Introduction to Machine Learning with Python

Course Description:

This course is an introduction to the field of machine learning and the Python programming language. It is designed for students with some programming experience, but no prior knowledge of machine learning. The course will cover the fundamental concepts and techniques of machine learning, as well as how to apply these techniques in Python using the scikit-learn library.

Course Objectives:

Upon completion of this course, students will be able to:

* Understand the fundamental concepts of machine learning, including supervised and unsupervised learning, overfitting, and bias-variance tradeoff
* Use the scikit-learn library to train and evaluate machine learning models in Python
* Use Python libraries such as NumPy, pandas, and matplotlib to manipulate and visualize data
* Understand the different types of classification, regression, and clustering algorithms and when to use them
* Implement and evaluate the performance of machine learning models on real-world data

Course Outline:

1. Introduction to Machine Learning
   * Definition and types of machine learning
   * Supervised and unsupervised learning
   * Overfitting and bias-variance tradeoff
2. Python for Machine Learning
   * Introduction to Python programming
   * NumPy for numerical computing
   * pandas for data manipulation and cleaning
   * matplotlib for data visualization
3. Machine Learning with scikit-learn
   * Introduction to the scikit-learn library
   * Training and evaluating machine learning models
   * Cross-validation and hyperparameter tuning
   * Evaluation metrics for classification and regression
4. Classification Algorithms
   * K-nearest neighbors (KNN)
   * Decision trees
   * Support vector machines (SVMs)
   * Logistic regression
5. Regression Algorithms
   * Linear regression
   * Polynomial regression
   * Ridge and Lasso regression
   * Elastic Net
6. Clustering Algorithms
   * K-means clustering
   * Hierarchical clustering
   * Density-based clustering
7. Advanced Topics
   * Ensemble methods
   * Deep learning with TensorFlow

Textbook:

* Introduction to Machine Learning with Python by Andreas Müller and Sarah Guido (O'Reilly Media)

Prerequisites:

* Basic programming skills in any language
* Familiarity with basic mathematics (e.g. algebra, calculus) is helpful but not required

Grading:

* Homework assignments: 40%
* Midterm exam: 20%
* Final project: 40%

Homework Policy:

* Homework assignments will be given on a weekly basis and are due the following week
* Late homework will not be accepted except in cases of documented emergencies
* Collaboration on homework is encouraged, but each student must write their own code and submit their own solutions

Academic Integrity:

* All work submitted must be your own
* Plagiarism and cheating will not be tolerated and may result in a grade of zero for the assignment or a failing grade in the course