Invictus Engineers

Machine Learning

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1. Introduction to Machine Learning & Scikit-Learn

Introduction
- ML Applications
- Choosing the Right ML Algorithm for the requirement

Scikit-Learn package
- Pros of Scikit-Learn
- Cons of Scikit-Learn
- Comparing it with other Frameworks

Data Representation for Scikit-Learn
- Tables of Data
- Features Matrix and Target Matrix

Data Preprocessing
- Untidy (Messy) Data
  - Handling Missing Values
  - Dealing with Outliers
- Dealing with Categorical Features (Nominal & Ordinal)
- Feature Engineering
- Rescaling Data

Scikit-Learn API
- Its working
  - Estimator
  - Predictor
  - Transformer

Supervised & Unsupervised Learning
- Supervised Learning
- Unsupervised Learning
- Reinforcement Learning

2. Unsupervised Learning – Applications

Introduction

Clustering
- Types of Clustering
- Applications of Clustering in different fields

Exploring a Dataset – Wholesale Customers Dataset (Sample data)
- Steps for Understanding the Dataset

Data Visualization
- Loading the Dataset
- Visualization Tools
- k-means Algorithm

- Deeper look into k-means Algorithm
  - Initialization Methods
  - Setting the Number of Clusters
- Mean-Shift Algorithm
  - Deeper look into Mean-Shift Algorithm
- DBSCAN Algorithm
  - Deeper look into DBSCAN Algorithm
- Evaluating the Performance of Clusters
  - Available Metrics for Evaluating in Scikit-Learn

3. Introduction to Supervised Learning

- Introduction
- Supervised Learning Tasks: Classification & Regression
- Model Validation and Testing
  - Data Partitioning: Dividing data into subsets
  - Clarifying the Split Ratio
  - Cross-Validation
- Evaluation Metrics: Performance Evaluation
  - Evaluation Metrics for Classification Tasks
    - Confusion Matrix
    - Accuracy
    - Precision
    - Recall
  - Choosing an Evaluation Metric for the purpose of study
  - Evaluation Metrics for Regression Tasks
- Error Analysis
  - Bias, Variance, and Data Mismatch

4. Supervised Learning Algorithms

- Introduction
- Exploring the Dataset
  - Understanding the Dataset
- The Naïve Bayes Algorithm
  - How Naïve Bayes Algorithm Work?
- The Decision Tree Algorithm
  - How Decision Tree Algorithm Work?
- The Support Vector Machine Algorithm
  - How SVM Algorithm Work?
- Error Analysis
  - Accuracy, Precision, and Recall

5. Supervised Learning - Neural Networks

- Introduction
- Artificial Neural Networks
  - How Do ANNs Work?
    - Forward Propagation
    - Cost Function
    - Backpropagation
    - Updating the Weights and Biases
  - Understanding the Hyperparameters
    - Number of Hidden Layers and Units
    - Activation Functions
    - Regularization
    - Batch Size
    - Learning Rate
    - Number of Iterations
  - Applications of Neural Networks
  - Limitations of Neural Networks
- Applying an Artificial Neural Network
  - Scikit-Learn's Multilayer Perceptron
- Performance Analysis
  - Error Analysis
  - Hyperparameter Fine-Tuning
  - Model Comparison

6. Project: Building a Machine Learning Application

- Introduction
- Program Definition
  - Building a Program – Key Stages
    - Preparation
    - Creation
    - Interaction
  - Understanding the Dataset
- Saving and Loading a Trained Model
  - Saving a Model
  - Loading a Model
- Interacting with a Trained Model

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