Course Outline

Introduction to Data Science, Machine Learning - AI using Python

Course Summary

Description

Machine Learning (ML) is changing the world. To use ML effectively, one needs to understand the algorithms and how to utilize them. This course provides an introduction to the most popular machine learning algorithms.

This course teaches doing Machine Learning using the popular SciKit-Learn package in Python language.

This course teaches Machine Learning from a practical perspective. In-depth coverage of Math / Stats is beyond the scope of this course.

Topics

- Python and SciKit-Learn
- ML Concepts
- Regressions
  - Linear Regression
  - Logistic Regressions
- Classifications
  - Naive Bayes
  - SVM
  - Decision Trees
  - Random Forest
- Clustering algorithms (K-Means)
- Principal Component Analysis (PCA)
- Recommendations

Audience

Data Analysts, Software Engineers, Data scientists

Prerequisites

- Good programming background
- familiarity with Python would be a plus, but not required
- No machine learning knowledge is assumed

Duration

Three days

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Course Outline

I. Python Basics
- A. Introduction to Python programming environment
- B. Introduction to Numpy and Pandas
- C. Labs
- D. Working with Jupyter notebooks
- E. Numpy and Pandas

II. Machine Learning (ML) Overview
- A. Machine Learning landscape
- B. Understanding Deep Learning use cases
- C. Understanding AI / Machine Learning / Deep Learning
- D. Data and AI
- E. AI vocabulary
- F. Hardware and software ecosystem
- G. Understanding types of Machine Learning (Supervised / Unsupervised / Reinforcement)

III. Python Scikit-Learn Library
- A. Scikit-Learn library overview
- B. Lab:
- C. Scikit-Learn utilities

IV. Feature Engineering and Exploratory Data Analysis (EDA)
- A. Preparing data for ML
- B. Statistics Primer
- C. Data cleanup
- D. Extracting features, enhancing data
- E. Visualizing Data
- F. Labs:
- G. Data cleanup
- H. Exploring data
- I. Visualizing data

V. Machine Learning Concepts
- A. Training and Testing
- B. Gradient Descent
- C. Overfitting / Under-fitting
- D. Cross-validation, bootstrapping
- E. Confusion Matrix
- F. ROC curve, Area Under Curve (AUC)

VI. Linear regression
- A. Linear Regression
- B. Errors, Residuals
- C. Multiple Linear Regression
- D. Evaluating model performance
- E. Labs:
- F. Use case: House price estimates

VII. Logistic Regression
- A. Understanding Logistic Regression
- B. Calculating Logistic Regression
- C. Evaluating model performance
- D. Labs:
- E. Credit card application
- F. college admissions

VIII. Classification: SVM (Supervised Vector Machines)
- A. SVM concepts and theory
- B. SVM with kernel
- C. Labs:
- D. Customer churn data

IX. Classification: Decision Trees & Random Forests
- A. Classification and Regression Trees (CART) introduction
- B. Decision Tree concepts
- C. Pruning trees
- D. Gini index
- E. Bias Variance Tradeoff
- F. Random Forest concepts
- G. Random Forests features and examples
- H. Labs:
- I. Predicting loan defaults
- J. Estimating election contributions

X. Classification: Naive Bayes
- A. Naive Bayes theory
- B. Running Naive Bayes algorithm
- C. Evaluating model performance
- D. Lab
- E. Spam filtering

XI. Unsupervised Algorithms
- A. Overview of unsupervised algorithms
- B. Supervised vs. unsupervised
- C. Understanding unsupervised algorithms

Course Outline (cont'd)

XII. Unsupervised: Clustering: K-Means

A. Theory behind K-Means
B. Running K-Means algorithm
C. Estimating the performance
D. Labs:
E. Predicting Uber demand
F. Clustering shopping trips

XIII. Unsupervised: Principal Component Analysis (PCA)

A. Understanding dimensions
B. Curse of dimensionality'
C. Reducing dimensions
D. Overview of Principal Component Analysis (PCA)
E. Eigenvectors and values
F. Implementing PCA algorithm
G. Labs:
H. Predicting wine quality
I. Predicting income from census data

XIV. Recommendations

A. Recommendation use cases
B. Recommender systems
C. Collaborative Filtering (CF)
D. Implementing CF algorithm
E. Lab:
F. Movie rating recommendation
G. Songs rating recommendation

XV. Final workshop (time permitting)

A. This is a group workshop
B. Each group will analyze a couple of real-world datasets and run ML algorithms
C. Each group will present their findings to the class