Date:_May 15,

Bar-Ilan University
אוניברסיטת בר-אילן

Syllabus

Course name: Machine Learning and Neural Networks for Neuroscience

Lecturer Name: Dr. Zvi Roth

Department Name: Brain Research Center

Course No: 27-504-01/02

Course Type:	Lecture
Scope of credits:	2 credit points + 1 credit point training
Year of study:	Graduate students
Semester:	A
Day & Time:	TBA
Reception Time:	___
Lecturer Email:	zviroth@gmail.com
Moodle Site:	TBA

Course description and learning goals

Course Abstract

Machine learning (ML) is a branch of artificial intelligence that enables computers to learn a model given a large amount of data in a way that resembles human learning. Neural networks (NNs) are a type of machine learning model inspired by the structure and function of the neural networks inside the human brain. In recent years, ML and in particular NNs have become very popular in many domains, and have been proved extremely effective in a range of applications, from machine vision and speech recognition to decision making and robotics.

Learning objectives

After completing the course students should understand the mathematical basis of Machine Learning, and be able to apply relevant Machine Learning techniques to real-world problems.

Knowledge

1. Learners will be familiar with core Machine Learning methods.
2. Learners will be able analyze the mathematical basis of different Machine Learning models.
3. Learners will be aware of the pros and cons of various Machine Learning techniques.

Skills

1. Learners will be able to choose appropriate Machine Learning techniques to analyze data.
2. Learners will be able to implement basic Machine Learning models in real-world situations.

Active learning – lessons plan:

You can plan an active learning process for the entire course or listfor each active learning activity lesson in the following table:

Lesson No.	Topic	Active learning	Required reading	Assessment
1	Introduction			
2	Linear regression			

3	Classification, Regularization			
4	Generalized linear models			
5	Generative algorithms, Model evaluation			
6	Decision Trees			
7	Support vector machines			
8	Kernels			
9	Artificial neural networks: Perceptron, MLP, Backpropagation			
10	Unsupervised learning			
11	Autoencoders			
12	Generative adversarial networks			
13	Natural language processing			
14	Review			

(In a course that lasts a whole year, the additional sessions should be added)

* There may be changes in the syllabus depending on learning progress and effectiveness

Final grade

Description of the learning product	Weight in the final score
Final project	Will account for 45% of the final grade
Home assignments	30% of final grade
Midterm exam	25% of final grade

Course requirements

Students must submit 80% of home assignments, and the final project.

Prerequisites

- Mathematics: Probability and statistics, Linear Algebra, Calculus.
- Fluency in a programming language preferably Python.

Bibliography: Up-to-date reading, viewing, and listening content items

- Machine Learning and Pattern recognition, C. Bishop (2006)
- Deep Learning, I. Goodfellow and Y. Bengio (2015)
- The Elements of Statistical Learning, T. Hastie et al. (2001)