

# Online Faculty Development Program **on** Emerging Trends in Deep Learning & its Applications

**ORGANISED BY**

Dr. D.Y.Patil Institute of Technology,  
Department of Computer Engineering,  
Pimpri, Pune-411018

**DPU**





# Deep Learning Overview

- Deep Learning Overview
- ML- DL- AI
- Machine Learning vs Deep Learning
- Deep Multi-Layer Perceptions
- Artificial Neural Network
- Handling Images CNN
- Image Processing Computer Vision
- Introduction to Functional API

# Learning ?



# Learning?

Can we recognize these pictures...??

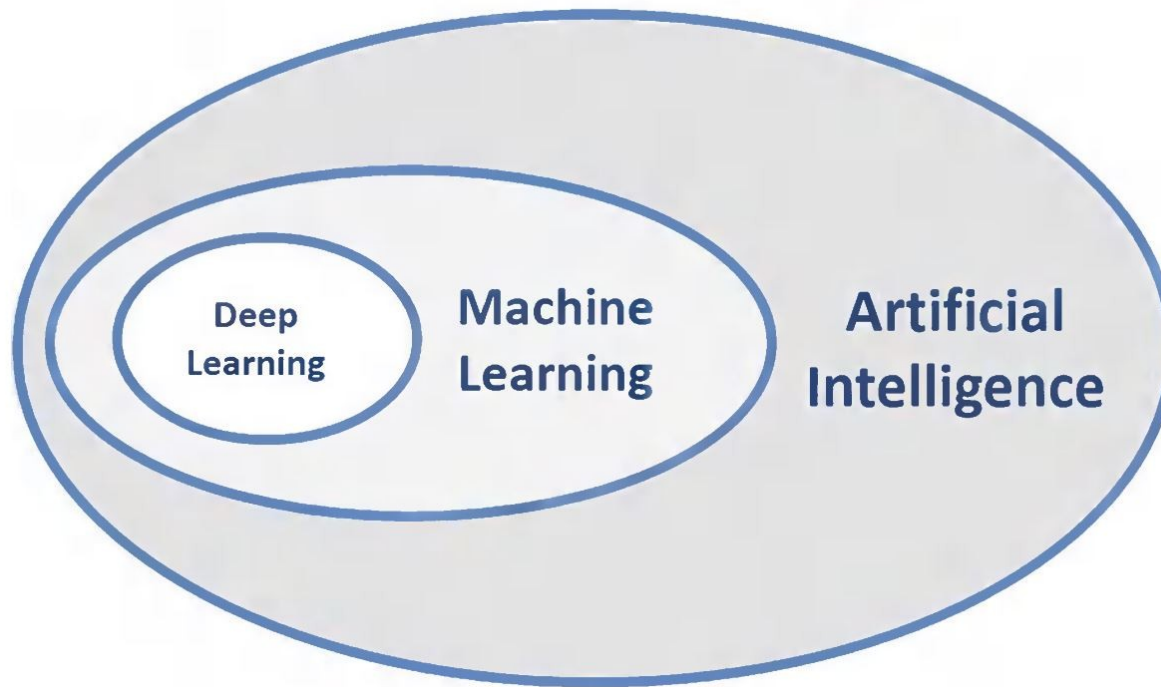


If...

Yes, then how do we recognize it..??

# ML-AI-DL

- Deep learning is **a part of** Machine Learning is **a part of** Artificial Intelligence.



# AI

- AI is a general field that encloses machine learning and deep learning

## **Suitable for solving well defined problem and logical problem**

- Example:

Playing Chess-----> EXPLICIT RULES.

## **But, What about Complex Problem?**

- Example:

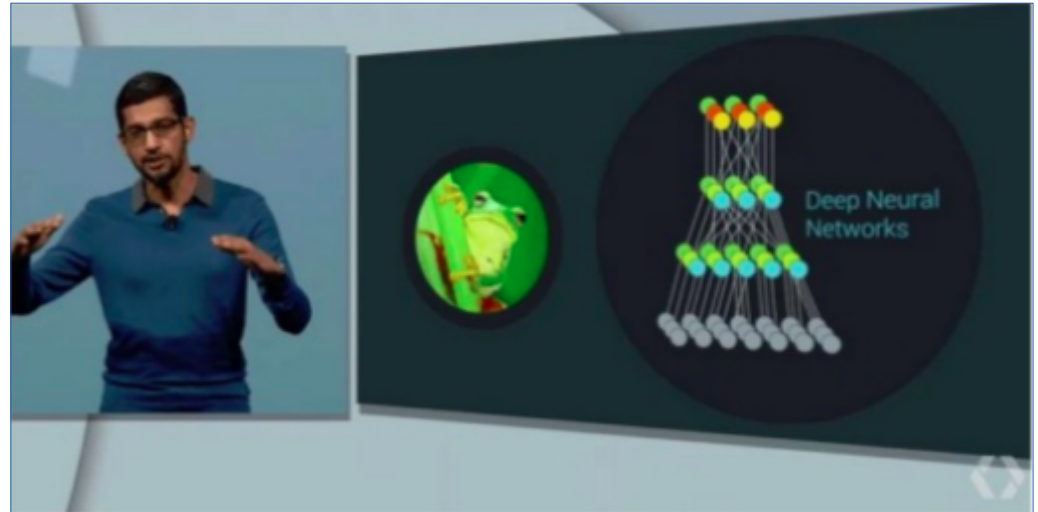
Image Classification, Language Translation and Speech Recognition.

- Hard to control or deal with to figure out explicit rules.
- A New Approach Emerge ---->> **MACHINE LEARNING.**

# Reality or Hype ML

- "Machine learning is a core, transformative way by which we're rethinking how we're doing everything."

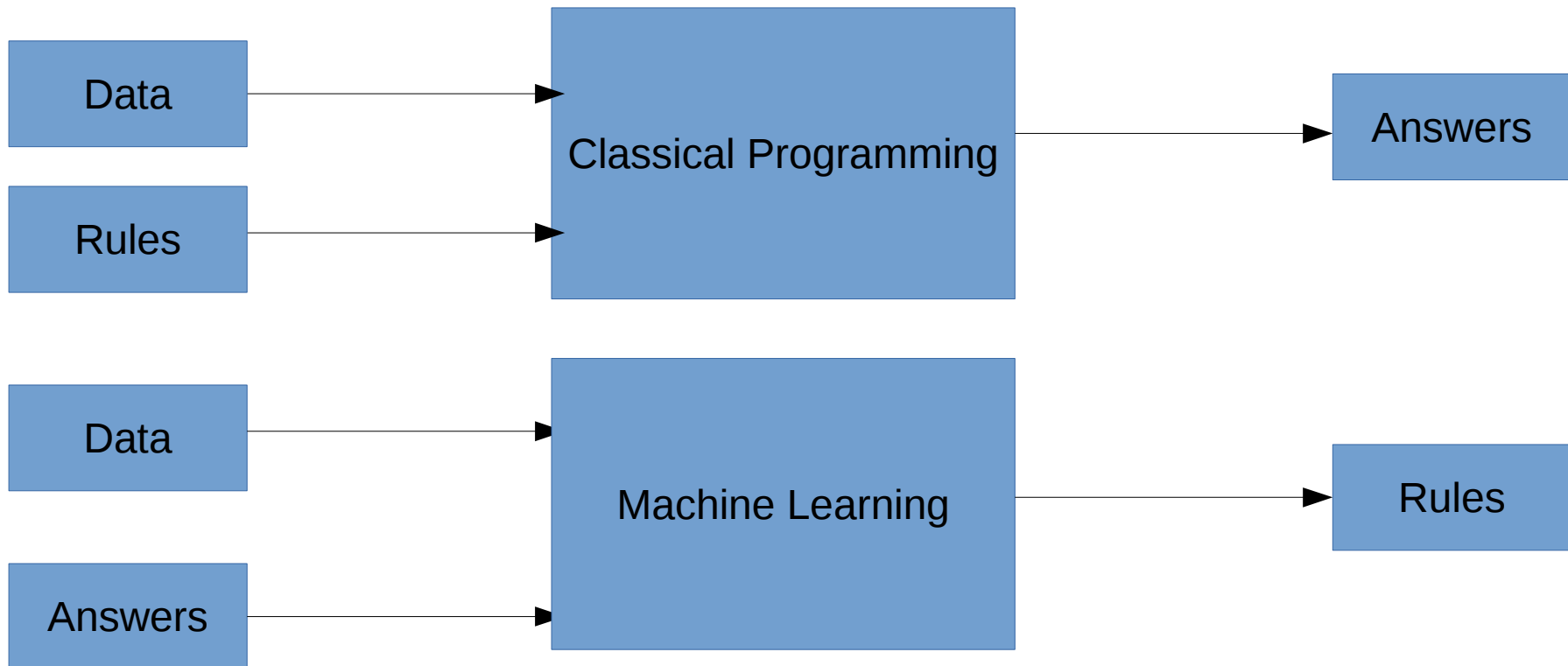
Sundar Pichai,  
CEO @Google





# ML

- Machine Learning,
- Data input and answer expected from the given input data---->> **Outcomes the rule.**



# Deep Learning?

## What it is?

- It is specific subfield of machine learning:
- It's a new take on learning representations from data
- Layered approach

## What is “Deep” in deep learning

- Its not reference to -->> any kind of deeper understanding achieved by layered approach.
- Its put an emphasis on learning successive layers of increasing meaningful representations.
- It stands for this idea of successive layers of representation.
- In other way we can say that “layered representations learning” and “hierachical representations learning”.

# Deep Learning?

## What is layered representations?

- Layered representations are learned via models called neural networks
- Layers stacked on top of each other
- Neural network is a reference to neurobiology (drawing inspiration from our understanding of the brain)
- Does it model brain?

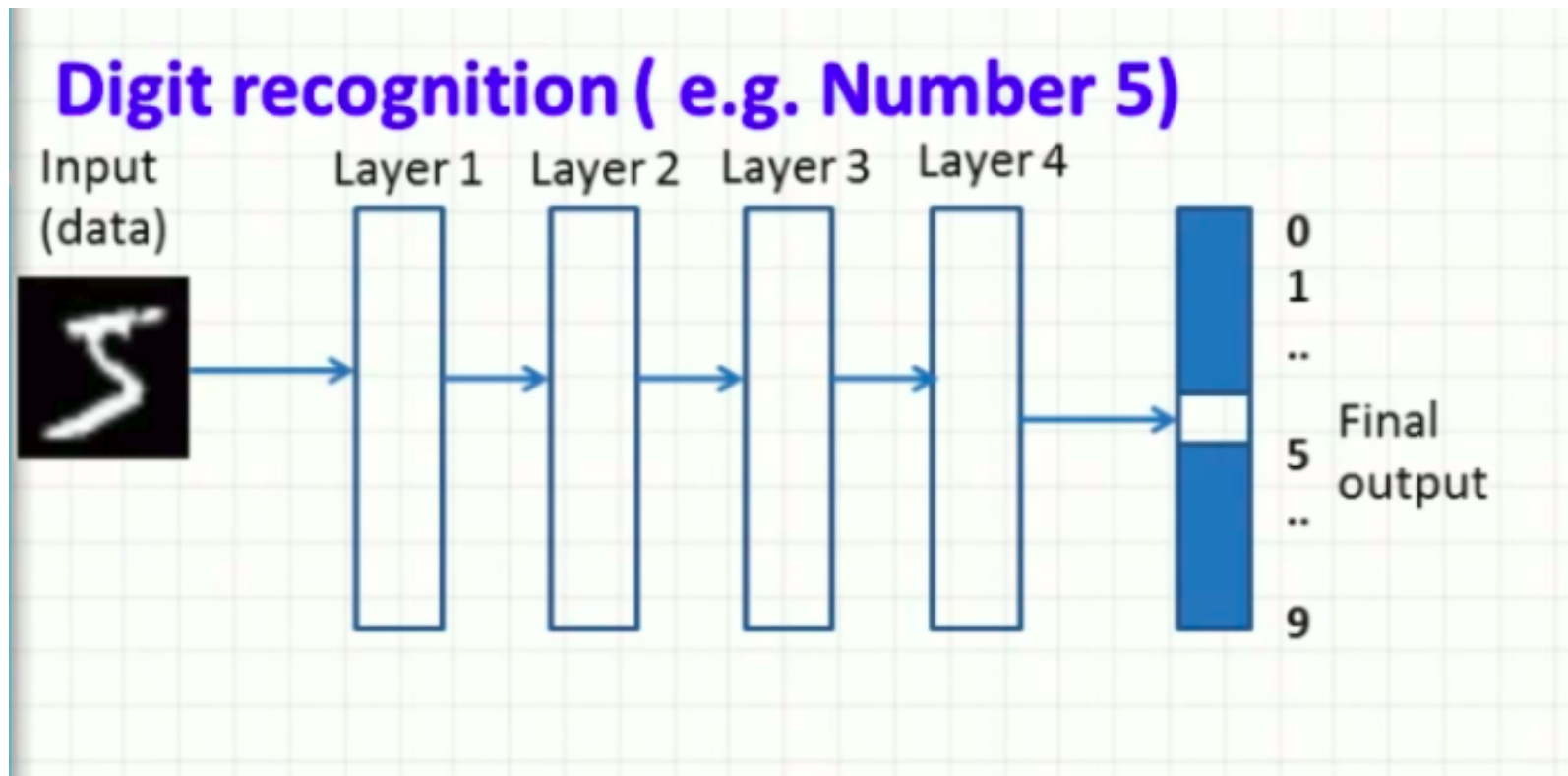
## DL models are not models of the brain

- There is no evidence that the brain implements anything like the learning mechanisms used in modern deep learning models.

# Deep Learning?

## So What it is ?

- Deep learning is a mathematical framework for learning representation from data.



# Deep Learning?

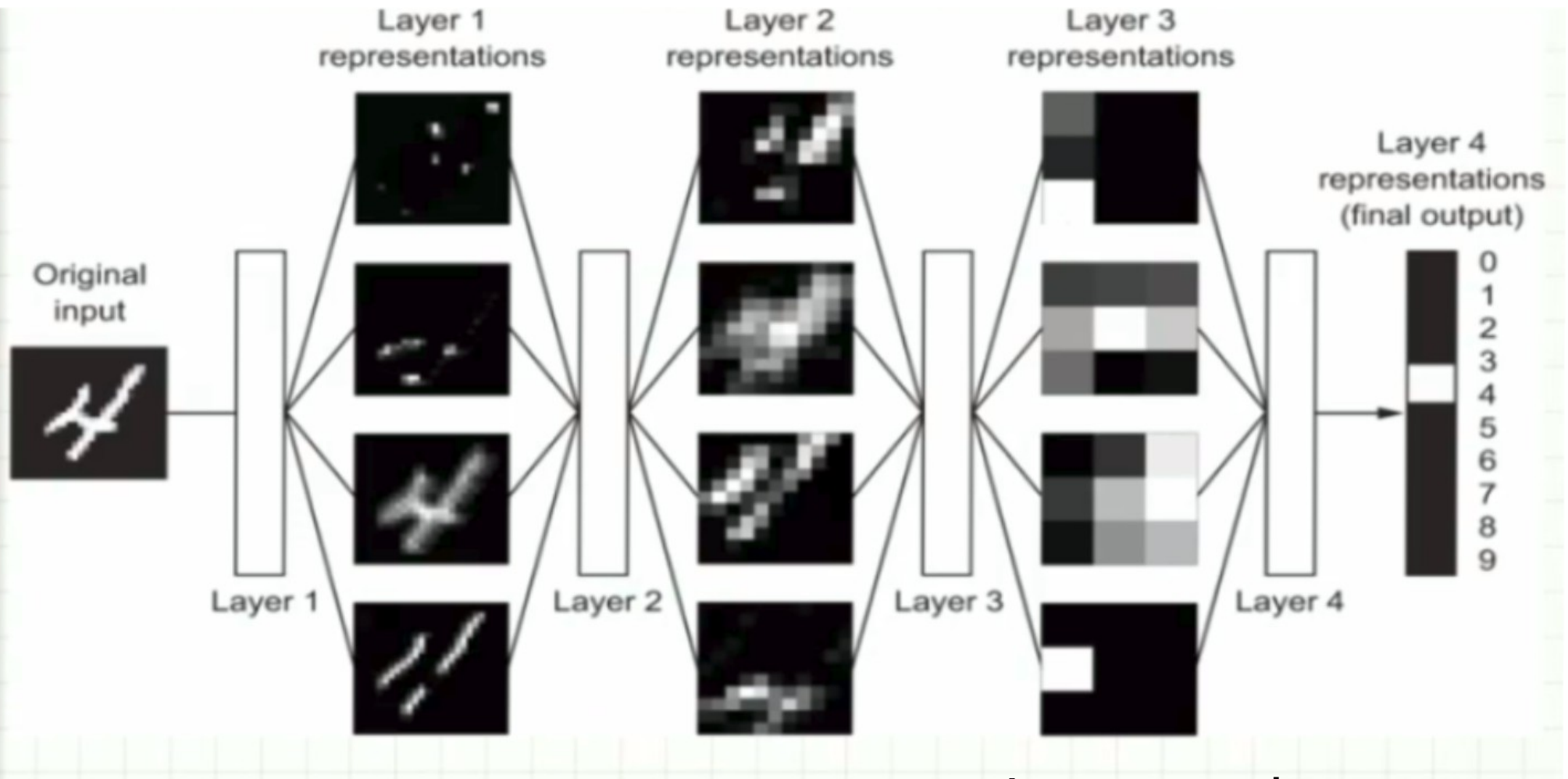


Image source: internet

## Digit Classification:

- The network transforms the digit image into representations.
- The representations are different from the original image and informative about the final result.

# Deep Learning?

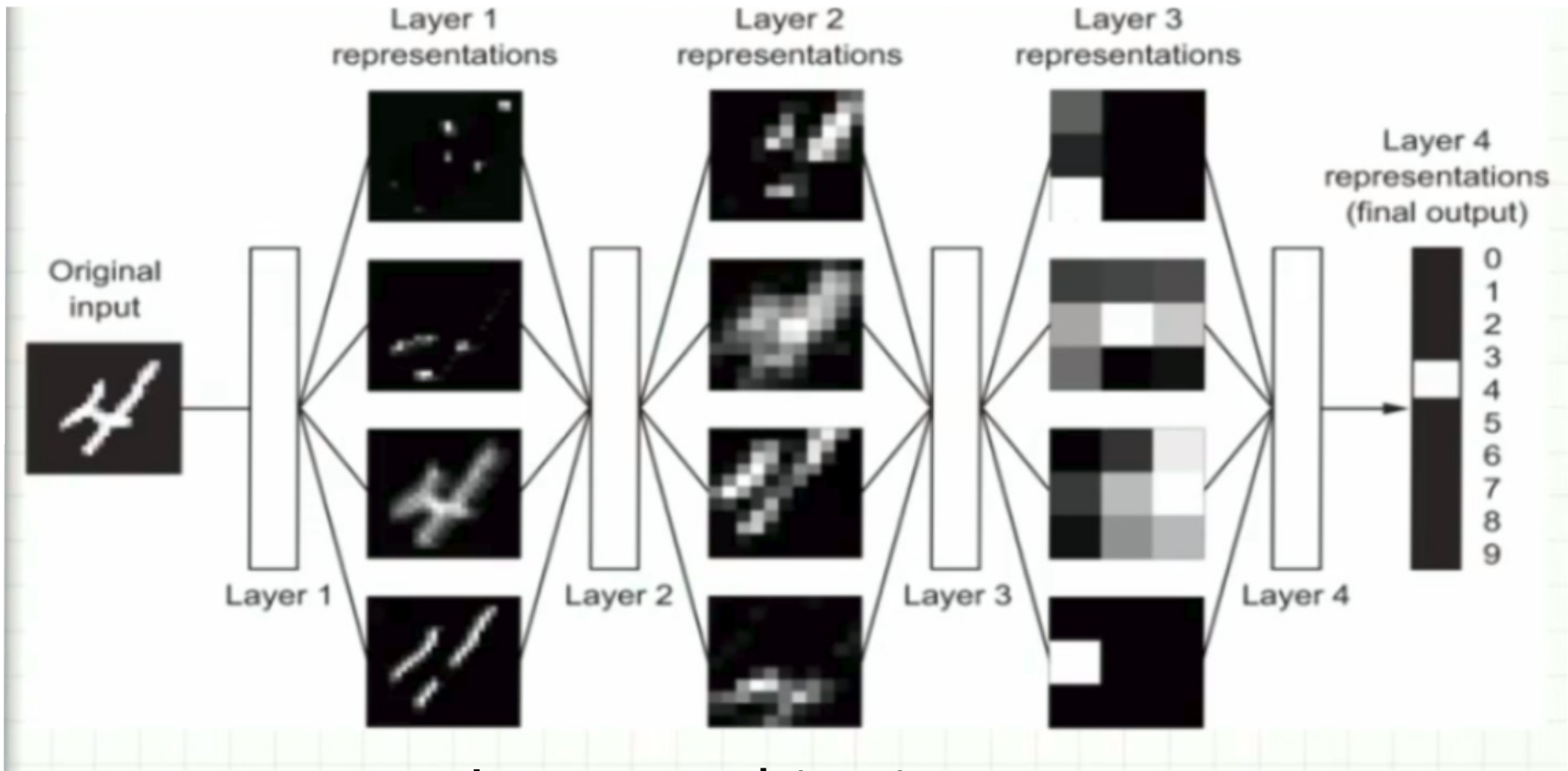


Image source: internet

## Deep Network :

- DN is an multistage information distillation operation where information goes through
- Successive filters and comes out increasingly purified.
- So that deep learning is an multistage way to learn data representations.

# What is the “Deep” in deep learning?

- Deep-learning networks are distinguished from the more general single-hidden-layer neural networks by their depth. Depth is the number of node layers where there are more than one hidden layers thus need for more computation power for forward/backward optimization while training, testing and eventually running these ANNs.

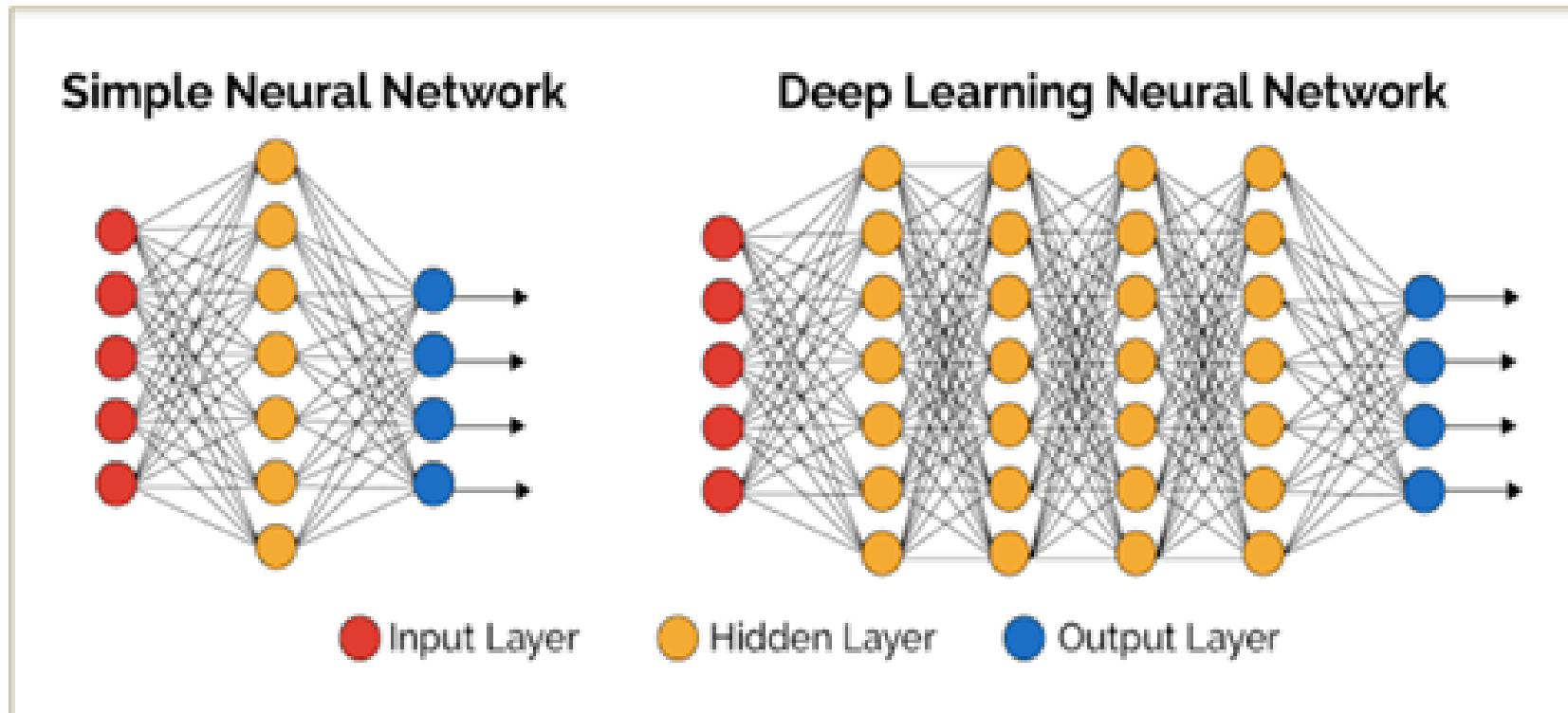
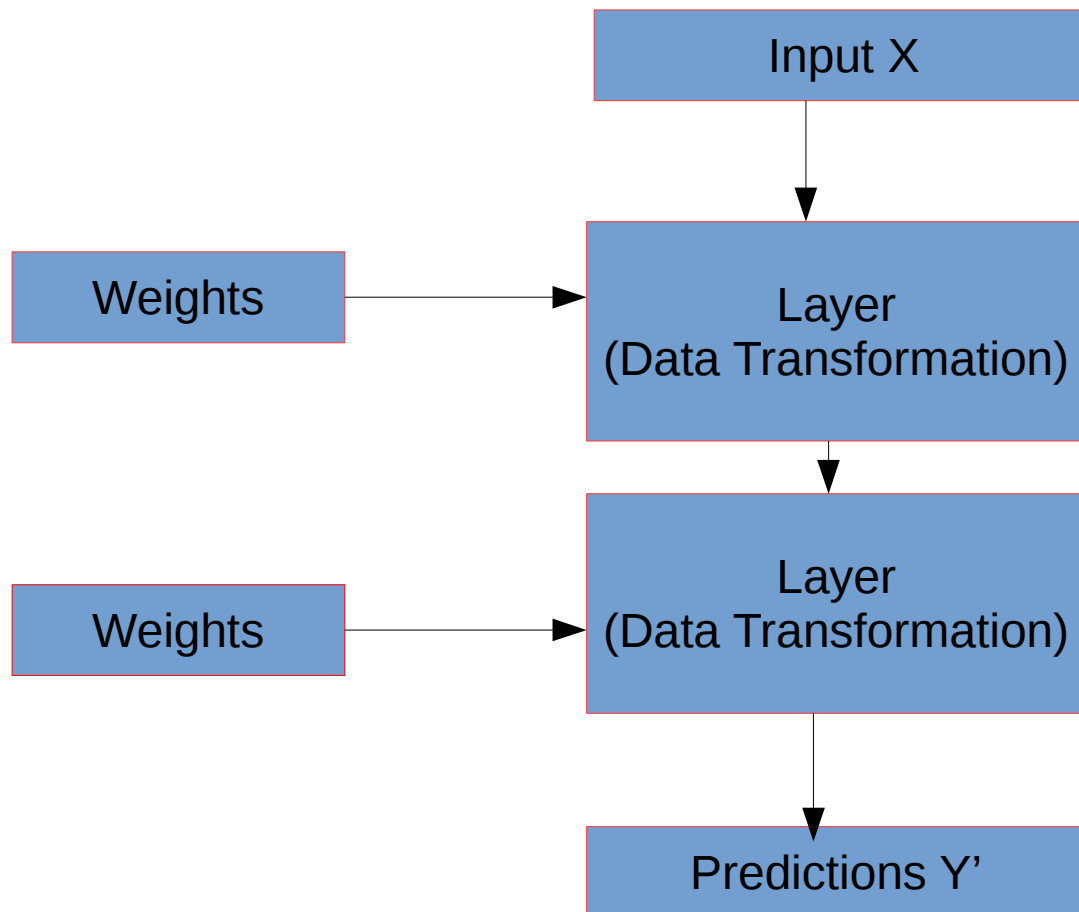


Image source: internet

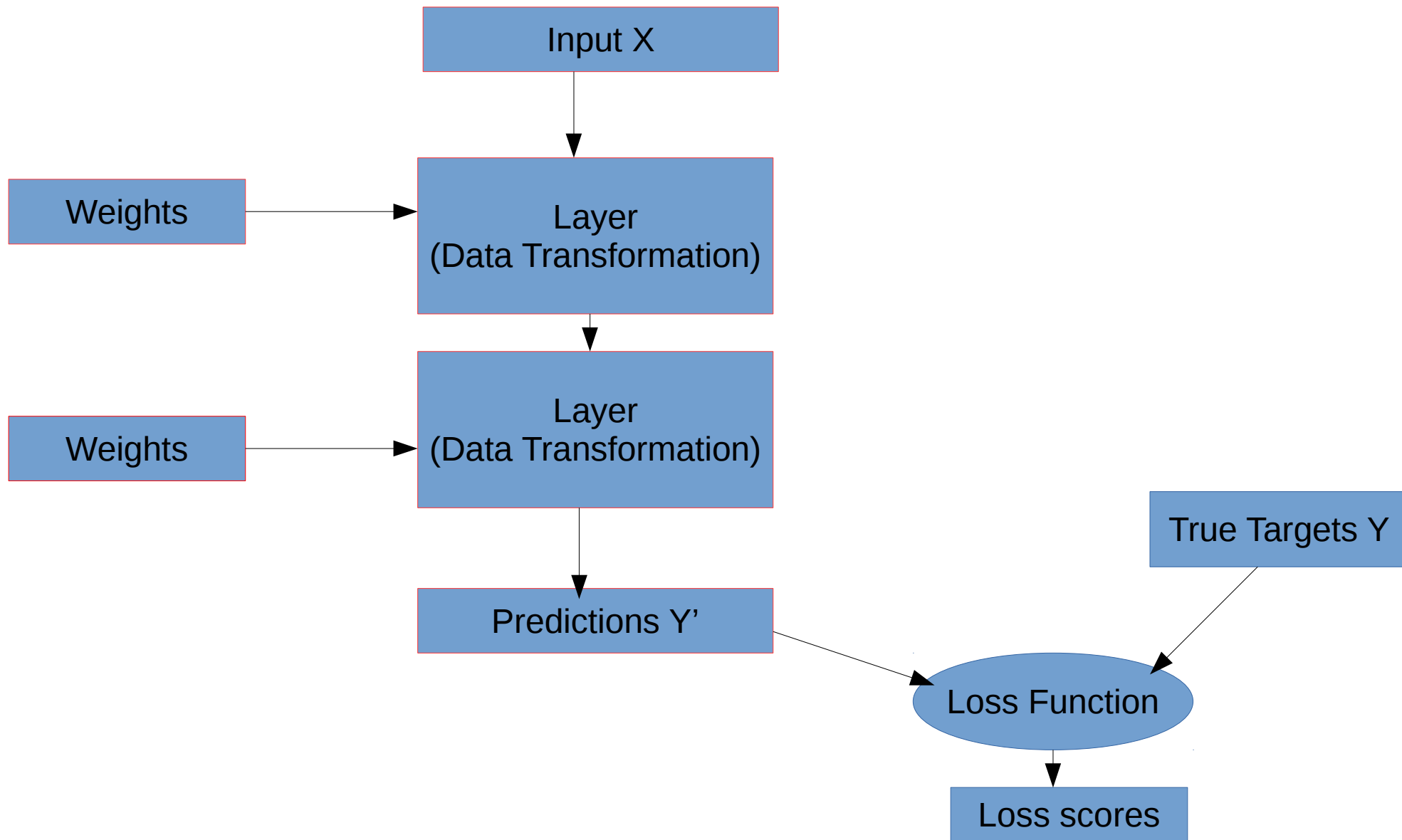
# “Learning” in Deep Learning?





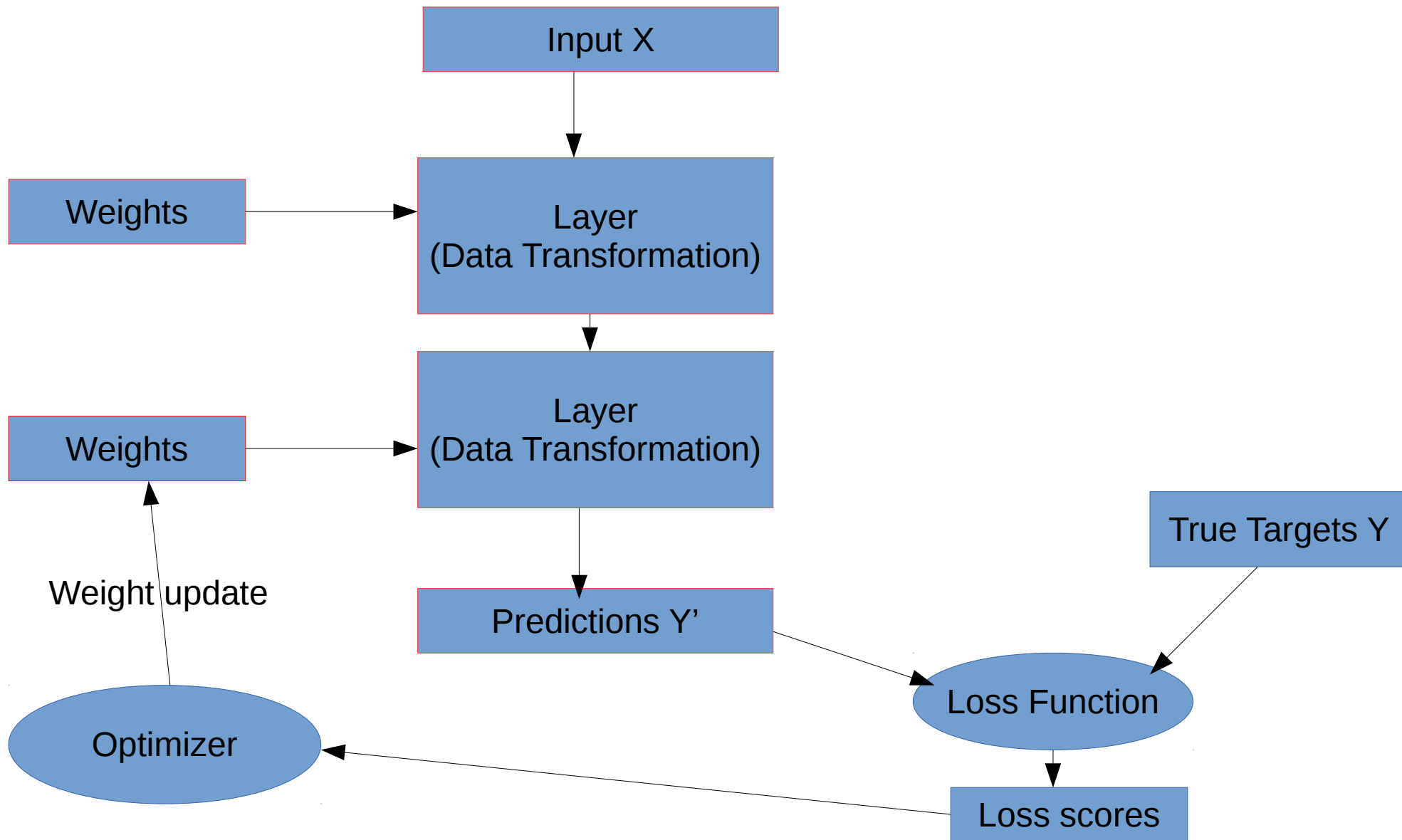
# “Learning” in Deep Learning?

- **Problem Statement:** To find out right values for weights



# “Learning” in Deep Learning?

- **Problem Statement:** To find out right values for weights



# Tensors

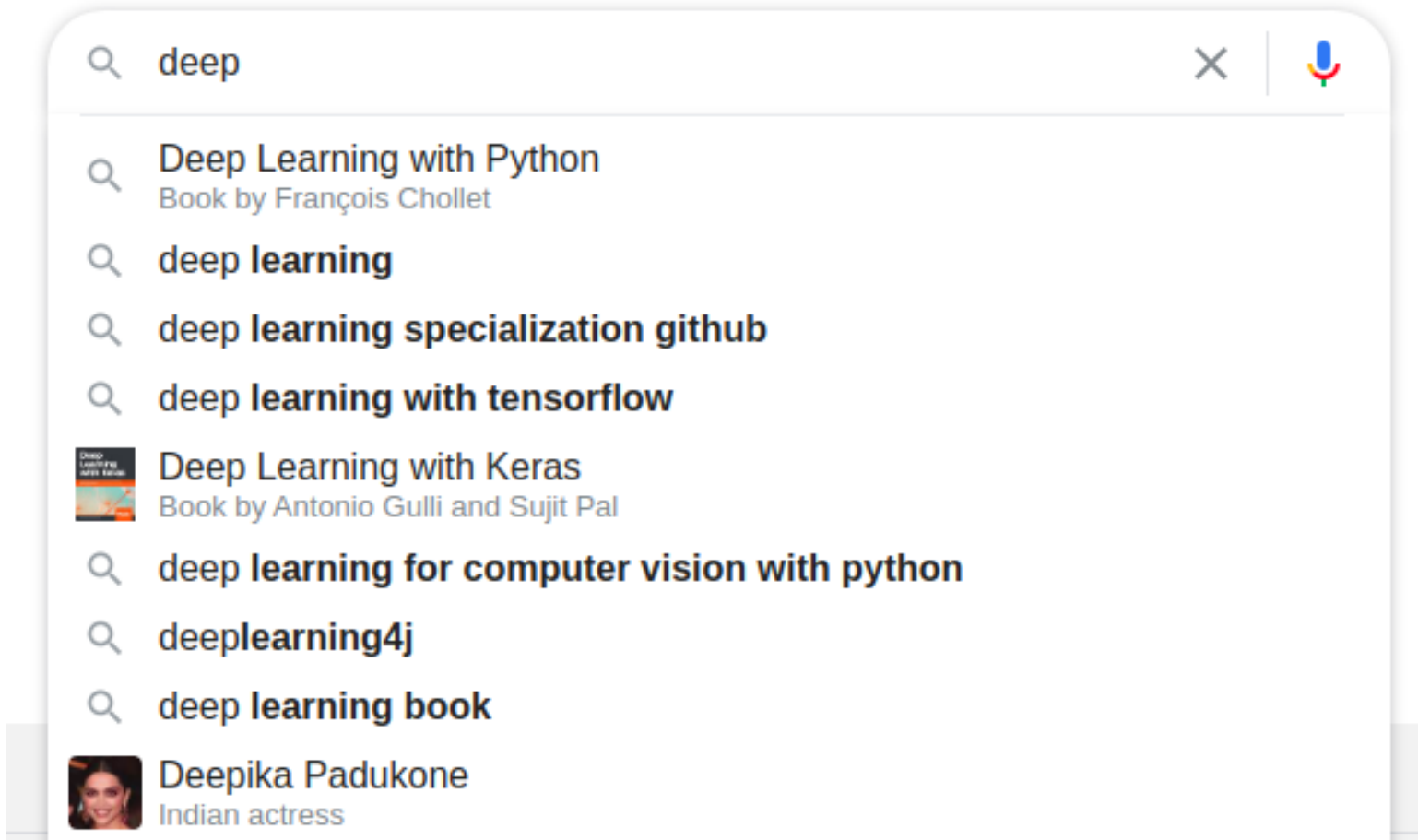
- Tensors are mathematical objects that generalize scalars, vectors and matrices to higher dimensions.
- Tensor is a container for data mostly for numbers or numeric value
- In a tensor dimension is called as axis.
- Example: Matrices ---->> 2D tensors
- **Why the name Tensor or Tensor Flow??**

# Tensors Operations

- Tensor Operations examples with Hands on
- <https://rubikscodex.net/2018/02/05/introduction-to-tensorflow-with-python-example/>

# Tensor Flow

- It is most famous deep learning library created by Google. Also we can call Google's Tensorflow
- Google uses ML in its products like, google alexa, search engine, image captioning, translation, recommendations.
- Example:



# Tensor Flow History

- Google has the world's most enormous data and computer system.
- Google uses deep learning neural networks to improve its services like, Search engine, translation, photo search engine, gmail.
- Google has build a framework called tensorflow for researcher and developer work together on an AI model.
- It was first published in 2015.
- It stable version 2017
- It is open source under Apache Open Source License

# Keras

- Define the training data
- We need to define the training data that is going to be important.
- Define the training data --->>Input tensors and target tensors.
- Define a network of layer (model)-->>maps input to targets.
- Iterate training data by using fit() function
- Predict / evaluate
- Defining Mode
  - Sequential class
  - Functional API

 **633** contributors



# Industry Traction---->> Keras

NETFLIX

UBER

Google

 instacart

 HUAWEI

 NVIDIA®

 Square

 Expedia®

 Zocdoc

yelp.



# Keras Hands on

## Keras datasets

- Keras supplies seven of the common deep learning sample datasets via the `keras.datasets` class. That includes `cifar10` and `cifar100` small color images, IMDB movie reviews, Reuters newswire topics, MNIST handwritten digits, **MNIST fashion images**, and Boston housing prices.
- **Problem Statement: Use MNIST Fashion images data and perform image classification.**

- **Problem Statement:** Use MNIST Fashion images data and perform image classification.

- Add input Layer
- Add Hidden layer(Dense)
- Add output layer
- Compile
- Fit model
- Evaluate, Predict.

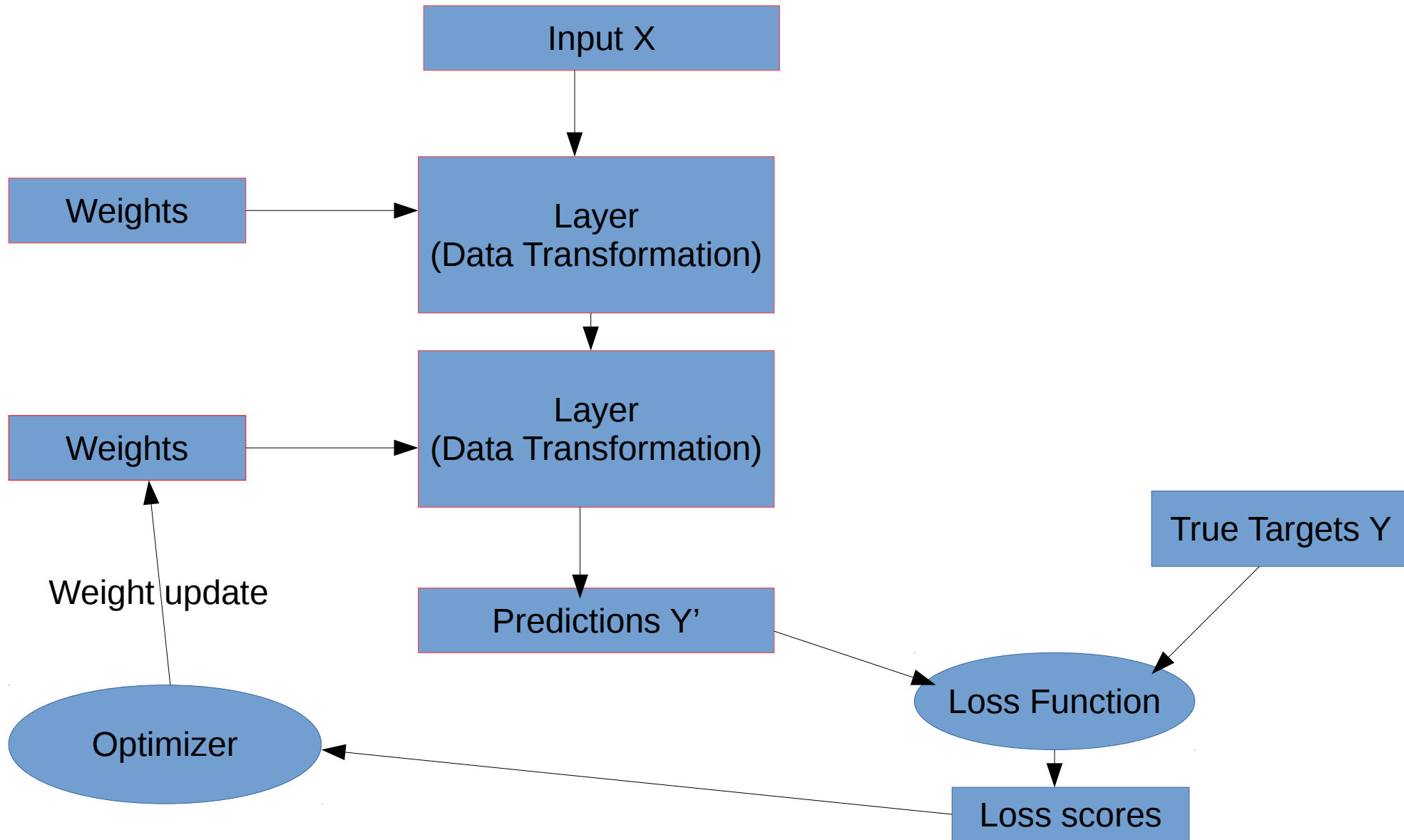
### Descriptions:

Label	Class
0	T-shirt/top
1	Trouser
2	Pullover
3	Dress
4	Coat
5	Sandal
6	Shirt
7	Sneaker
8	Bag
9	Ankle boot



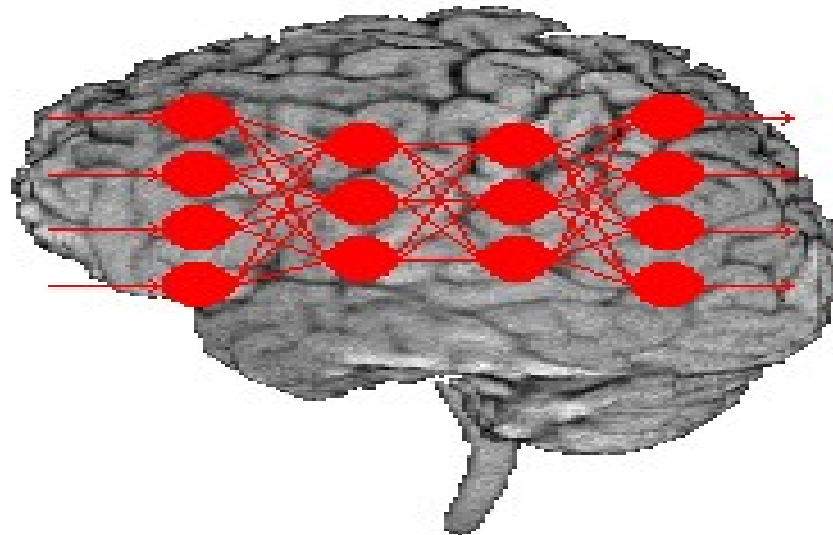
# What exactly is ANN ?

- Artificial neural networks (ANNs), usually called neural networks (NNs), are computing systems which are inspired by the biological neural networks that constitute human brains.



# ANN

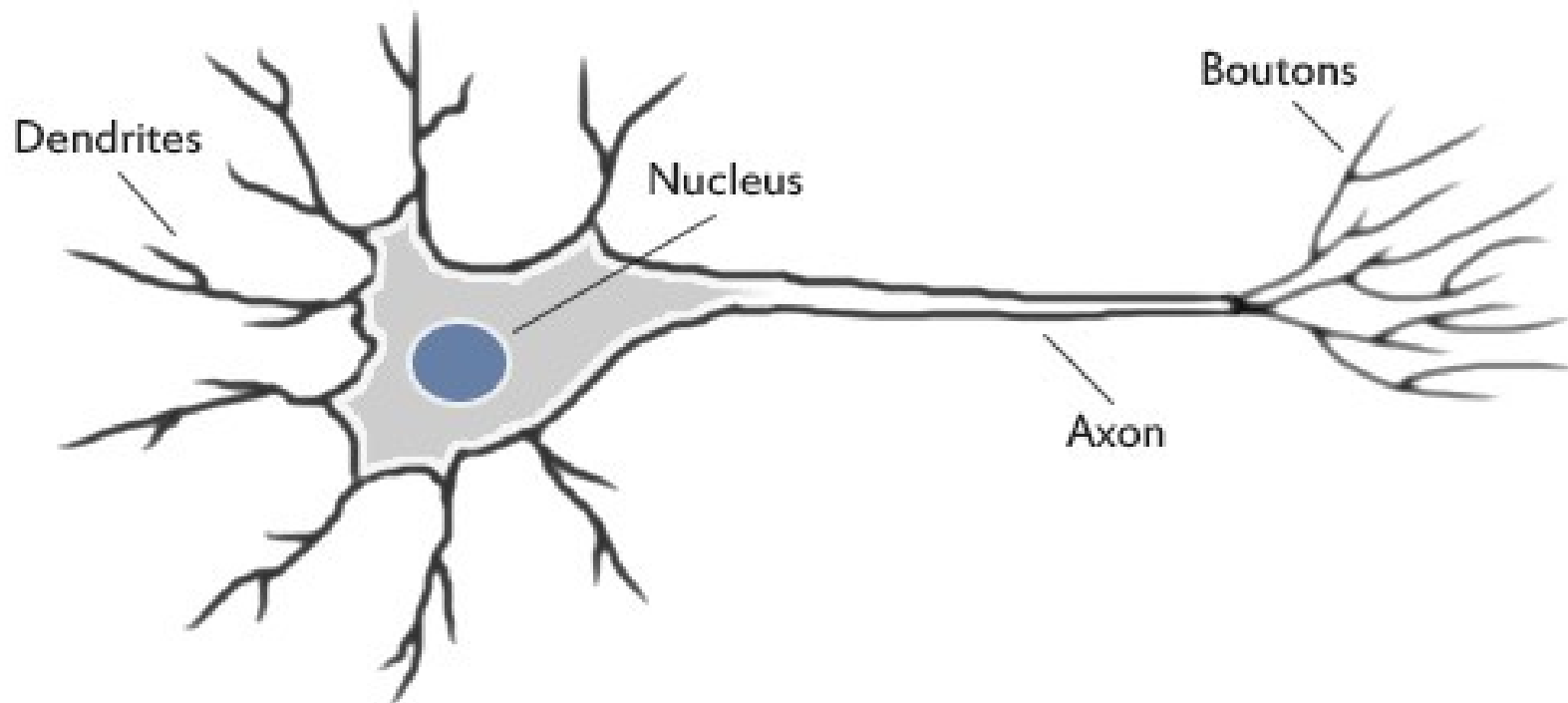
- The brain is capable of performing quite complex computations, inspiration for artificial neural networks.
- The human brain composed of a number of neurons.
- The building blocks of neural networks are the “Neurons”
- In technical term we can say that Unit or Nodes.



# Artificial Neural Networks

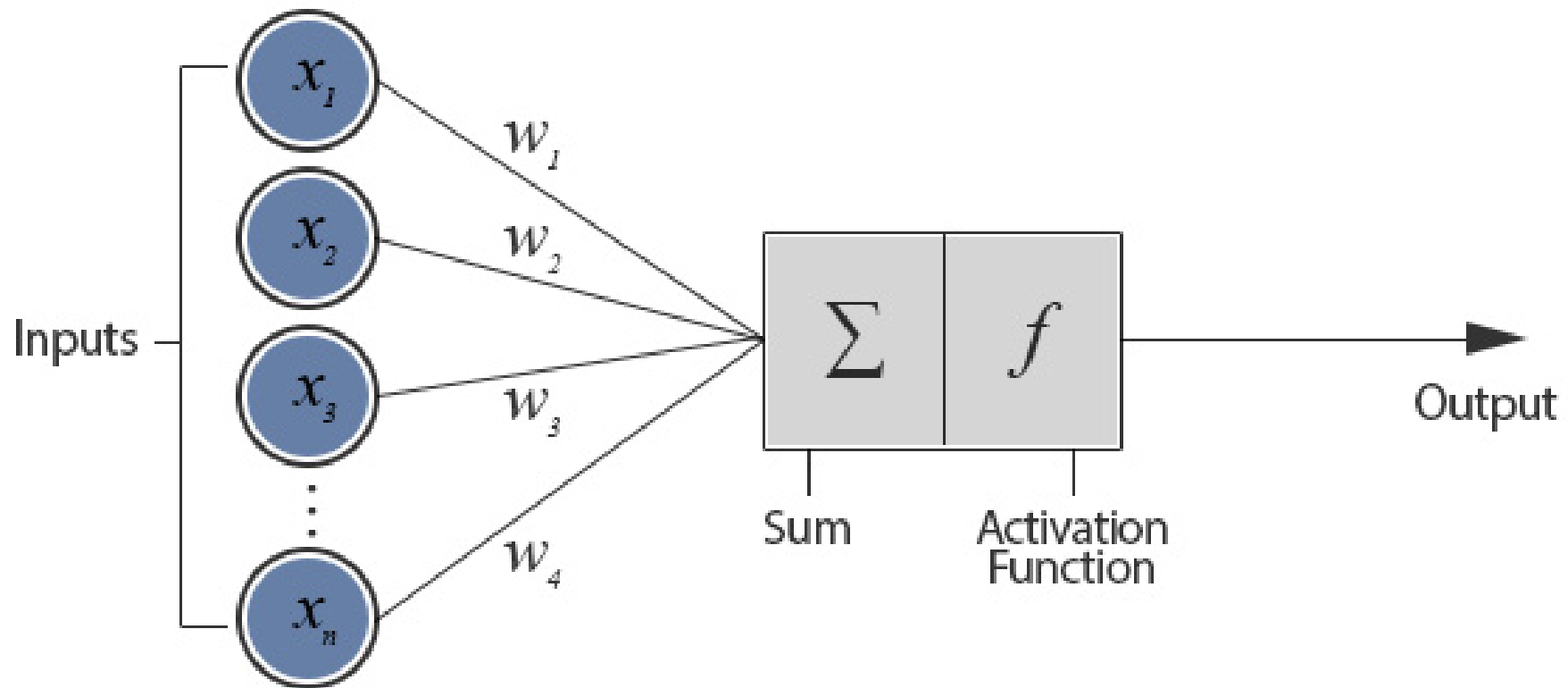
**Basically,**

- each neuron receives **input** from many other neurons using Dendrites.
- changes its internal state (**activation**) based on the current input.
- sends **one output signal** to many other neurons, possibly including its input neurons (recurrent network).



# Modeling Artificial Neurons

- The single artificial neuron is a simple tree structure which has input nodes and a single output node, which is connected to each input node.



## Here's an example of how this work:

Input 1 ( $x_1$ ) = 0.6

Input 2 ( $x_2$ ) = 1.0

Weight 1 ( $w_1$ ) = 0.5

Weight 2 ( $w_2$ ) = 0.8

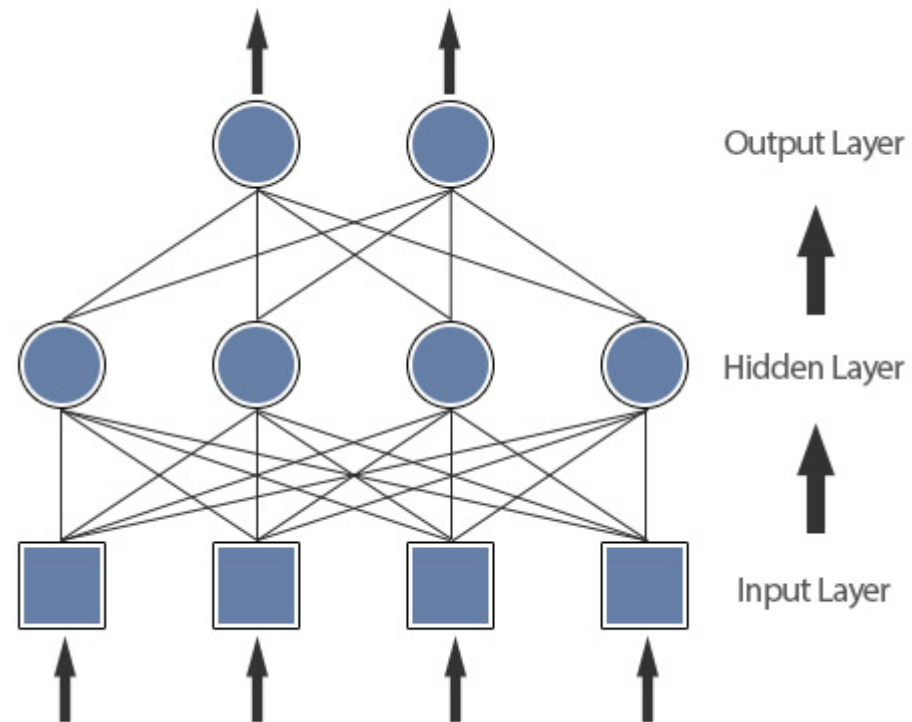
Threshold = 1.0

First we multiple the inputs by their weights and sum them:

$$x_1w_1 + x_2w_2 = (0.6 \times 0.5) + (1 \times 0.8) = 1.1$$

# ANN Multi-layer Neural Networks

- Each input from the input layer is fed up to each node in the hidden layer, and from there to each node on the output layer.
- There can be any number of nodes per layer and there are usually multiple hidden layers to pass through before ultimately reaching the output layer.
- To train this network a learning algorithm is needed which should be able to tune.
  - The weights between the output layer and hidden layer
  - Also weights between the hidden layer and input layer

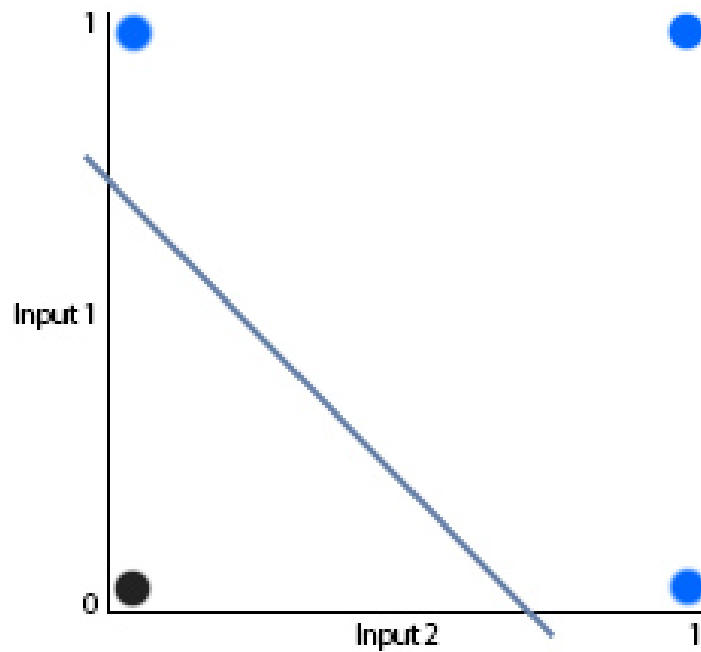




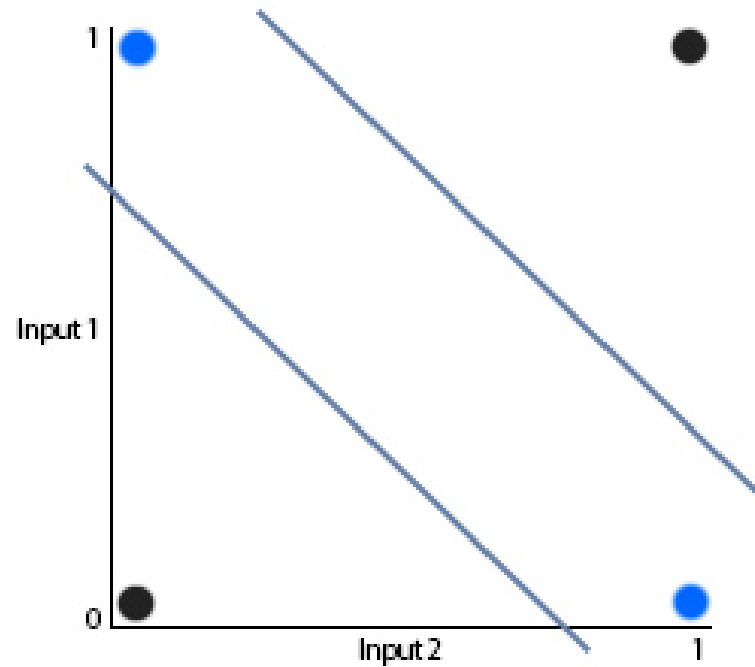
# Hidden Layer Role in NN

- why we usually require a hidden layer to solve our problem, take a look at the following examples:

OR Function

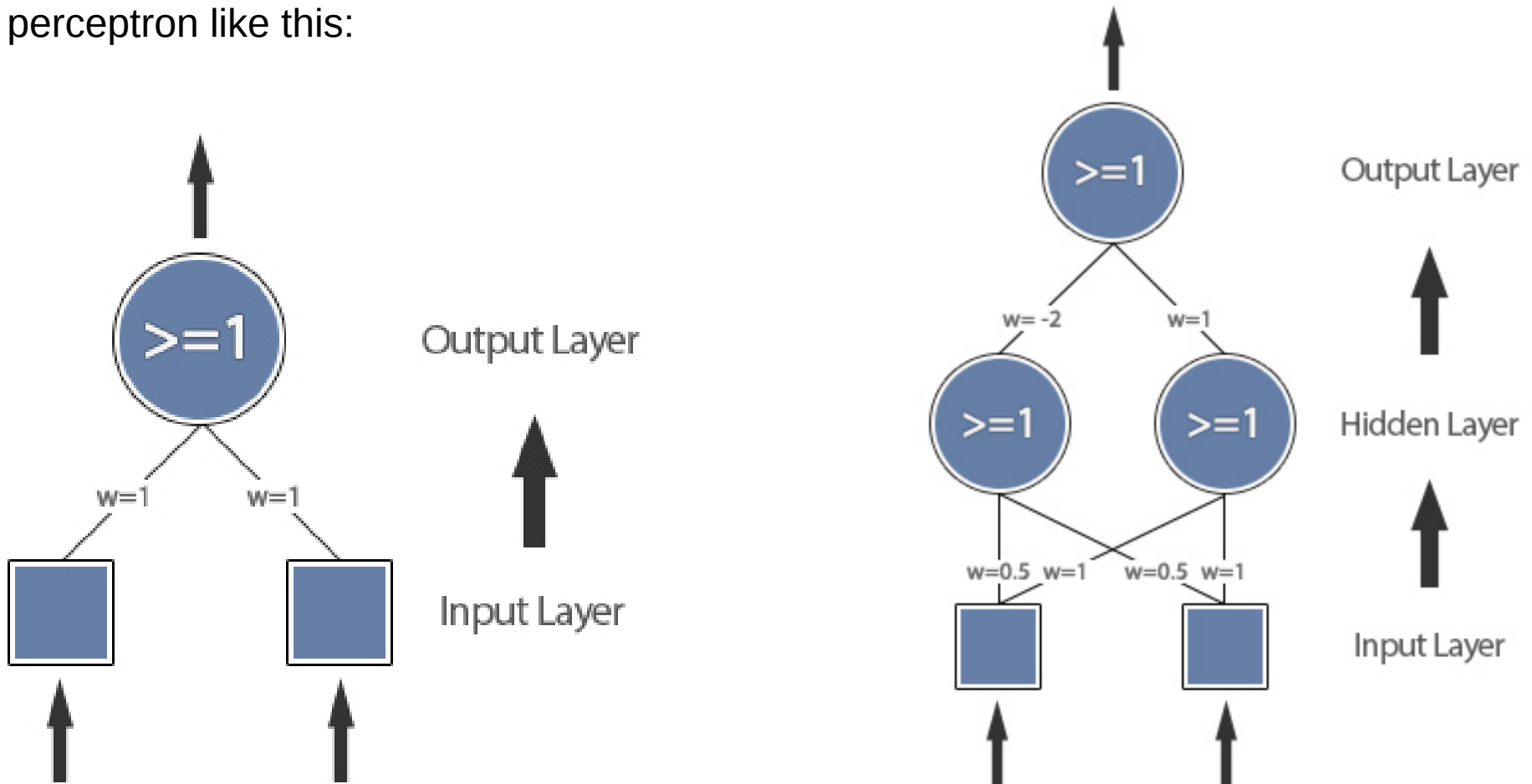


XOR Function



# Hidden Layer Role in NN

- The OR function can be separated on the graph with a single straight line, this means the function is “linearly separable” and can be modelled within our neural network without implementing a hidden layer, for example, the OR function can be modeled with a single perceptron like this:



**However to model the XOR function we need to use an extra layer:**

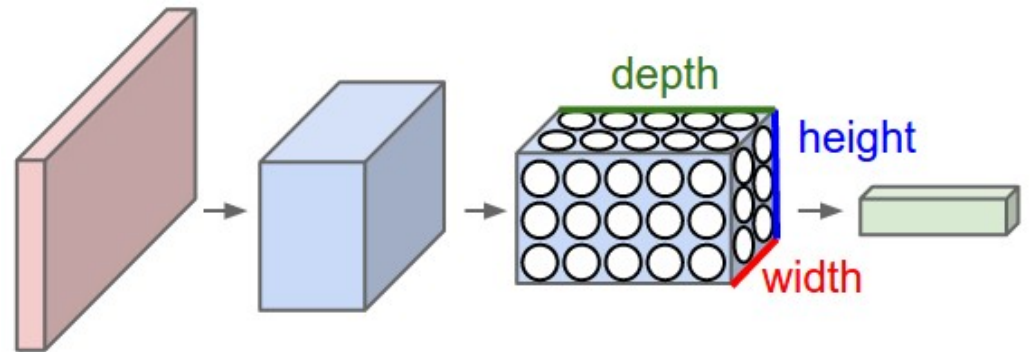
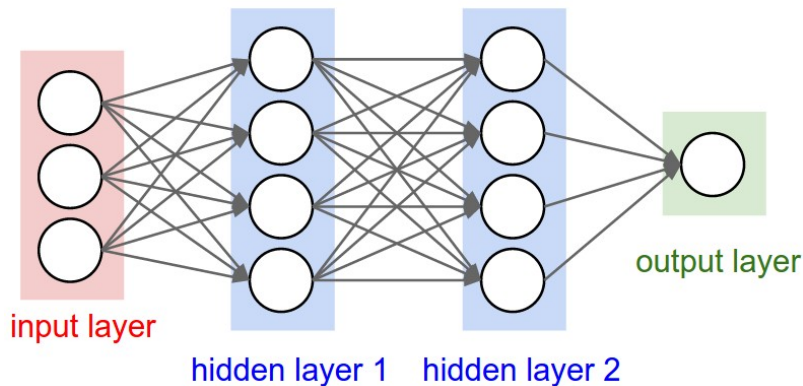
# Image Classification Hands on

- [https://www.tensorflow.org/api\\_docs/python/tf/keras/datasets/fashion\\_mnist/load\\_data](https://www.tensorflow.org/api_docs/python/tf/keras/datasets/fashion_mnist/load_data)

# What is Convolutional NN

- CNN is a deep neural network originally designed for image analysis. Recently, it was discovered that the CNN also has an excellent capacity in sequent data analysis such as natural language processing.

- 



- Left: A regular 3-layer Neural Network. Right: A ConvNet arranges its neurons in three dimensions (width, height, depth), as visualized in one of the layers. Every layer of a ConvNet transforms the 3D input volume to a 3D output volume of neuron activations. In this example, the red input layer holds the image, so its width and height would be the dimensions of the image, and the depth would be 3 (Red, Green, Blue channels).

# Thank You



**Cell:9607589982,  
mail: [dnyaneshlavhkare@gmail.com](mailto:dnyaneshlavhkare@gmail.com)**