

Course Number: 286.4112

Spring Semester (B), 2022, Wednesdays, 14:15-17:45

Course Syllabus: Applied ML for Healthcare

Lecturer:

Ortal Dayan, ort.dayan@gmail.com

Prerequisites:

Basic Python

Target Audience:

Biostatistics MPH program students

Course Objectives & Learning Outcomes:

The course provides a detailed guide on how to complete Machine Learning Projects End to End using Classical Machine Learning algorithms and Neural Networks for making predictions using tabular data and with the Python libraries Scikit-Learn and Keras. In addition, we will review NLP methodologies for entity recognition. Students will gain a good understanding of the theory behind ML algorithms and the methodologies for completing an end to end data science project using Python.

Course Structure:

Each session will comprise 4 hours of lectures in which we will look under the hood of ML algorithms, learn about the steps in the workflow of ML projects and how to implement these in Python by studying Python programming concepts for ML and reviewing code implementations.

Methodology:

Revision of the topics covered in class and gaining practical experience in data science by completing an end to end research project in applied ML

Course Assessment:

Compulsory attendance in 80% of meetings

Passing Grade: 60

100% of the course grade will be based on completing a Data Science research project using EHR data in a team

Course Content:

Lesson	Topics	Subtopics
1	Intro to ML with emphasis on applications in healthcare	<ul style="list-style-type: none"> - What is ML and why to use it - Types of ML with examples from healthcare - Main Challenges of Training Data (Non representative data, underfitting/overfitting, hyperparameter tuning)
2	Review of Python for ML	<ul style="list-style-type: none"> - OOP in Python for ML - Python Libraries: Numpy, Pandas, Scikit-Learn - Python Libraries: Matplotlib and Seaborn
3	ML project workflow part 1	<ul style="list-style-type: none"> - Tidy data requirements - EDA
4	ML project workflow part 2	<ul style="list-style-type: none"> - Data preparation (incl. transformation pipelines) - Training and comparing performance between models - Fine tuning models - Feature importance - Error Analysis - Evaluation on Test Set
5	Classification	<ul style="list-style-type: none"> - Binary, multiclass, multilabel and multipotput - Performance measures - Changing the decision threshold - Upsampling and undersampling - Error Analysis
6	Linear Regression	<ul style="list-style-type: none"> - Linear Regression (Cost Function, Normal equation and Gradient Descent) - Polynomial Regression - Regularized Linear Models: Ridge, Lasso, ElasticNet and Early stopping - Logistic Regression - Softmax Regression



7	Support Vector Machines	- Linear and Non-Linear kernel SVMs for classification and regression
8	Decision Trees & Ensemble Methods	- Classification Decision Trees - Regression Decision Trees - Bagging, Pasting and Boosting - Random Patches and Random Subspaces - Random Forest and Xgboost
9	Dimensionality Reduction	- PCA , IPCA and t-SNE
10	Unsupervised Learning	- The K-means Algorithm and its applications
11	Introduction to Artificial Neural Nets (ANNs)	- Perceptron and Multilayer Perceptron (MLP) - Building NN Models using Keras - Fine Tuning NNs
12	Training Deep Neural Nets	- Vanishing /Exploding gradients - Pre training - Optimizers - Regularization
13	Intro to NLP for Healthcare	- Text preparation - Entity Recognition

Compulsory Literature:

Aurelien Geron. (2019). Hands-On Machine Learning with Scikit-Learn, Keras and Tensorflow, O'reilly Media, Inc.

*סטודנט יקר,

אם יש לך לקות למידה או מוגבלות/בעיה רפואית שעשויה להשפיע על לימודיך, ושבגינה את/ה זקוק/ה להתאמות אנא פנה/י לדיקנאט הסטודנטים למדור נגישות ולקויות למידה:

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לאבחון והתאמות בגין לקות למידה ו/או הפרעת קשב יש לפנות ליה"ל:

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אם יש ברשותך מכתב התאמות מהאוניברסיטה ואת/ה זקוק/ה להנגשה בקורס אנא פנה/י אל"י בשעות הקבלה או במייל בסמוך לתחילת הקורס.

If you have a disability that may affect your studies and for which you may require accommodations, please contact the Accessibility and Learning Disabilities Department at the Dean of Students office

e-mail: LDA@univ.haifa.ac.il Phone number: 04-98249265

Students that receive accommodation letters, and need academic adjustments, please meet with me to discuss the provisions of those accommodations as early in the semester as possible.