Neural Networks & SVM

→ NN is often considered as a black box

Brain → Neuron

NN → Node

→ less complexity (ANN → Advanced) than → fruit fly brain (1L Neurons)

75 million → Rat

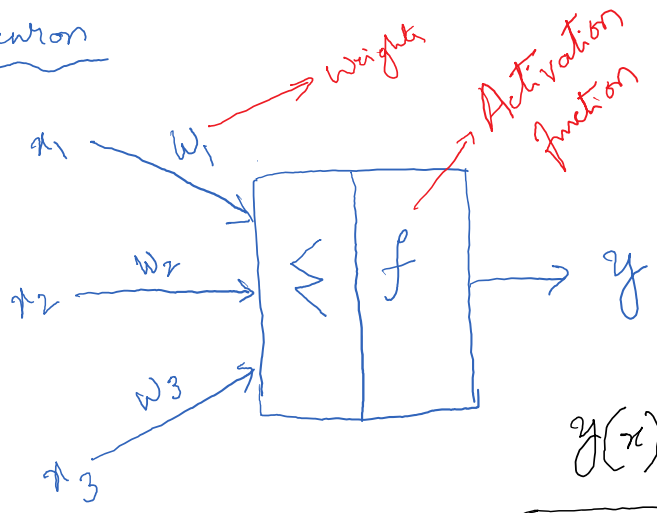
85 Billion → Humans.

Eg: → OCR → Recognition

→ Strength / Weather Reports etc

ANN → Relation btn set of I/p signals & O/p signals using a Biological NN model.

Single Neuron



$$y = c + m_1x_1 + m_2x_2 + m_3x_3$$

bias (similar to intercept)

$$y(x) = f\left(w_1x_1 + w_2x_2 + w_3x_3\right)$$

$$y(x) = f\left(\sum w_i x_i\right)$$

W → weight → It allows each of the n i/p's to Contribute More or less amount to the sum of the i/p signal

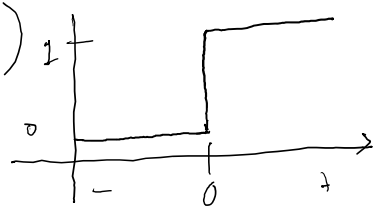
Activation fn → It transforms neuron's Combined i/p into a single O/p

Topology → Architecture → Defines the no of neurons & the pattern they are Connected

Training Algo → Specifies how connection weights are set in order to

Training Algo → Specifies how connection weights are set in order to suppress or excite neurons in proportion to I/p signal

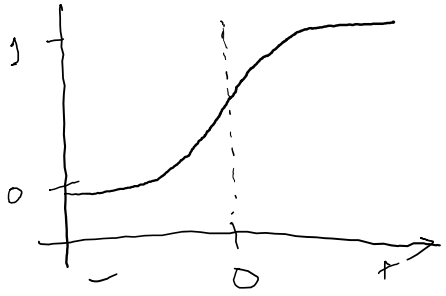
Activation fns → Threshold Activation fn (Biological)



Widely used → Sigmoid Activation fn

O/p btn 0 & 1

$$f(x) = \frac{1}{1+e^{-x}}$$



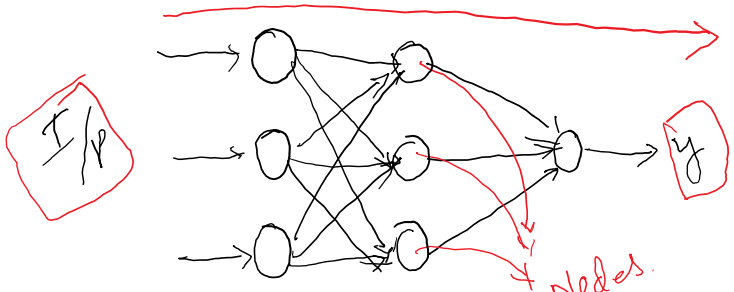
Linear AF

Saturated Linear AF

Gaussian AF

RBF → Radial bias function

Topology → ① Nodes & Layers → No std Rule to define this



Forward flow of Information

→ Feed Forward

Layer >>> hidden layer.

→ Multiple hidden layers → Deep Neural Network

→ Process of training a DNN → Deep learning

Backpropogation → Bidirectional Information flow.

→ This is how a neural net balances the weights

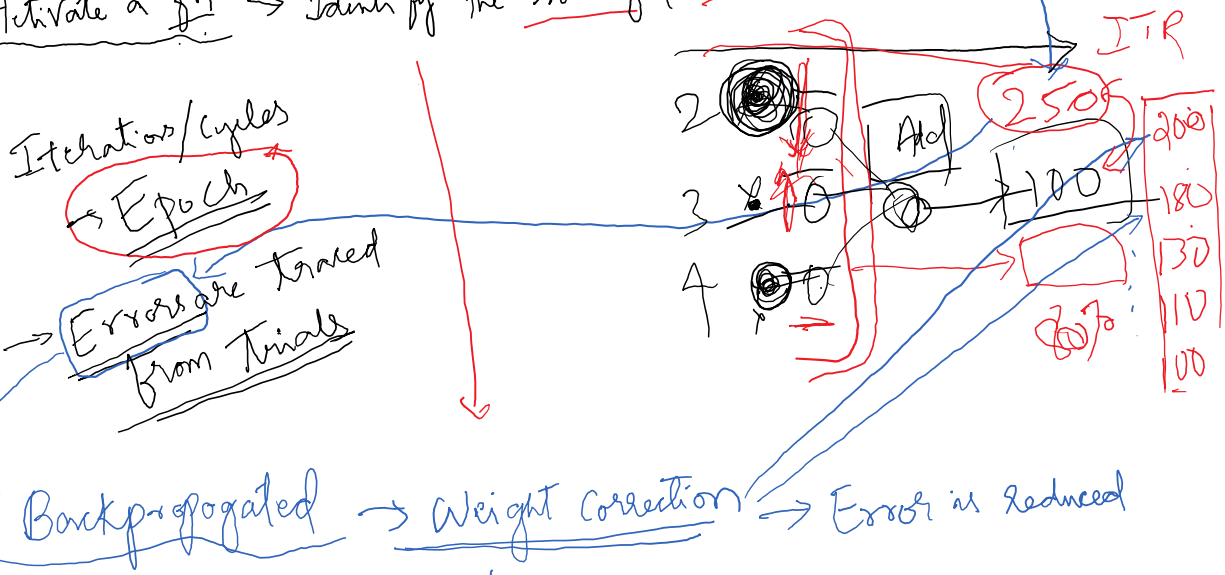
→ This is the process how it learns

Flow

⇒ Initial ANN → Blank state → Random weights

Forward Info

→ Activate a fn → Identify the strong & weak Connections.



Iterations/Cycles

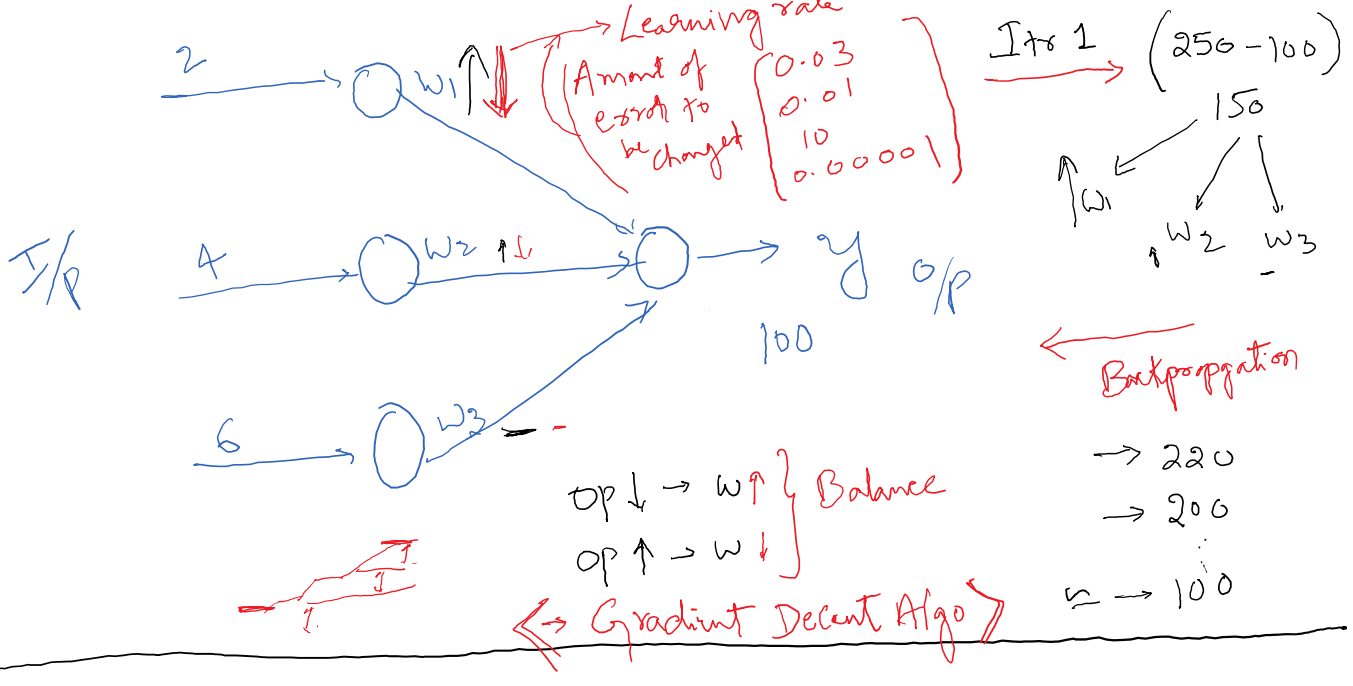
→ Epochs

→ Errors are traced from Trials

Backpropogated → Weight Correction → Error is Reduced

↓

Balanced weight / good output



SVM → Support Vector Machines

→ Tries to create a boundary/plane to separate data in a multidimensional space (Examples & feature values)

→ Goal of SVM is to create a flat boundary → "Hyperplane"

→ Combines → Nearest neighbour & Linear Regression (multiple)

→ Excellent computational power

→ Highly Complex

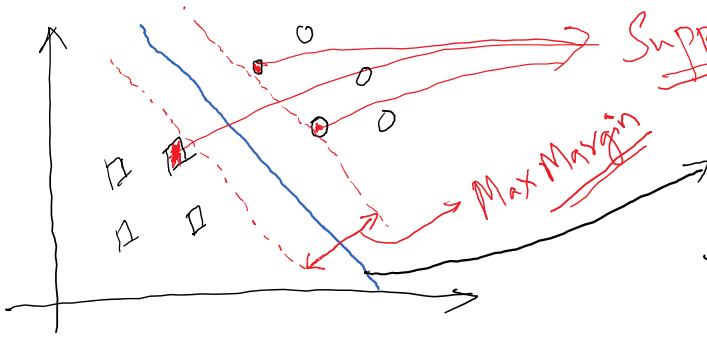
Classifications of Hyperplanes

(1) Linear separable

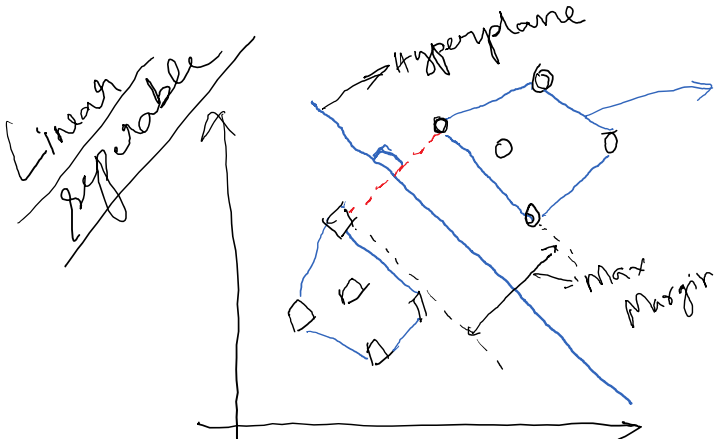
(2) Non-linear separable plane

→ Kernals →

→ Max Margin Hyperplane → line/plane has greatest separation



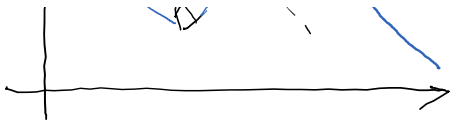
→ How to identify Support vectors?



→ Convex hull (1)

→ Margin (2)

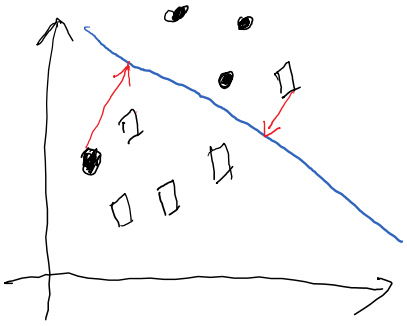
→ Perpendicular bisector of the shortest dist btw convex hull's (3)



The shortest ... 2 Convex hull's

→ Quadratic optimisation Algo

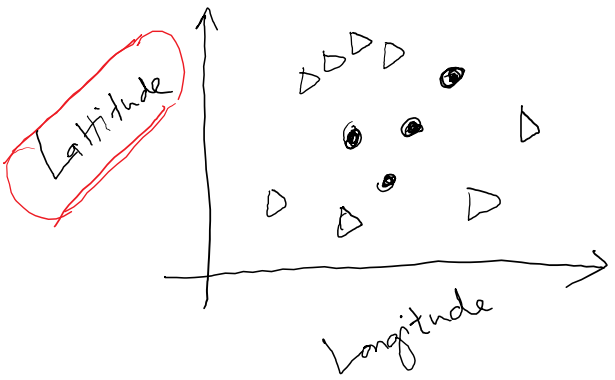
Non linear Separable

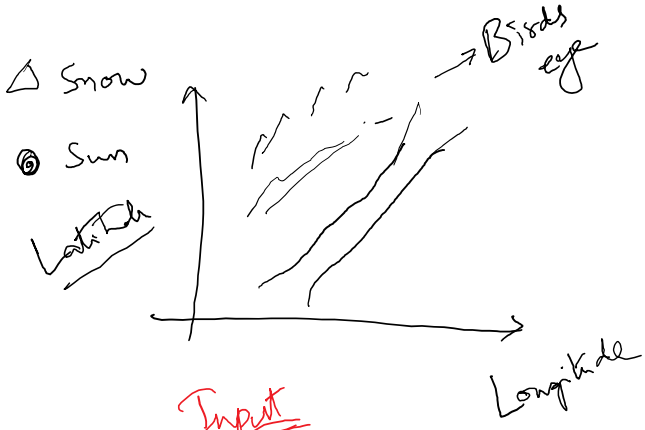


→ Auto balance → Complex

→ Kernal

→ Kernal Trick



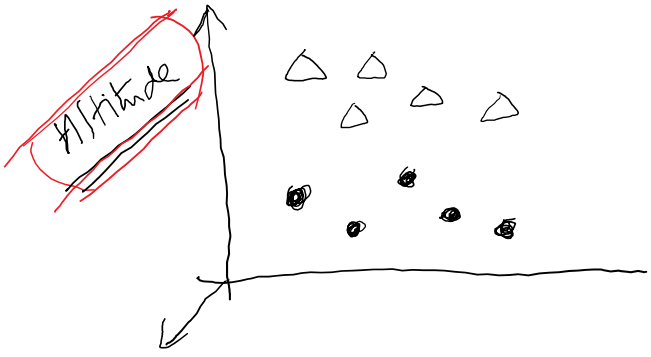


Converts the Non-linear into close to linear Relation

Kernal Trick.
→ Creates a new dimension

Input Space

Attitude



Types of Kernals

→ Linear Kernal → Doesn't transform the data

→ Polynomial Kernal → Degree "d" added to simple non-linear transformation

→ Sigmoid Kernal → Analogous to our NN → Sigmoid fn

→ Gaussian RBF Kernal → Similar to NN → RBF fn

→ No specific rule for Kernal selection → Depends of learning task