Machine Learning Course Syllabus

Description:

This course is designed for experienced software developers who want to gain a strong foundation in Machine Learning (ML) and acquire advanced tools for practical work in the field. The course covers topics like data exploration, traditional ML algorithms, evaluation metrics, optimization techniques, MLOps fundamentals, and more. Students will gain hands-on experience in data science workflows and machine learning model development using Python, Colab, scikit-learn, MLOps tools, and many more.

Prerequisites:

- Prior programming experience (Python)
- Basic mathematical background (recommended)

Course Outline:

1. **Introduction to ML**
    - Course Introduction
    - Overview of Machine Learning and Data Science (MLDS)
    - Introduction to Google Colab and Python
2. **Scientific Computing with Python**
    - NumPy Basics
    - Pandas Library
3. **Mathematical Foundations**
    - Linear Algebra
    - Statistics and Probability Theory
4. **K-Nearest Neighbors (KNN) & Model Selection**
    - Model Selection Strategies
    - Accuracy, Train/Test Split

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5. **Exploratory Data Analysis (EDA) & Preprocessing** ○ EDA Techniques

○ Data Preprocessing

○ Visualization Libraries

6. **Linear Regression & Evaluation Metrics I** ○ Simple and Multivariate Linear Regression ○ Confusion Matrix

○ Accuracy, Precision, Recall, F1-score

7. **Logistic Regression & Evaluation Metrics II** ○ Logistic Regression

○ Train/Test/Validation Splits

○ Cross-Validation, Overfitting & Underfitting ○ Bias-Variance Tradeoff

○ AUC, ROC Curve

8. **Optimization Techniques**

○ Gradient Descent

○ Learning Rate and Convergence

○ Stochastic Gradient Descent (SGD)

○ Overfitting & Underfitting Analysis

9. **Decision Trees I**

○ Decision Tree Algorithm

○ Entropy and Information Gain

10. **Decision Trees II**

○ Gradient Boosting

○ Random Forests, CatBoost, AdaBoost

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11. **Unsupervised Learning I**
    - K-means Clustering
    - DBSCAN
    - Hierarchical Clustering
12. **Unsupervised Learning II**
    - HDBSCAN
    - Variations & Advanced Topics
13. **Case Study**
    - Titanic Dataset Analysis
14. **Bayesian Classifiers & Support Vector Machines (SVM)**
    - Bayesian Classifiers
    - Support Vector Machines (SVM)
15. **Dimensionality Reduction**
    - PCA, t-SNE, LDA
16. **Time Series Analysis & Anomaly Detection**
    - Time Series Analysis
    - Anomaly Detection
17. **Introduction to MLOps**
    - MLOps Concepts
    - Model Lifecycle Management
    - Monitoring and Logging
18. **Course Summary & Review**

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