ML001 [Machine Learning Theory + Practical]

Section - 1 [Basics of Machine Learning]

- ❖ Fundamentals of Machine Learning
  - ➢ What is Machine Learning? The way I like to think about it!
  - ➢ Cool Applications of Machine Learning
  - ➢ Types of ML and Their Types
  - ➢ Workflow of basic ML Problem
  - ➢ Main Challenges of Machine Learning
  - ➢ Dividing the data
  - ➢ Two famous problems of Machine learning:-
    - ■ Underfitting
    - ■ Overfitting
  - ➢ Solutions to the Overfitting and Underfitting
  - ➢ Quizzes
- ❖ Supervised Learning and Unsupervised Learning In Depth
- ❖ Assignment released

Section - 2 [Linear Regression & Regularization]

- ❖ Linear Regression
  - ➢ What is Linear Regression? Visual Understanding
  - ➢ Hypothesis Function Or Prediction Function
  - ➢ Closed Form Solution aka Normal Equation
  - ➢ Coding Normal Equation
  - ➢ Cost Function
  - ➢ Gradient Descent
  - ➢ Assumptions & Pros and Cons of Linear Regression

- ❖ Regularized Linear Models
  - ➢ Ridge Regression
  - ➢ Lasso Regression

- Problem Sets Releases

Section - 3 [Logistic Regression & Performance Metrics]

- Logistic Regression
  - Hypothesis Function
  - Cost Function
  - Gradient Descent
  - Assumptions and Pros and Cons

  - Problem Sets Releases

Section - 4 [Support Vector Machine]

- Support Vector Machines
  - Linear SVM Classification
    - Hard/Soft Margin Classification
  - Non-Linear SVM Classification
    - How does it work?
    - Polynomial Kernel [Homogenous & Inhomogeneous]
    - RBF Kernel
  - Computing SVM Classifier
    - Primal and Dual Problem
    - Sub-Gradient Descent
    - Coordinate Descent
  - Transductive SVM
  - SVR

  - Problem Sets releases

Section - 5 [PCA]

- Review of Linear Transformation & EigenVectors and EigenValues
- Dimensionality Reduction Need
- Basic Intuition Behind PCA
- Algorithm:-
  - Data Preprocessing [Data Standardization]
  - Compute the Covariance Matrix
  - Compute the cumulative energy content for each eigenvector
  - Select a subset of the eigenvectors as basis vectors
  - Projecting Back
- Pros and Cons
- Summary

- Problem Sets releases

Section - 6 [Learning Theory]

- ❖ Bias and Variance TradeOff
- ❖ Approx Estimation Error
- ❖ Empirical Risk Minimization

- ❖ Problem Sets releases

Section - 7 [Decision Trees & Random Forest]

- ❖ Decision Trees
  - ➢ Training of Decision Trees
  - ➢ Prediction in Decision Trees
  - ➢ Information Measures:-
    - ■ Entropy
    - ■ Information Gain
    - ■ Gini Impurity
  - ➢ Hyperparameter Tuning
  - ➢ Project Proposal

  - ● Decision Trees Assignment

- ❖ Ensemble Learning
  - ➢ Ensemble Learning
    - ■ Bagging
      - ● Random Forest
    - ■ Boosting
      - ● Gradient Boosting
      - ● Adaboost
      - ● XGboost
    - ■ Stacking
    - ■ Cascading

  - ➢ Problem Sets releases [3 problems sets]

Section - 8 [Learning more algorithms and building more projects]

- ➢ Naive Bayes
- ➢ K-Nearest Neighbors

Section - 8 [Unsupervised Learning Algorithms]

- Unsupervised Learning and Clustering Intro and Types
- Cluster Analysis
- Unsupervised Learning Algorithms
  - K-Means with K-Means ++
  - Hierarchical Clustering Techniques
  - Unsupervised Learning Problem set and project releases
  - K-Means Programming Assignment

Section - 9 [Building Applications]

  - Building Heart Failure Detection System with deployment
  - Building Fake news detection system
  - Building Email Spam Detection System
- Student projects:-
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