

Machine Learning Course Syllabus

1. Course Introduction

- Course Introduction

2. Introduction to AI and Machine Learning

- Learning Objectives
- The emergence of Artificial Intelligence
- Artificial Intelligence in Practice
- Sci-Fi Movies with the concept of AI
- Recommender Systems
- Relationship Between Artificial Intelligence, Machine Learning, and Data Science - Part A
- Relationship Between Artificial Intelligence, Machine Learning, and Data Science - Part B
- Definition and Features of Machine Learning
- Machine Learning Approaches
- Machine Learning Techniques
- Applications of Machine Learning - Part A
- Applications of Machine Learning - Part B
- Key Takeaways

3. Data Preprocessing

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- Learning Objectives
- Data Exploration: Loading Files
- Demo: Importing and Storing Data
- Practice: Automobile Data Exploration I
- Data Exploration Techniques: Part 1
- Data Exploration Techniques: Part 2
- Seaborn
- Demo: Correlation Analysis
- Practice: Automobile Data Exploration II
- Data Wrangling
- Missing Values in a Dataset
- Outlier Values in a Dataset
- Demo: Outlier and Missing Value Treatment
- Practice: Data Exploration III
- Data Manipulation
- Functionalities of Data Object in Python: Part A
- Functionalities of Data Object in Python: Part B
- Different Types of Joins
- Typecasting
- Demo: Labor Hours Comparison
- Practice: Data Manipulation
- Key Takeaways
- Lesson-end project: Storing Test Results

4. Supervised Learning

- Learning Objectives
- Supervised Learning
- Supervised Learning- Real-Life Scenario
- Understanding the Algorithm
- Supervised Learning Flow
- Types of Supervised Learning – Part A
- Types of Supervised Learning – Part B
- Types of Classification Algorithms

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- Types of Regression Algorithms - Part A
- Regression Use Case
- Accuracy Metrics
- Cost Function
- Evaluating Coefficients
- Demo: Linear Regression
- Practice: Boston Homes I
- Challenges in Prediction
- Types of Regression Algorithms - Part B
- Demo: Bigmart
- Practice: Boston Homes II
- Logistic Regression - Part A
- Logistic Regression - Part B
- Sigmoid Probability
- Accuracy Matrix
- Demo: Survival of Titanic Passengers
- Practice: Iris Species
- Key Takeaways
- Lesson-end Project: Health Insurance Cost

5. Feature Engineering

- Learning Objectives
- Feature Selection
- Regression
- Factor Analysis
- Factor Analysis Process
- Principal Component Analysis (PCA)
- First Principal Component
- Eigenvalues and PCA
- Demo: Feature Reduction
- Practice: PCA Transformation
- Linear Discriminant Analysis
- Maximum Separable Line

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- Find Maximum Separable Line
- Demo: Labeled Feature Reduction
- Practice: LDA Transformation
- Key Takeaways
- Lesson-end Project: Simplifying Cancer Treatment

6. Supervised Learning: Classification

- Overview of Classification
- Classification: A Supervised Learning Algorithm
- Use Cases
- Classification Algorithms
- Decision Tree Classifier
- Decision Tree: Examples
- Decision Tree Formation
- Learning Objectives
- Choosing the Classifier
- Overfitting of Decision Trees
- Random Forest Classifier- Bagging and Bootstrapping
- Decision Tree and Random Forest Classifier
- Performance Measures: Confusion Matrix
- Performance Measures: Cost Matrix
- Demo: Horse Survival
- Practice: Loan Risk Analysis
- Naive Bayes Classifier
- Steps to Calculate Posterior Probability: Part A
- Steps to Calculate Posterior Probability: Part B
- Support Vector Machines: Linear Separability
- Support Vector Machines: Classification Margin
- Linear SVM: Mathematical Representation
- Non-linear SVMs
- The Kernel Trick
- Demo: Voice Classification
- Practice: College Classification

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- Key Takeaways
- Lesson-end Project: Classify Kinematic Data

7. Unsupervised Learning

- Learning Objectives
- Overview
- Example and Applications of Unsupervised Learning
- Clustering
- Hierarchical Clustering
- Hierarchical Clustering: Example
- Demo: Clustering Animals
- Practice: Customer Segmentation
- K-means Clustering
- Optimal Number of Clusters
- Demo: Cluster-Based Incentivization
- Practice: Image Segmentation
- Key Takeaways
- Lesson-end Project: Clustering Image Data

8. Time Series Modeling

- Learning Objectives
- Overview of Time Series Modeling
- Time Series Pattern Types Part A
- Time Series Pattern Types Part B
- White Noise
- Stationarity
- Removal of Non-Stationarity
- Demo: Air Passengers I
- Practice: Beer Production I
- Time Series Models Part A
- Time Series Models Part B
- Time Series Models Part C
- Steps in Time Series Forecasting

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- Demo: Air Passengers II
- Practice: Beer Production II
- Key Takeaways
- Lesson-end Project: IMF Commodity Price Forecast

9. Ensemble Learning

- Learning Objectives
- Overview
- Ensemble Learning Methods Part A
- Ensemble Learning Methods Part B
- Working of AdaBoost
- AdaBoost Algorithm and Flowchart
- Gradient Boosting
- XGBoost
- XGBoost Parameters Part A
- XGBoost Parameters Part B
- Demo: Pima Indians Diabetes
- Practice: Linearly Separable Species
- Model Selection
- Common Splitting Strategies
- Demo: Cross-Validation
- Practice: Model Selection
- Key Takeaways
- Lesson-end Project: Tuning Classifier Model with XGBoost

10. Recommender Systems

- Learning Objectives
- Introduction
- Purposes of Recommender Systems
- Paradigms of Recommender Systems
- Collaborative Filtering Part A
- Collaborative Filtering Part B
- Association Rule Mining

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- Association Rule Mining: Market Basket Analysis
- Association Rule Generation: Apriori Algorithm
- Apriori Algorithm Example: Part A
- Apriori Algorithm Example: Part B
- Apriori Algorithm: Rule Selection
- Demo: User-Movie Recommendation Model
- Practice: Movie-Movie recommendation
- Key Takeaways
- Lesson-end Project: Book Rental Recommendation

11. Text Mining

- Learning Objectives
- Overview of Text Mining
- Significance of Text Mining
- Applications of Text Mining
- Natural Language Toolkit Library
- Text Extraction and Preprocessing: Tokenization
- Text Extraction and Preprocessing: N-grams
- Text Extraction and Preprocessing: Stop Word Removal
- Text Extraction and Preprocessing: Stemming
- Text Extraction and Preprocessing: Lemmatization
- Text Extraction and Preprocessing: POS Tagging
- Text Extraction and Preprocessing: Named Entity Recognition
- NLP Process Workflow
- Demo: Processing Brown Corpus
- Practice: Wiki Corpus
- Structuring Sentences: Syntax
- Rendering Syntax Trees
- Structuring Sentences: Chunking and Chunk Parsing
- NP and VP Chunk and Parser
- Structuring Sentences: Chinking
- Context-Free Grammar (CFG)
- Demo: Twitter Sentiments

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- Practice: Airline Sentiment
- Key Takeaways
- Lesson-end Project: FIFA World Cup

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