

# Neural Networks

**Neural Networks** is one of the most significant discoveries in history.

Neural Networks can solve problems that can't be solved by algorithms:

- Medical Diagnosis
- Face Detection
- Voice Recognition

**Neural Networks** is the essence of **Deep Learning**.

## The Deep Learning Revolution

**The deep learning revolution is here!**

The deep learning revolution started around 2010. Since then, Deep Learning has solved many "unsolvable" problems.

The deep learning revolution was not started by a single discovery. It more or less happened when several needed factors were ready:

- Computers were fast enough
- Computer storage was big enough
- Better training methods were invented
- Better tuning methods were invented

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## Neurons

Scientists agree that our brain has around 100 billion neurons.

These neurons have hundreds of billions connections between them.



Image credit: University of Basel, Biozentrum.

Neurons (aka Nerve Cells) are the fundamental units of our brain and nervous system.

The neurons are responsible for receiving input from the external world, for sending output (commands to our muscles), and for transforming the electrical signals in between.

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## Neural Networks

Artificial Neural Networks are normally called Neural Networks (NN).

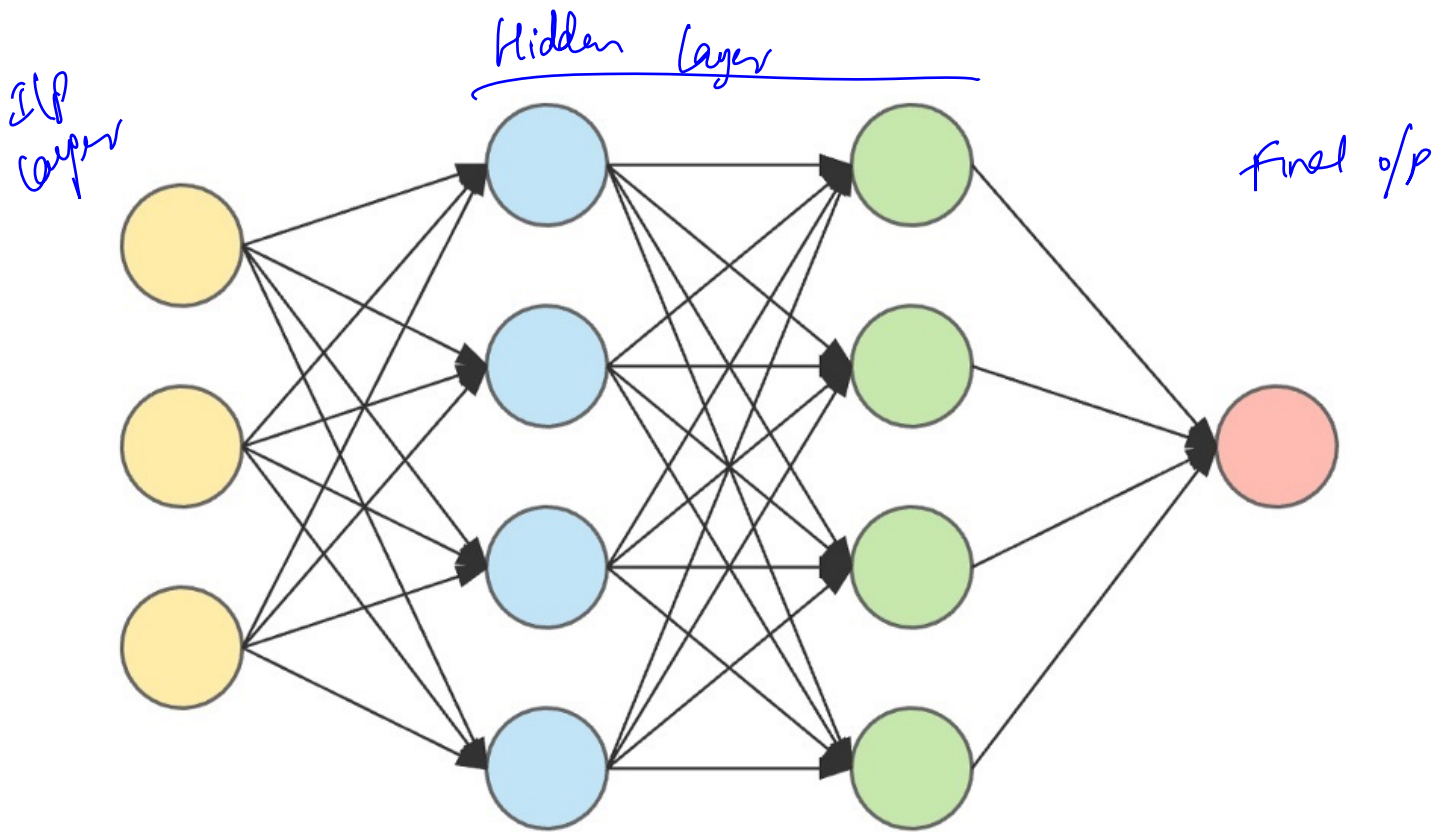
Neural networks are in fact multi-layer **Perceptrons**.

The perceptron defines the first step into multi-layered neural networks.

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## The Neural Network Model

Input data (Yellow) are processed against a hidden layer (Blue) and modified against another hidden layer (Green) to produce the final output (Red).



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## Tom Mitchell

Tom Michael Mitchell (born 1951) is an American computer scientist and University Professor at the Carnegie Mellon University (CMU).

He is a former Chair of the Machine Learning Department at CMU.

*"A computer program is said to learn from experience  $E$  with respect to some class of tasks  $T$  and performance measure  $P$ , if its performance at tasks in  $T$ , as measured by  $P$ , improves with experience  $E$ ."*

Tom Mitchell (1999)

E: Experience (the number of times).

T: The Task (driving a car).

P: The Performance (good or bad).

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## The Giraffe Story

In 2015, **Matthew Lai**, a student at Imperial College in London created a neural network called **Giraffe**.

Giraffe could be trained in 72 hours to play chess at the same level as an international master.

Computers playing chess are not new, but the way this program was created was new.

Smart chess playing programs take years to build, while Giraffe was built in 72 hours with a neural network.