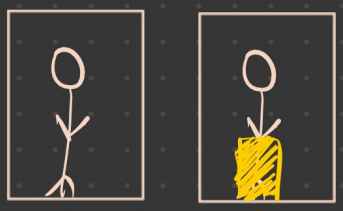
Agenda - 30/11/2024

1) Image Variation

2) Neural Network

Image Variation

(1) Occlusion - Part of an object in a image is hidden or partially hidden.

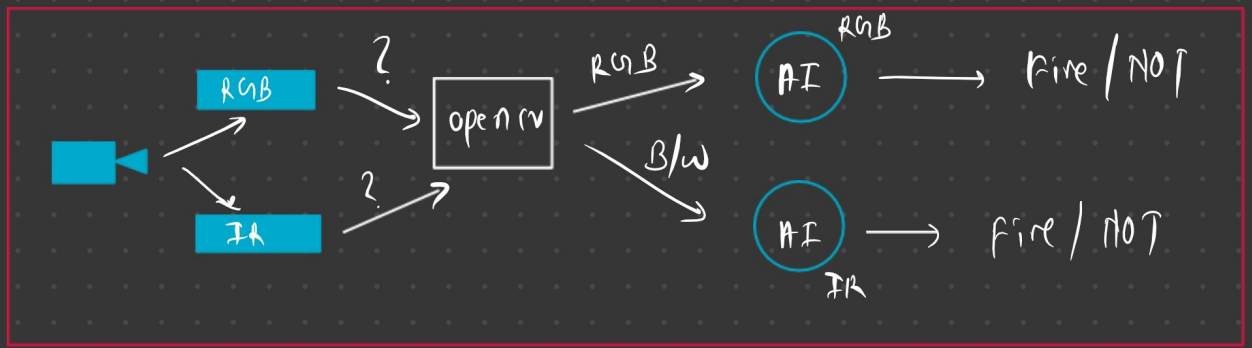


trained → predict → low performing system.

(2) Illumination / Exposure

→ Under exposed

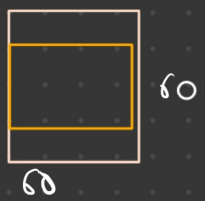
→ over exposed



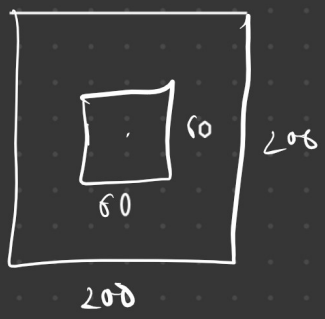
(3) Scale Variation

Objects appear at different size due to their distance from camera.

Q. How to make number plate small?



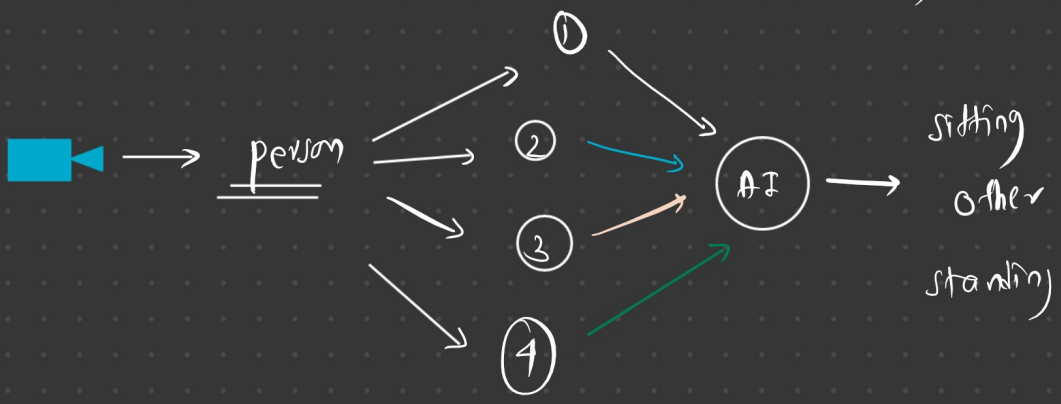
Padding

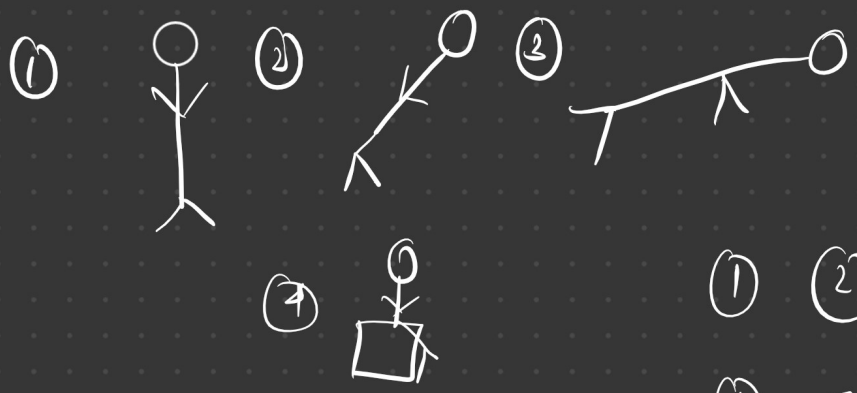


(4) Background Variation

(5) Pose variation

Q. Check whether a person is standing or sitting.





1 2 → standing

4 → sitting

(6) Noise

random variation in pixel intensity

Additional examples

Occlusion :—

Illumination + low light

Neural Network

A neural network is computation model inspired by the structure of human brain.

It consist of interconnected layers of node.

Node (Neurons) designed to process & learn pattern from data.

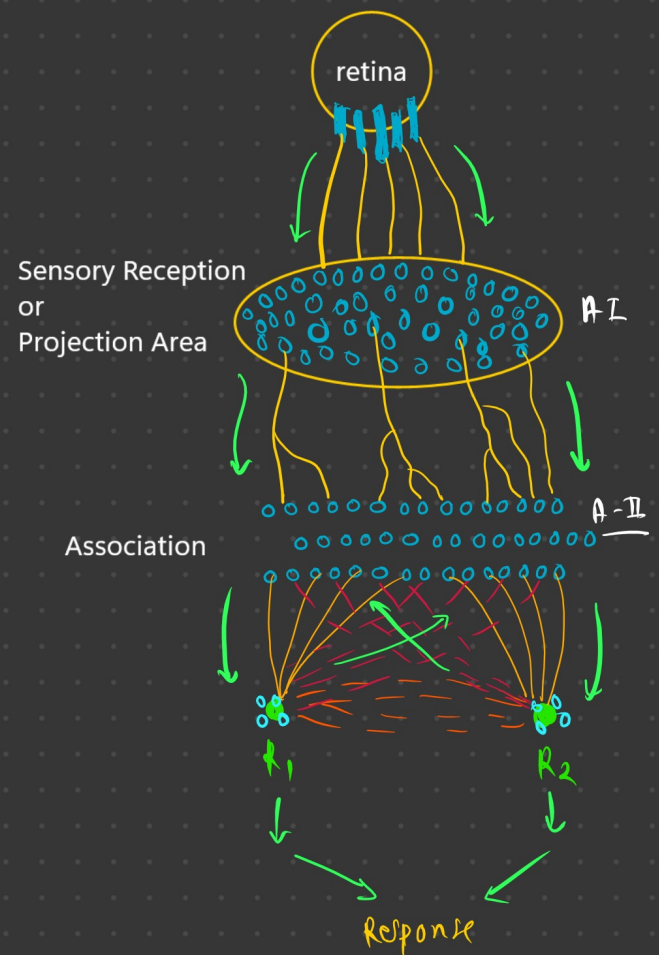
Perceptron Origin

Perceptron, a hypothetic nervous system or machine designed to illustrate some of fundamental properties of intelligent system.

In 1957, Frank Rosenblatt simulated the Perceptron on an IBM 704.

His organization of a perceptron is constructed of three kinds of cell ("units")

A-I , A-II , R



Organization of a perceptron

Modern Perceptron

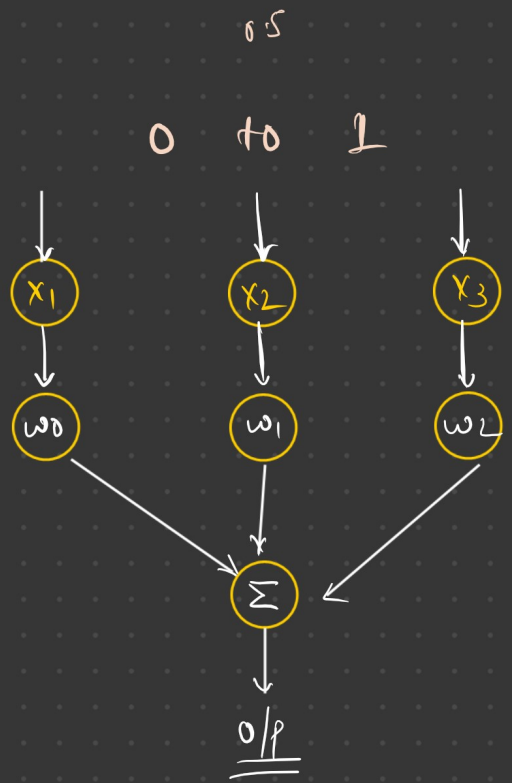
Perceptron is an algorithm for learning a binary classifier called a threshold function.

A function that maps its input x to an output $f(x) \to y$

$f(x) \to$ Heaveside step function

$f(x) \to h(w \cdot x + b)$

$\to h(x) : \begin{cases} 1 & x \geq 0 \\ 0 & x < 0 \end{cases}$



Neuron $= \begin{bmatrix} x_1 \cdot w_0 + x_2 \cdot w_1 + \\ x_3 \cdot w_2 \end{bmatrix}$

sigmoid $\to \begin{bmatrix} 1 \\ 0 \end{bmatrix}$

$w =$ vector of real-valued weights

$x =$ real-valued vector

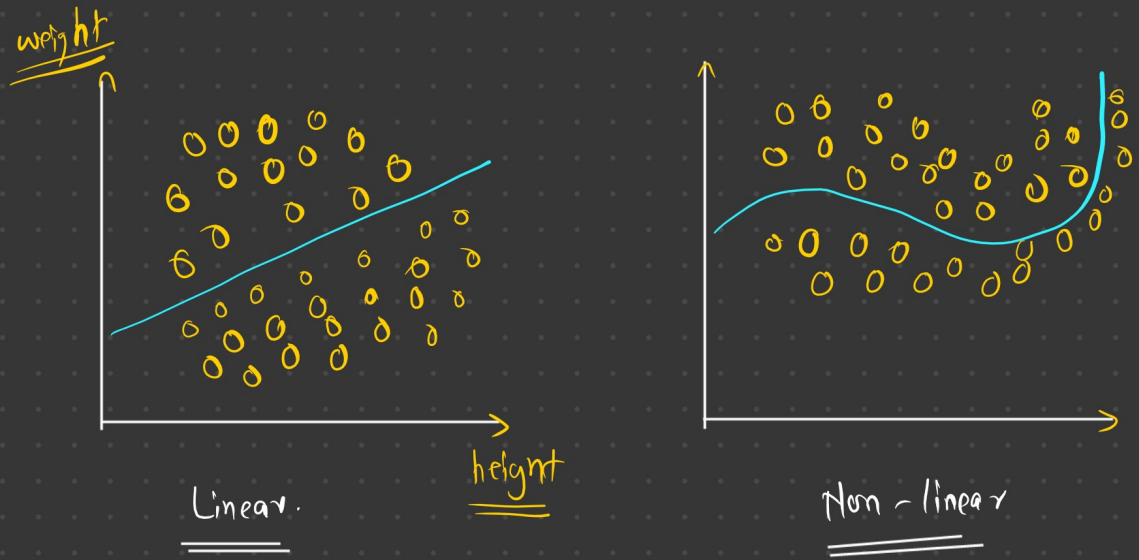
Single layer, Single neuron

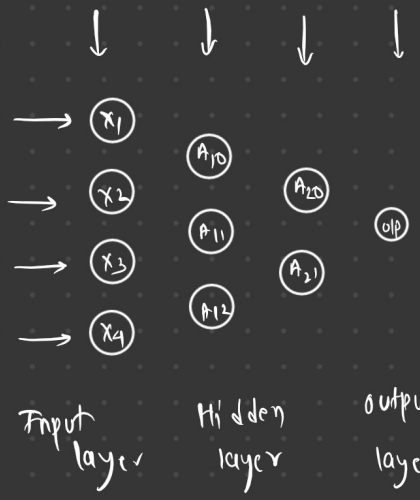
Neuron :

A neuron is a computation unit that performs a weightage sum of its input, add bias, & applies an activation function to produce an output.

Types

- Single layer Perceptron
  - Binary classification
  - for linear seperable problems
- Multi layer perceptron
  - $\geq$ Hidden layer
  - non-linear activation function (ReLU, sigmoid, tanh)
  - can solve non-linear problem.





Multi-Layer perceptron

Regression | classification

Timeseries

Transformers

For attention mechanism

Convolution Neural Network

Image Data

Reccurent Neural Network

Sequential Data

Limitation of tradition Methods

→ Algo like Decision Tree, SVM are good structure data but not with complex data like image, text or audio.

→ They rely too much on manual feature extration.

Need for End to End Training

→ They enable end to end learning & network learn best features automatically during training.

Others

→ Availibilty of large dataset

→ improvent in hardware, help in training deep neural network.

Advantages

→ Automatic feature extration.

→ Excel in unstructured data

→ Non linear Activation function, solves complex & non-linear relationship.

→ Generalization. It will work on unseen data.

What Neural Networks Do with Data?

→ Compression — Each layer filters out irrelevant details & reduce the input's dimensionality. In image data, these layers identify edges, corners, & texture, reduce the complexity of raw pixel data.

→ Deeper layer combine simpler features to form high-level representation.
  → for edges to shapes to object.

→ Ability to generalize.

Intuition

ML

→ Analyse where to cut
→ How to shape the Block
→ Manual processing

DL

→ Initial layer learn to create rough shape.
→ Next layer refines reshape
→ final layers completes the bat.

Components of Neural Network

- Input layer
- Hidden layer
- Output layer
- Back propogation
- Batch Normalization
- Forward Pass
- weights
- Neurons
- loss Function
- Learning rate
- Epoch & Iteration
- Hyper parameter
- Bias
- Activation Function
- Optimizer
- Dropout
- Batches