## Regression

Regression is a supervised machine learning technique which is used to predict continuous values.

## Classification

Classification is a supervised machine learning method where the model tries to predict the correct label of a given input data.

## Clustering

The process of grouping similar data points together without predefined categories, helping to discover hidden patterns and structures within a dataset.

∴ **Grouping data points into clusters based on their similarity or common characteristics.**

## Underfitting

→ Underfitting is when the training error is high.

→ Underfitting means that your model makes accurate, but initially incorrect predictions.

## Overfitting

Overfitting is when the testing error is high.

Overfitting means that your model makes not accurate predictions.

# Optimizations:-

Optimizers are algorithms that adjust the model's parameters during training to minimize a loss function. They enable neural networks to learn from data by iteratively updating weights and biases.

# Types of Optimizers:-

→ Stochastic Gradient Descent
→ Adam
→ RMSprop
→ AdaGrad
→ Momentum

# Three Main Funtions:-

→ Parameters
→ Loss function
→ Optimization function.

## Gradient Descent:

Gradient descent is an iterative optimization algorithm for find the local minimum of a function.

## Stochastic Gradient Descent:

Stochastic gradient descent is an optimization algorithm often used in machine learning applications to find the model parameters that correspond to the best fit between predicted and actual outputs.

| Gradient Descent | Stochastic Gradient Descent. |
| --- | --- |
| → All points in calculating loss and derivatives. | → Single point in loss function and its derivative randomly |

## Logistic Regression:

A process of modeling the probability of a discrete outcome given an input variables.

∴ To predict a binary outcomes such as Yes or No.

## Loss function of Regression.

→ Mean square loss
→ Mean absolute loss.

## Loss function of Classification

→ ~~Sigmoid~~ loss
→ Hinge loss
→ Logistic loss

## Loss function of Multiclass:

→ Softmax
→ Cross entropy

## Hyperparameters:

Hyperparameters are parameters whose value are set before starting the model training process.

## Regularization:

A regularization is a techinque used to prevent overfitting and improve the generalization of neural networks.

∴ Regularization for hyperparameters helps modify the gradient so that it does not step in directions that lead it to overfit.

→ Dropout
→ DropConnect
→ $L_1$ penalty
→ $L_2$ penalty

Separable/Non-separable

Supervised Learning → features / Labels Given

Regression → Model ko data detay hai real number deta hai (Prediction karwatay hai)

Classification

Model ko finite no. of classes detay hai e.g; cat, dog. in classes k andar classify kasta hai

Unsupervised Learning → Features are given, Labels are not given.

Clustring →

Distance kum ho Similar data k cluster bna deta hai

Underfitting.

Model itna simple hota hai k pattern ko identify nahi kar sakta.

Training and testing data bad.

Overfitting

Model khdd ko itna train kr leta.

Training are good but un testing Seen data bad.

## Optimizers

Model k error ko minimize karta hai.
Weights ko update karta hai.

Types of Optimizers:

| | |
|---|---|
| SGD | Adagrad |
| Adam | Momentum |

## Functions:

→ Parameter
Weights / bias

→ Loss Function
Error

### Gradient Descent.

Ak batch k bd weights update karta hai

### Stochastic Gradient Descent.

Ak point k bd weight update karta hai

### Logistic Regression

Binary k liye ye use kartay hai.

## Loss function

Actual output } ko calculate karnay
Predicted output } k bd jo result aata hai vo error hota hai

Mean Square Error

$$\frac{1}{n} \Sigma (y_i - \hat{y}_i)^2$$

Mean Absolute Error

$$\frac{1}{n} \Sigma |y_i - \hat{y}_i|$$

## Hyperparameter

User-define.
(change kar saktay hai).

## Regularization.

Used in overfitting ko kum karnay k liye.

## Dropout.

Layer ko drop karta hai

## Dropconnet.

kuch neurons ko drop karta hai.

Perceptron:
↳ The simplest form of an ANN, capable of performing binary classification tasks.

Single layer Perceptron
↳ A single layer perceptron is a type of neural network architecture with a single layer of input units and a single output units, suitable for linearly separable problems.

Multilayer Feedforward Neural Network
↳ It is also known as multilayer perceptron, consists of multiple layers of interconnected neurons, including input, hidden, and output layers. It can handle complex, nonlinear problems.

Activation function
↳ Compares the input value to a threshold value.
Input value > threshold → Neuron Activated
Input value < threshold → Not activated bcz output Not sent on the next or hidden layer.

[ Sigmoid Function

Is normally used to refer specifically to the logistic function, also called logistic sigmoid function.

All sigmoid function is normally used to refer spe