Keras is an open source Neural Network library written in python.

Tensorflow is an open source ML Framwork by google inc.

**AI is the field of making machines smart** — allowing them to learn, reason, and act like humans. We use AI to **automate**, **optimize**, and **solve complex problems** faster and better than traditional approaches.

**Machine Learning:** Field of study involving Algorithms that learn from data to make predictions/recognize patterns.

**Deep Learning:** Subset of ML using neural networks with many layers to make better predictions/conclusions.

Learning Path

**Supervised**

1. Linear Regression (Metrics- mse, r2, ) Ridge, Lasso Regression
2. Logistic Regression (Classification, Accuracy, Precision, Recall, F1, Cross Validation) – it is linear decision boundary, uses gradient descent for minimization
3. KNN Classifier(Optimal K value with cross validation, classification, Min Max Scaler, Bias Variance Tradeoff)
4. Naïve Bayes(Gaussian Naiye Bayes for classification,)- classification based on conditional probability assuming the features to be independent.
5. Support Vector Machine(Operates even in infinite dimensions): effective when number of features > number of samples. SVM finds **\*\*the most optimal line\*\*** that leaves the **\*\*widest possible gap\*\*** between the two sets of dots.
6. Decision Trees: Classification , regression

captures non linear relationships effectively, no normalization required. But subject to overfitting. Finds the best split and splits the data set. Entropy and Gini Index. Pruning can help.

1. Bagging & Random Forest

Combining multiple decision trees for a powerful classification model. Bagging draws random subset of samples from the dataset and trains a decision tree and takes the majority of the outputs as the output.

Problem: All decision tree not independent of each other as they share features, so they may look similar often and again overfit.

Solution: Selecting random features along with a random subset for every tree. Reduces the variance when averaging across the trees. Number of features is sqrt of total number of features

1. Boosting

A decision tree of height 1(called a stump) is a linear classifier. Sequentially train a weak classifier for penalizing the misclassified datapoint by assigning it more weight. End result is a additive combination of weak learners that form a strong classifier.

1. PCA: is a widely used technique for dimensionality reduction. It transforms a dataset with many features into a smaller set of uncorrelated features.

**Unsupervised:**

1. Clustering – K Means, DBSCAN, Hierarchical Clustering

ML\_PROJECT1: Deal with Olivetti dataset of 40 people and 10 images of every person, 64 x 64 every image, in total of 4096 features every image. Use PCA to reduce the number of features , determine the optimal number of features by plotting Cumulative Variance Explained by Principal Components against the principal component and picking up the component giving 95 percent of variance overall. Reduce the training set to 123 features and train various ML models.

**DEEP LEARNING**