

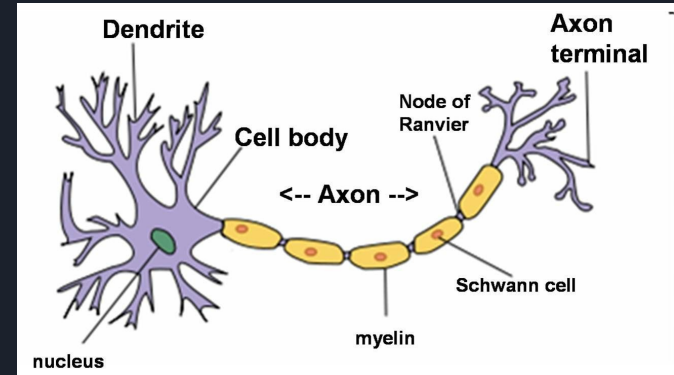
A decorative graphic on the left side of the slide consisting of two overlapping parallelograms. The front one is blue and the back one is light green. Both are tilted at an angle.

Deep Learning Introduction

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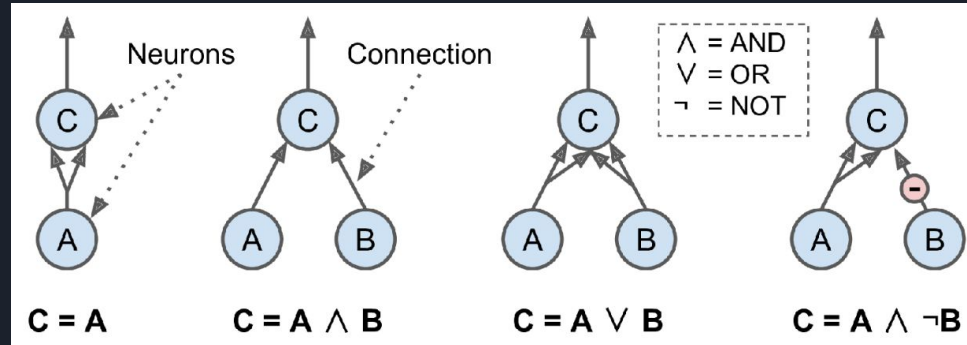
Definition

- Subset of Machine Learning and based on ANNs.
- ANNs: Inspired from human brain's architecture.
- First introduced back in 1943 in their paper "A Logical Calculus of Ideas Immanent in Nervous Activity".
- Failed afterwards in 1960s!
- Powerful ML algorithms took over in the 90s.
- Probably won't die again this time!
 - Outperformance
 - Computation power increase
 - Algorithm Improvement



Neuron-like Computational Logic

- Proposed by the aforementioned paper.
 - One or more binary inputs.
 - One binary output.
- Some basic logic (at least **two** active inputs make the output active):



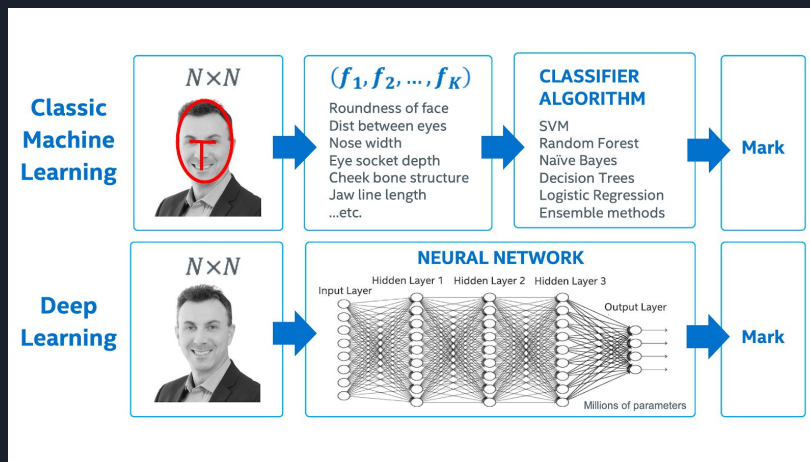


Threshold Logic Unit

- More complex computations.
- The inputs and output are **numbers** instead of booleans.
- Each input has a corresponding weight.
- Neuron's job:
 - Multiply each input and its weight.
 - Sum over them.
 - Apply a "step function".
- The "perceptron" is simply a **single** layer of TLUs.
 - Invented in 1957 by Frank Rosenblatt.
- Fully connected.
- A "Neural Network" is typically made of three layers:
 - Input layer
 - Layers of TLUs (if the number gets high enough, it is called "Deep NN")
 - Output layer

DL vs. ML

- As said before, Deep Learning is Machine Learning and both follow the same goal.
- An ML model needs an outsider (a human in most cases) to help when wrong predictions occur. E.g. the algorithm needs to be tuned.
- But with DL it isn't the same case;
- Larger amount of data and time required for training.





Two New Subjects

1. Vectorization technique: broadcasting scalar operations to vectorized ones resulting in faster runtime.
2. Gradient Descent algorithm: a famous optimization algorithm used in both ML and DL.