

What is Deep Learning

The Big Picture – From History to Today's Implementations

Daniel Schalk

October 19, 2018



History of Deep Learning

Deep Learning Timeline - 1

1943

Warren S. McCulloch and **Walter Pitts** published tried to understand how the brain could produce highly complex patterns by using many basic cells that are connected together.

1943

Deep Learning Timeline - 1

1943

Warren S. McCulloch and **Walter Pitts** published tried to understand how the brain could produce highly complex patterns by using many basic cells that are connected together.

1943

1950

1950

Alan Turing predicted the impact of Machine Learning. Additionally, he crafted what has been dubbed The Turing Test.

1957

Frank Rosenblatt declared that he construct a system which works similar to the perceptual processes of a biological brain - The Perceptron.

Deep Learning Timeline - 1

1943

Warren S. McCulloch and **Walter Pitts** published tried to understand how the brain could produce highly complex patterns by using many basic cells that are connected together.

1960

Henry J. Kelley published "Gradient Theory of Optimal Flight Paths". Many of his ideas were used to develop the basics of a continuous backpropagation model (aka the backward propagation of errors) used in training neural networks.

1943

1950

1960

1950

Alan Turing predicted the impact of Machine Learning. Additionally, he crafted what has been dubbed The Turing Test.

1957

Frank Rosenblatt declared that he construct a system which works similar to the perceptual processes of a biological brain - The Perceptron.

Deep Learning Timeline - 1

1943

Warren S. McCulloch and **Walter Pitts** published tried to understand how the brain could produce highly complex patterns by using many basic cells that are connected together.

1960

Henry J. Kelley published "Gradient Theory of Optimal Flight Paths". Many of his ideas were used to develop the basics of a continuous backpropagation model (aka the backward propagation of errors) used in training neural networks.

1943

1950

1950

Alan Turing predicted the impact of Machine Learning. Additionally, he crafted what has been dubbed The Turing Test.

1957

Frank Rosenblatt declared that he construct a system which works similar to the perceptual processes of a biological brain - The Perceptron.

1960

1965

1965

Alexey Ivakhnenko and **V. G. Lapa** created the first *working* deep learning networks, applying what had been only theories and ideas up to that point.

Ivakhnenko developed a learning algorithm using deep feedforward multilayer perceptrons. For that reason alone, many consider Ivakhnenko the father of modern deep learning.

Deep Learning Timeline - 1

1943

Warren S. McCulloch and **Walter Pitts** published tried to understand how the brain could produce highly complex patterns by using many basic cells that are connected together.

1960

Henry J. Kelley published "Gradient Theory of Optimal Flight Paths". Many of his ideas were used to develop the basics of a continuous backpropagation model (aka the backward propagation of errors) used in training neural networks.

1970 - First AI Winter

AI was subject to critiques and financial setbacks. AI researchers had failed to appreciate the difficulty of the problems they faced.

AI was claimed to only be suitable for solving "toy" versions.

1943

1950

1950

Alan Turing predicted the impact of Machine Learning. Additionally, he crafted what has been dubbed The Turing Test.

1957

Frank Rosenblatt declared that he construct a system which works similar to the perceptual processes of a biological brain - The Perceptron.

1960

1965

1965

Alexey Ivakhnenko and **V. G. Lapa** created the first *working* deep learning networks, applying what had been only theories and ideas up to that point.

Ivakhnenko developed a learning algorithm using deep feedforward multilayer perceptrons. For that reason alone, many consider Ivakhnenko the father of modern deep learning.

1970

Deep Learning Timeline - 2

Fascination Deep Learning

Turing Tests, Image Recognition, Speech Recognition, Text Mining,
Neural Style Transfer, ...

Why Deep Learning is so Powerful?

Singlelayer Perceptron

Multilayer Perceptron

Convolution

Pooling

Lets Get Deep

Automated Feature Generation

Getting More Complex

RNN, LSTM, GAN

Challenges in Deep Learning

→ Transfer learning.

Expensive Training

→ Use server or GPUs.

About Implementations

Keras, PyTorch, mxnet, ...

Tensorflow, Theano, CNTK, ...

Low-Level Implementations

cuda, CUDA, ...

Where to Start in the DL Jungle

Getting Started with Keras - Installation

Getting Started with Keras - Overview

- Instead of introducing theory first, we want to get into the topic by applying it.
- We use examples from the book **Deep Learning with Python** which are prepared as **notebooks**.
- **But:** When using something new, e.g. a convolution layer or optimizer, try to understand what it does and why it might be beneficial!

Getting Started with Keras - First Neural Net

Explain API

Getting Started with Keras - First Neural Net

Some Code

Getting Started with Keras - Getting Deep

Explain API

Getting Started with Keras - Getting Deep

Some Code

Getting Started with Keras - Transfer Learning

Explain API

Getting Started with Keras - Transfer Learning

Some Code

Outlook

Very very short intro how text mining connects to deep learning
(gensim, word vectors, ...)

This is what comes closest to AI as we are thinking of it. Just show examples

