Machine Learning - Course Content

1. Getting Started (Level of Difficulty: Basic)

❖ **Topics:**

1. Introduction to the Course
2. Setting up the required softwares
   - Python 3.x
   - Anaconda (Spyder IDE)
   - Jupyter Lab
3. Python Programming

   - Data Types
   - Data Structures
   - Conditional Statements
   - Functions
   - List Comprehensions
   - Lambda
   - Classes

❖ **Assignment on Python Programing**

2. Statistics (Level of Difficulty: Intermediate)

❖ **Topics:**

1. What is Statistic?
2. What are various types of Statistics?
   a. Descriptive Statistics
      i. Measures of Central Tendency
         1. Mean, Median and Mode
      ii. Measures of Spread
         1. Range
         2. Standard Deviation
         3. Inter Quartile Range
         4. Variance
   b. Inferential Statistics
      i. What is test?
      ii. Confidence Interval
3. Terms used in Statistics
4. Types of Variables
   a. Quantitative
      i. Discrete
      ii. Continues
   b. Qualitative
5. Levels of Measurement
   a. Nominal
   b. Ordinal

      c. Interval

      d. Ratio

6. Probability Density Function and Probability Mass Function
7. Common Data Distributions

    a. Discrete

      i. Symmetric

        1. Binomial Distribution

        2. Uniform Discrete Distribution

      ii. Asymmetric a.k.a Skewed

        1. Geometric Distribution

        2. Negative Binomial Distribution

        3. Hypergeometric Distribution

    b. Continues

      i. Symmetric

        1. Uniform a.k.a Multimodal Distribution

        2. Triangular Distribution

        3. Normal Distribution

        4. Cauchy Distribution

      ii. Asymmetric or Skewed

        1. Exponential Distribution

        2. Lognormal Gamma Weibull Distribution

        3. Minimum Extreme Distribution

❖ **Hands On:**

1. **Exploratory Data Analysis of Boston Housing Prices Data set**

3. Probability (Level of Difficulty: Intermediate)

❖ **Topics:**

1. What is Probability?
2. What is Conditional Probability?
   - What are the properties of conditional probability?
3. Multiplication rule of Probability
4. What is a Random Experiment?
5. What is a Sample Space?
6. What is an event?
7. What are various types of events?

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- Simple a.k.a Elementary Event
- Compound Event
- Certain Event
- Impossible Event
- Equivalent Events a.k.a Identical Events
- Equally Likely Events
- Mutually Exclusive Events
- Independent Events

8. Bayes Theorem
   - Partition of Sample Space
   - Theorem of total probability
   - What is Hypothesis?
   - What is Priori Probability?
   - What is Posteriori Probability?
9. What is a Random Variable?
   - Probability Distribution of a Random Variable
   - Mean of a Random Variable
   - Variance of a Random Variable
10. Bernoulli Trials and Bernoulli Distribution

4. Machine Learning Foundations (Level of Difficulty: Advanced)

❖ **Topics:**

1. Overview

1. Introduction
2. Decision Trees
3. Naive Bayes
4. Gradient Descent
5. Linear Regression
6. Logistic Regression
7. SVM
8. Neural Networks
9. Kernel Method
10. Recap and Exercise
11. K-means Clustering
12. Hierarchical Clustering
13. Conclusion

2. Model Selection a.k.a Hyper Parameter Tuning

3. Testing Models

4. Evaluation Metrics

1. Confusion Matrix
2. Accuracy
3. Precision
4. Recall

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   5. F1 Score
   6. F-beta Score
   7. ROC Curve
   8. Regression Metrics

 5. Error Detection

   1. Model Complexity Graph
   2. K Fold Cross Validation
   3. Learning Curves

 6. Outro

5. H2O Machine Learning Framework
❖ **Topics**

 1. Introduction to H2O and Installation
 2. Data Import and Export
 3. Common Model Parameters
 4. Model Building and Evaluation
 5. Hyper Parameter Tuning
 6. Model Export

❖ **Hands On Project:**
 1. Customer Churn Prediction

6. Mastering Supervised Learning (Level of Difficulty: Advanced)

❖ **Topics:**

 1. Supervised Learning Introduction
 2. Introduction to Regression
 3. Decision Trees
 4. Neural Networks
 5. SVMs
 6. Naive Bayes
 7. Ensemble B&B

❖ **Hands On Projects:**
  ▪ Boston House Price Prediction
  ▪ Movie Rating Prediction
  ▪ Titanic Survival Exploration
  ▪ Email Spam Detector
  ▪ Find Donors for Charity
  ▪ Media Product Classification

7. Mastering Unsupervised Learning (Level of Difficulty: Advanced)

❖ **Topics:**

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    I.   **Introduction to Unsupervised Learning**
    II.   **Clustering**
    III.   **Feature Scaling**
    IV.   **Feature Selection**
    V.   **PCA**
    VI.   **Feature Transformation**

❖ **Hands On Projects:**

- Customer Segmentation
- Topic Modelling

8. Capstone Project

Note: If student completes all the Mini Projects and the Exercises mentioned in the course successfully, he/she will be equipped with enough hands on and experience by using which one can develop production level Machine Learning Solution.