האוניברסיטה העברית בירושלים
THE HEBREW UNIVERSITY OF JERUSALEM

The Hebrew University of Jerusalem

Syllabus

INTRODUCTION TO MACHINE LEARNING - 67577

Last update 22-10-2017

HU Credits: *5*

Degree/Cycle: *1st degree (Bachelor)*

Responsible Department: *computer sciences*

Academic year: *0*

Semester: *2nd Semester*

Teaching Languages: *Hebrew*

Campus: *E. Safra*

Course/Module Coordinator: *Matan Gavish*

Coordinator Email: *gavish@cs.huji.ac.il*

Coordinator Office Hours: *Wed 12:00-13:00*

Teaching Staff:

Dr. Matan Gavish
Ms. Michal Moshkovitz
Mr. Yoav Wald
Mr. Erez Peterfreund
Mr.

Course/Module description:

This is an introductory course to the field of machine learning. The course will cover the foundations of statistical learning, and the applicability of machine learning to real world problems. In particular, we'll focus on the PAC model, and will address fundamental questions like: What is machine learning? What type of concepts are learnable? How can we learn from data? We will also build a machine learning toolbox and will also cover additional models of learning such as online learning, unsupervised learning, clustering, generative models and parameter estimation. Besides the theoretical foundations, we will cover tools which were found efficient in solving practical problems. In particular: Decision trees, deep learning, SVM and kernel methods, Lasso, Nearest Neighbor, Boosting, PCA, Perceptron, Weighted Majority. The course will include theoretical exercises as well as empirical projects in which we will learn machine learning methods for natural language processing and pattern recognition.

Course/Module aims:

Understand the foundation of learning theory and the major algorithms

Learning outcomes - On successful completion of this module, students should be able to:

define PAC learning.
employ algorithms learnt in class.
choose the appropriate algorithm for a given problem.
prove basic results in the theory of learning.

Attendance requirements(%):

0

Teaching arrangement and method of instruction: lectures, recitations, home exercises

Course/Module Content:

Probability: review
Measure Concentration

Introduction and Gentle Start
A formal Learning Model
PAC Model
Learning Via Uniform Convergence
The Bias-Complexity Tradeoff
No-Free-Lunch
VC-dimension
Linear Predictors
Boosting
SVM
Deep neural networks
Validation
MDL and SRM
Convex Optimization
Convex Learning Problems
Stochastic Gradient Descent
Regularized loss minimization
Ridge Regression
SVM
Kernels
Decision Trees
Nearest Neighbor
Online Learning
Clustering
Dimensionality Reduction
Spectral Clustering
Generative Models

Required Reading:
N.A

Additional Reading Material:
The book:
Understanding Machine learning: From Theory to Algorithms

Course/Module evaluation:
End of year written/oral examination 90 %
Presentation 0 %
Participation in Tutorials 0 %
Project work 0 %
Assignments 10 %
Reports 0 %

Research project 0 %
Quizzes 0 %
Other 0 %

Additional information:
N.A