

**School:** Efi Arazi School of Computer Science B.Sc

## Machine Learning from Data

**Lecturer:**

Prof. Arik Shamir    arik@idc.ac.il

**Tutors:**

Mr. Yinnon Meshi    yinnon.meshi@post.idc.ac.il

Mr. Yarden Rachamim    yarden.rachamim@post.idc.ac.il

**Teaching Assistant:**

Mr. Ben Galili    ben.galili@post.idc.ac.il

---

Course No.:	Course Type :	Weekly Hours :	Credit:
3141	Lecture	4	4

Course Requirements :	Group Code :	Language:
Final Exam	222314101	Hebrew

**Prerequisites**

**Equivalent:**

53 - Calculus II

**Prerequisite:**

52 - Calculus I  
53 - Calculus II  
54 - Linear Algebra I  
55 - Linear Algebra II  
77 - Algorithms  
109 - Introduction To Probability

**Students who took one of the courses listed below will not be allowed to register to the course Machine Learning from Data (3141):**

3566 - Introduction to Machine Learning

---

## Course Description

An introductory level machine learning course. We will present the main principles of data-driven learning algorithms. We will provide the theoretical basis for learning algorithms and learn about pros and cons of different approaches, from both a mathematical and a practical point of view.

Students will implement and use algorithms and will practice their application in real life data contexts. Homework and examples will be based on python code developed by the students as well as, in special cases, on using python/sklearn packages.

Subjects covered include:

1. Linear models: regression, logistic regression, feature selection
  2. Decision trees , including different approaches to splitting nodes and pruning techniques
  3. Bayesean learning, including the advantages and disadvantages of naive vs full Bayes approaches
  4. The perceptron - both primal and dual
  5. kNN
  6. Density estimation and EM
  7. SVMs, including hinge/slack variables and how they affect results
  8. Unsupervised learning - clustering techniques
  9. PAC learning and sample complexity
  10. VC dimension
  11. Statistical estimates of error rates
- 

## Course Goals

Algorithms and examples will be discussed and analyzed.

Homework assignments will include practical tasks and the development of python methods and classes to address specific learning tasks.

Successful students will have knowledge of several important machine learning algorithms.

They will have experience in applying these methods in simple datasets and learning tasks and in the process of evaluating and criticizing the results.

---

## Grading

$0.5 \cdot \text{HW} + 0.5 \cdot \text{Exam}$ .

Must pass exam as well as the HW.

HW assignments are in pairs. Only exceptional cases will be considered for submission in singles.

There will be 1 mandatory HW assignment.

The HW grade will be calculated by averaging grades from n-1 submitted assignments.

That is - students can opt not to submit one assignment.

---

## Learning Outcomes

Successful students will have knowledge of several important machine learning algorithms and experience in applying them in simple datasets and learning tasks.

Successful students will have experience in working with python and sklearn

---

## Lecturer Office Hours

Prof. Zohar Yakhini , Arazi C123

Prof. Ariel Shamir Arazi C115

---

## Teaching Assistant

Ben Galili, Yinnon Meshi, Shuly Finley, Yarden Rachamim, Saar Buchnik

Contact details will be included in the slides for the first class

---

## Reading List

1. Duda, Hart and Stork: Pattern Classification
2. Mitchel: Machine Learning
3. Bishop: Pattern Recognition and Machine Learning
4. James, Witten, Hastie, Tibshirani: An introduction to statistical learning
5. Online courses: Andrew Ng, Pedro Domingos