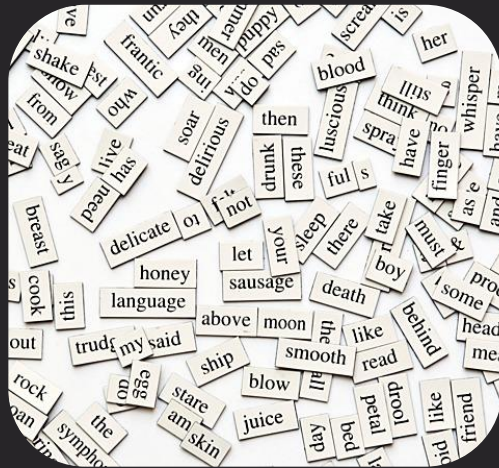
1990s

2000s

Unstructured Data Boom

2010s

- **Unprecedented growth in unstructured data (text, images, videos) due to the internet boom.**
- **Cloud computing and GPU's became cheaper and affordable.**



1990s

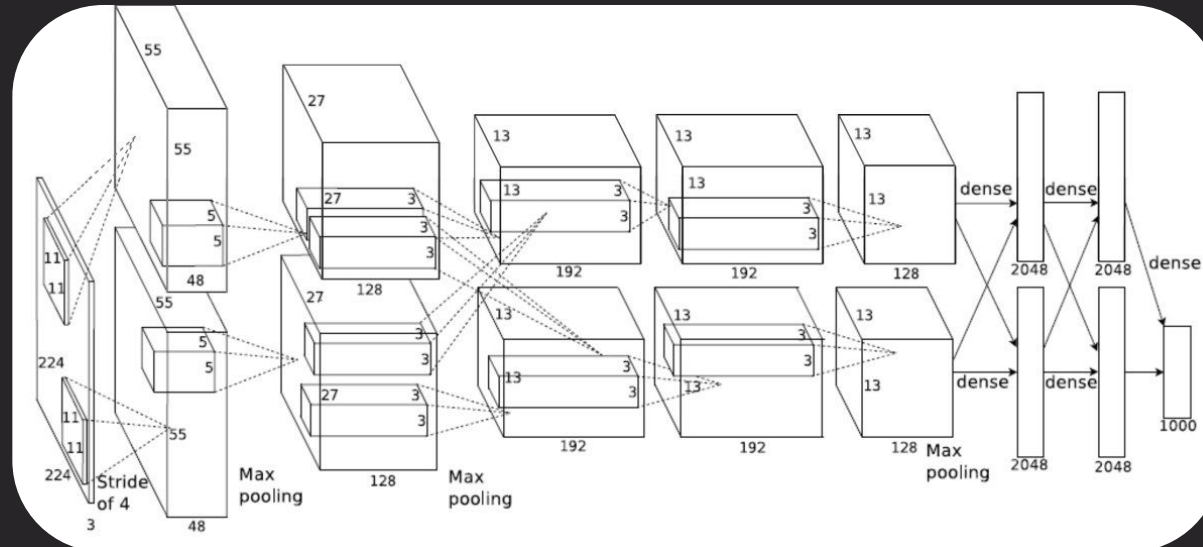
2000s

2010s

Breakthroughs in
Deep Learning

2012 ◀ AlexNet

- AlexNet's leap in machine image recognition at ImageNet.
- Reduced error rate on ImageNet from 26.2% to 15.3%.



AlexNet Architecture

1990s

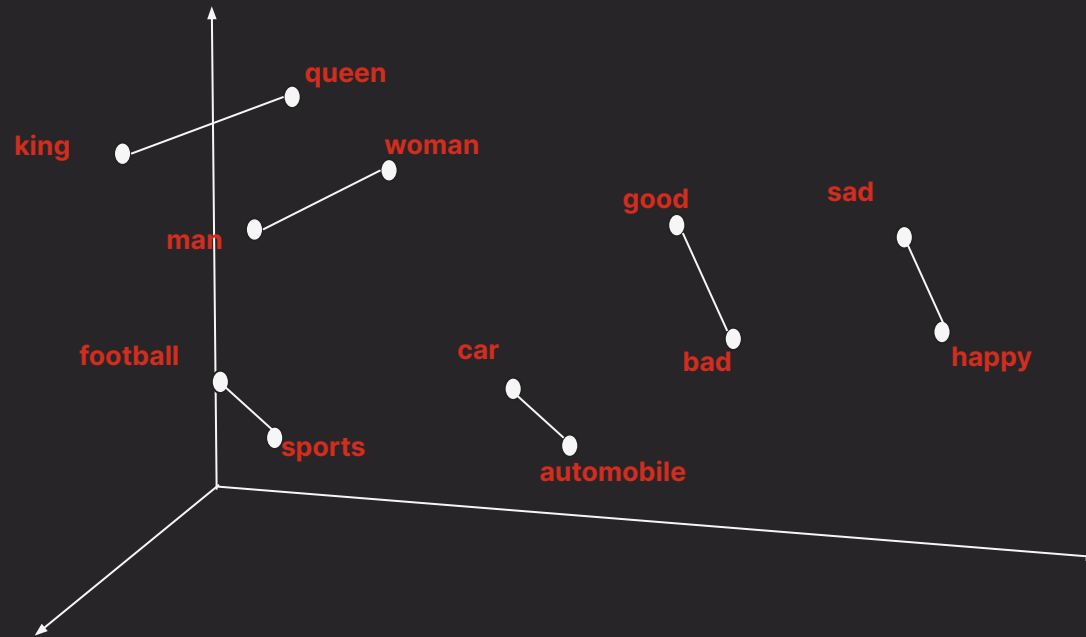
2000s

2010s

Breakthroughs in
Deep Learning

2013 ◀ Word2Vec

- **Google's Word2Vec** advanced in machine language understanding.
- Turned words → Vectors → Similar Names



1990s

2000s

2010s

Breakthroughs in
Deep Learning

2014 ◀ GANs

- Emergence of GANs by Ian Goodfellow, revolutionizing applications in art, fashion, and science.



Ian Goodfellow

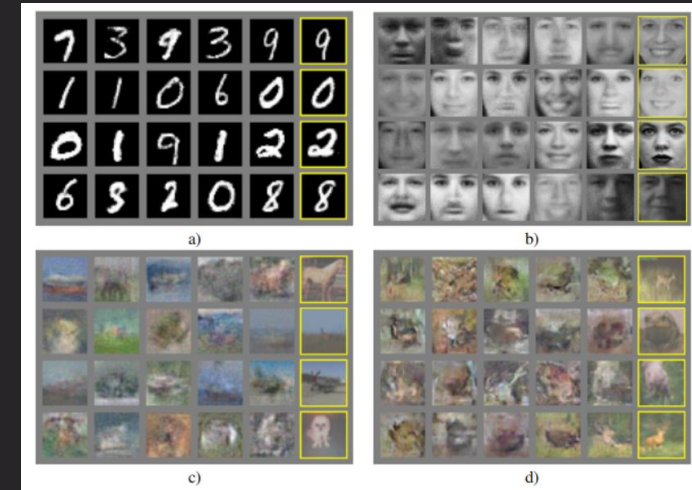


Image by GAN

1990s

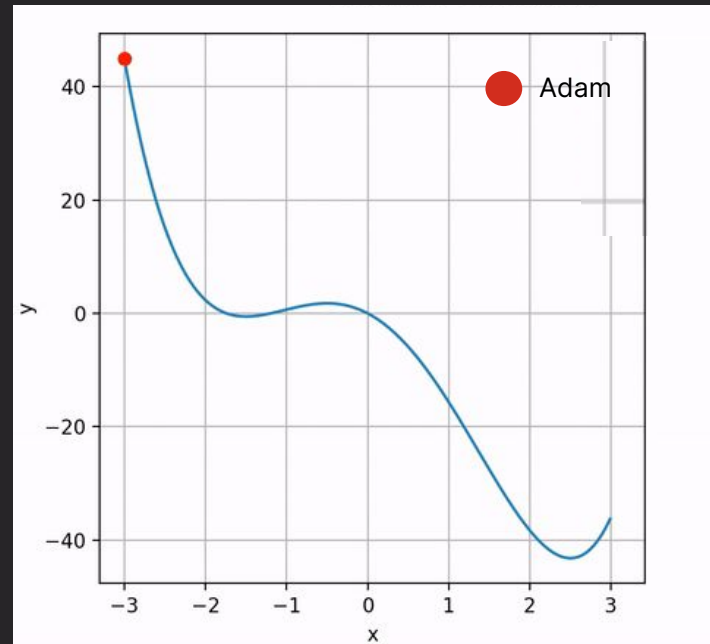
2000s

2010s

Breakthroughs in
Deep Learning

2014 ◀ Adam Optimizer

- Adam is a popular optimizer that minimizes loss during the training of the neural network.
- Adam optimizer finds best model parameters faster.



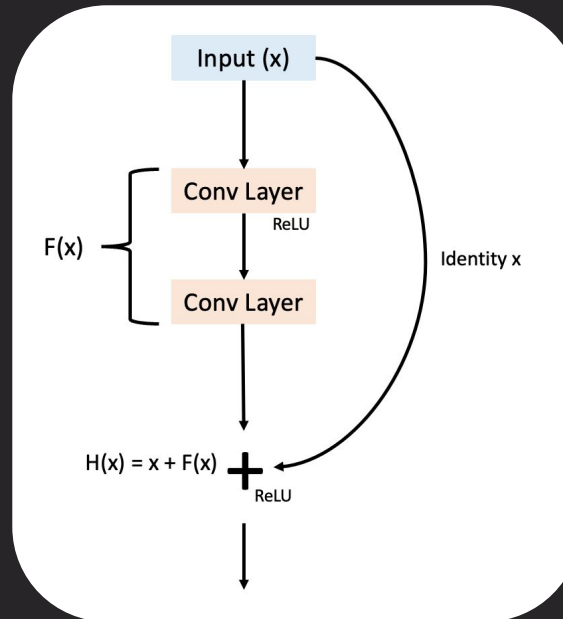
1990s

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Breakthroughs in
Deep Learning2015  ResNet

- ResNet Used a technique called “skip connections” allowing deeper neural networks to learn effectively with losing information.



ResNet Architecture

1990s

2000s

2010s

Breakthroughs in
Deep Learning

- Deep Learning defeats world champion in the board game “Go”
- Number of possibilities in the board game = 10^{360}

2016 ◀ AlphaGo



AlphaGo beats 'Go' world champion

1990s

2000s

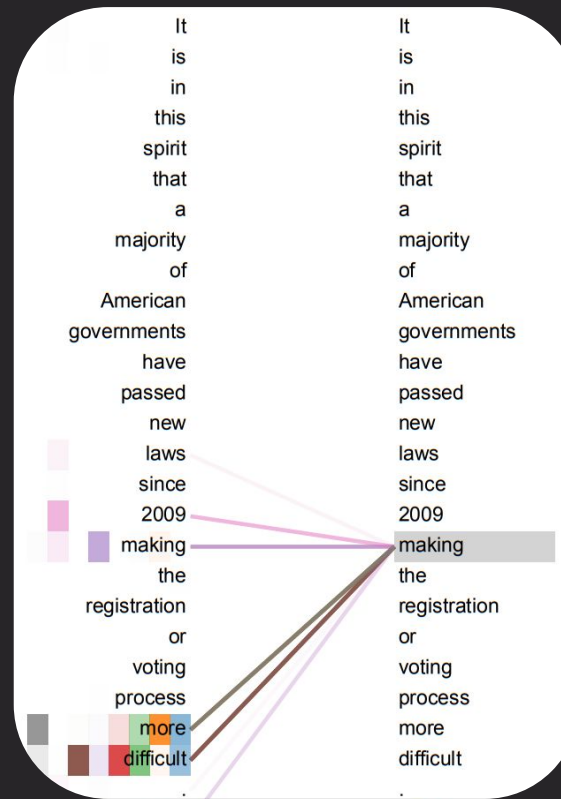
2010s

Breakthroughs in
Deep Learning

2017

Attention
Mechanism

- Attention Mechanism was a major landmark in Natural Language Processing (NLP).



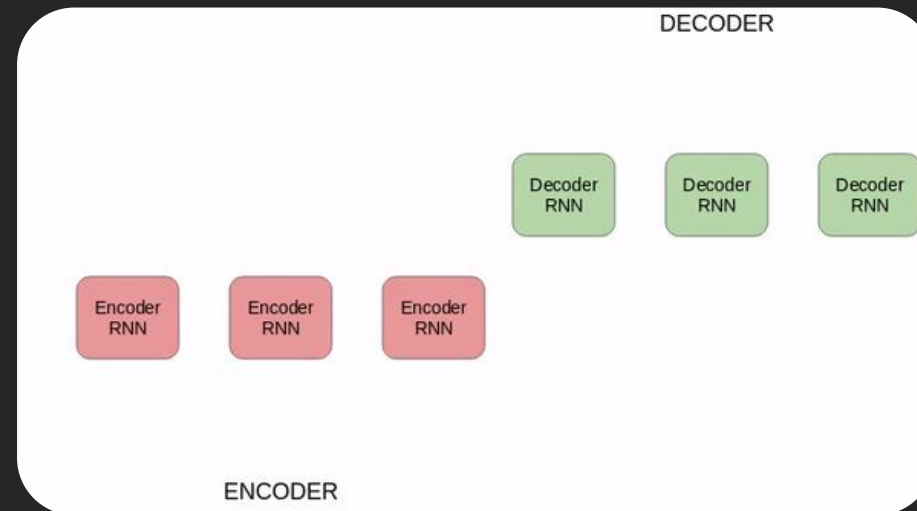
1990s

2000s

2010s

Breakthroughs in
Deep Learning

- Development of BERT and transformers.
- AI began to grasp context and details in language better.



Working of Transformers

- ChatGPT - Chat **G**enerative **P**re-trained **T**ransformer

2018

The Age of
Transformers

1990s

2000s

2010s

Breakthroughs in
Deep Learning

- Stable Diffusion launched, transforming text-to-image generation.
- ChatGPT is capable of human-like text generation and conversation.



**Hyper-realistic Face Generation
using Stable Diffusion**



ChatGPT

2022 ◀ ChatGPT

1990s

2000s

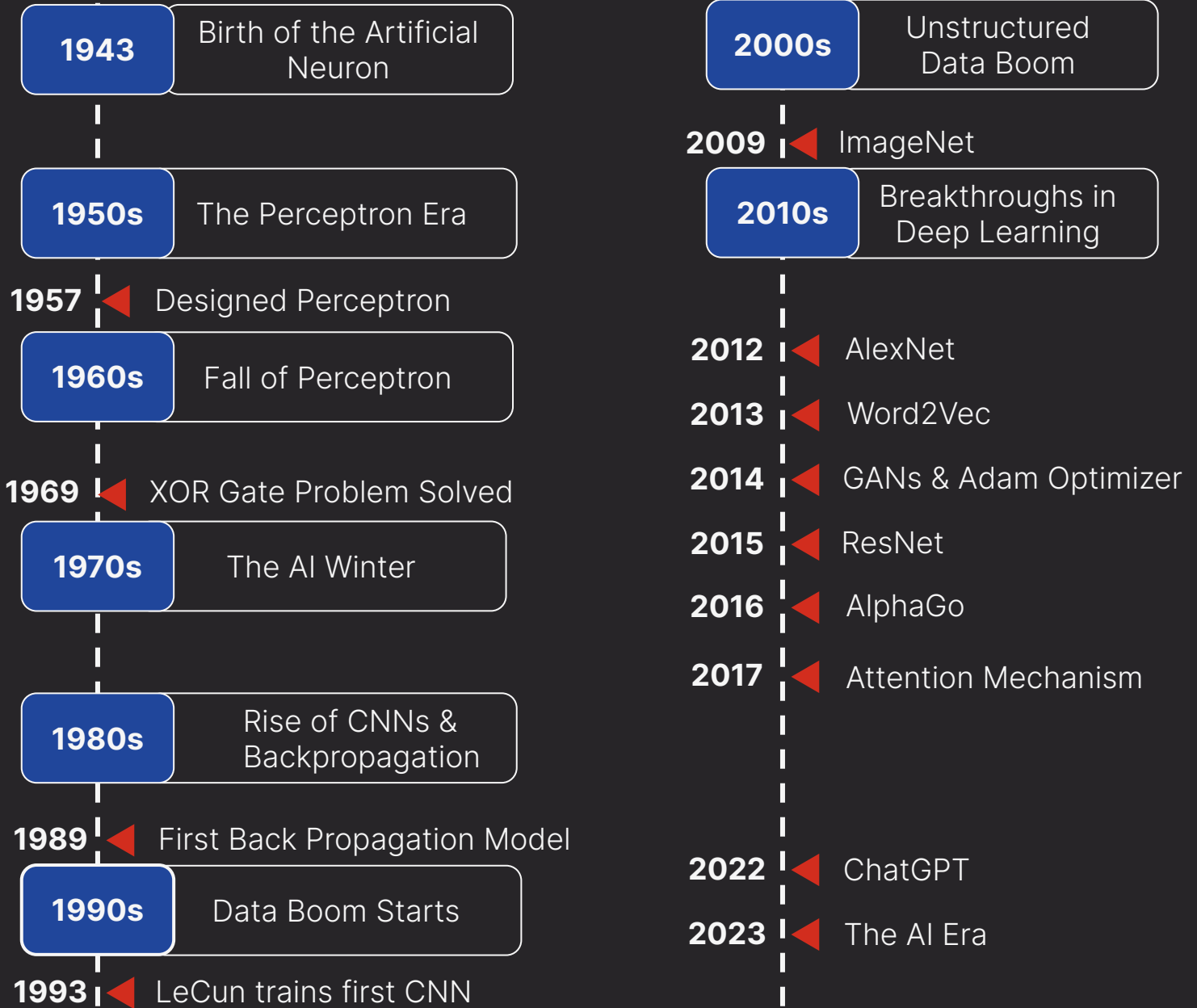
2010s

Breakthroughs in
Deep Learning

- Multimodal models to produce text, images, videos and audios.
- Deep learning algorithms fulfill diverse creative needs.



Summary



Up Next: Neuron Know-How