האוניברסיטה העברית בירושלים
THE HEBREW UNIVERSITY OF JERUSALEM

The Hebrew University of Jerusalem

Syllabus

Advanced Course in Machine Learning - 67912

Last update 18-09-2024

HU Credits: *4*

Degree/Cycle: *2nd degree (Master)*

Responsible Department: *Computer Sciences*

Academic year: *0*

Semester: *2nd Semester*

Teaching Languages: *English and Hebrew*

Campus: *E. Safra*

Course/Module Coordinator: *Dr. Yedid Hoshen*

Coordinator Email: *yedid.hoshen@mail.huji.ac.il*

Coordinator Office Hours: *TBD*

Teaching Staff:

Prof. Yedid Hoshen

Course/Module description:

The course will teach the core machine learning principles behind some of the most exciting recent progress in AI e.g. Text-to-Image, ChatGPT. While specific deep learning technologies change constantly, the core ML principles change much more slowly making their study very profitable. The course will give students an understanding of the principles, as well as the exciting recent applications. It will provide both the mathematical formalism and the intuition for the principles. The course will also develop practical understanding through two practical exercises.

For completing the exercises in the course, students are required to purchase a subscription for one month for Google Colab Pro, which is current 10$ a month. Student who require financial assistance can apply for it.

Course/Module aims:

This course will give the student an in-depth understanding of the core principles the lead the latest research and development in machine learning. The course will give the student experience in formulating and solving new problems with advance machine learning methods.

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

Ability to convert real world tasks into machine learning problems.
Deep understanding of the principles at the core of advanced machine learning methods.
Experience in implementing advanced machine learning methods in code.

Attendance requirements(%):

0

Teaching arrangement and method of instruction: Lecture, 3 Exercises, Exam

Course/Module Content:

Deep supervised learning (a unifying framework for ResNet and Transformers) PyTorch
Generative models: autoregressive, variational inference, score/diffusion, distributional distance (integral probability metrics, GANs)
Representation learning - fully supervised, self-supervised (augmentation and multi-

modal based), compositionality, disentanglement (ICA and non-linear)
Self-supervised applications - retrieval, advanced clustering, anomaly detection, domain translation, source separation
Learning with limited supervision - semi-supervised learning, domain generalization and adaptation
Explainability
Learning in unstructured modalities: graphs, time series, tabular data.

Required Reading:
None

Additional Reading Material:

Grading Scheme:
Written / Oral / Practical Exam 75 %
Submission assignments during the semester: Exercises / Essays / Audits / Reports / Forum / Simulation / others 25 %

Additional information:
The evaluation will consist of a research project (75%) and quizes (25%). A small bonus will be awarded for attendance above the basic requirement.