UNIVERSITY of NICOSIA

Course Syllabus

Course Code	Course Title	ECTS Credits
COMP-522	Machine Learning and Data Mining	10
Prerequisites	**Department**	**Semester**
Students are expected to have background knowledge in probability, linear algebra, statistics and algorithms. Students with a strong numerate background should be able to catch up	Computer Science	Fall
Type of Course	**Field**	**Language of Instruction**
Elective	Computer Science	English
Level of Course	**Lecturer(s)**	**Year of Study**
2nd Cycle	Prof. Athena Stassopoulou Dr. Ioannis Katakis	2nd
Mode of Delivery	**Work Placement**	**Corequisites**
Face-to-face	N/A	None

Course Objectives:

Machine Learning is concerned with computer programs that automatically improve their performance through experience (e.g., programs that learn to identify fraudulent credit card transactions, recommend music and movies, categorize news articles based on the topic, etc). Data mining is the process of automatically discovering information from large data sets. This course covers the theory and practical algorithms for machine learning and data mining such as: classification, decision trees, Bayesian networks, neural networks, support vector machines, clustering. Emphasis will be given to recent applications of Machine Learning to Data Mining and text and web data processing.

Learning Outcomes:

After completion of the course students are expected to be able to:

- demonstrate an understanding of the various machine learning algorithms used for

classification and prediction.
- analyze a machine learning problem and evaluate the likely effectiveness of different learning methods on that problem
- evaluate models/algorithms with respect their accuracy
- deal with data related issues that need to be addressed for successful data mining to be carried out
- implement a machine learning method and apply that method to a problem
- be familiar with cutting edge concepts and applications of machine learning and data mining like Deep Learning, Fraud Detection, Sentiment Analysis

Course Content:

1. Introduction to Machine Learning and Data Mining: Definitions, overview of various topics, examples.
2. Data: Types of data, data preprocessing.
3. Classification: Basic Concepts
4. Decision Tree Classifiers: How the tree works, building the decision tree, measures for selecting best split, algorithm for Decision Tree Induction.
5. Bayesian classifiers: using Bayes Theorem for classification, Naïve Bayes Classifier, Bayesian Networks.
6. Artificial Neural Networks (ANN): Perceptron, Multilayer ANN, Deep Learning
7. Rule-based classifiers, nearest-neighbor classifiers, Support Vector Machines, Ensemble methods
8. Evaluating Classifiers: Metrics, ROC curves, class imbalance problem
9. Cluster Analysis: Basic concepts and algorithms (K-means, DBSCAN)
10. Data Mining Applications: Mining social networks, mining text and web data, fraud detection, anomaly detection, sentiment analysis.

Learning Activities and Teaching Methods:

Lectures, Practical Exercises and Assignments.

Assessment Methods:

Assignments, Projects, Midterm and Final Exams

Required Textbooks / Readings:

Title	Author(s)	Publisher	Year	ISBN
Introduction to Data Mining	P.N. Tan, M. Steinbach, V. Kumar	Addison Wesley	2006	01321321367

Recommended Textbooks / Readings:

Title	Author(s)	Publisher	Year	ISBN
Data Mining: Practical Machine Learning Tools and Techniques (3rd edition)	I. H. Witten , E. Frank, M. A. Hall	Morgan Kaufmann	2011	0123748569
Machine Learning	Tom Mitchell	McGraw Hill	1997	0071154671
Pattern Recognition and Machine Learning	Christopher Bishop	Springer	2007	0387310738