

The Hebrew University of Jerusalem

Syllabus

Advanced data analysis II: data vs. theory - 77743

Last update 19-11-2018

<u>HU Credits:</u> 3

Degree/Cycle: 2nd degree (Master)

Responsible Department: Physics

<u>Academic year:</u> 0

Semester: 2nd Semester

<u>Teaching Languages:</u> Hebrew

<u>Campus:</u> E. Safra

<u>Course/Module Coordinator:</u> Prof Yehuda Hoffman

Coordinator Email: hoffman@huji.ac.il

<u>Coordinator Office Hours:</u> upon appointment

Teaching Staff:

Prof Yehuda Hoffman

Course/Module description:

The course develops advanced methods of analyzing and simulating experimental/observational data. The main focus is on the confrontation of theory with data: parameters estimation, hypothesis testing and Bayesian inference. Inference without theory by machine learning will be introduced

Course/Module aims:

To introduce students to up to date ideas and concepts and expose and train them with state of the art tools of (big) data analysis.

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

Conceptual and practical know-how of big data analysis

Attendance requirements(%):

100

Teaching arrangement and method of instruction: lectures

Course/Module Content:

- 1. Review: statistics and probability
- 2. Frequentist vs. Bayesian analysis
- *3. Fourier analysis: FFT, power spectrum and correlation functions*
- 4. Signal and image processing: filtering and noise reduction
- 5. Random variables and random fields: random and constrained realizations
- 6. Theory vs. data: parameters estimation, Fisher matrix, hypothesis testing
- 7. Bayesian inference in (numerical) practice: Monte Carlo Markov Chains (MCMC)

8. Inference without theory: artificial neural networks (also known as machine learning)

<u>Required Reading:</u> None

<u>Additional Reading Material:</u> None <u>Course/Module evaluation:</u> End of year written/oral examination 0 % Presentation 0 % Participation in Tutorials 0 % Project work 75 % Assignments 25 % Reports 0 % Research project 0 % Quizzes 0 % Other 0 %

<u>Additional information:</u> prerequisite: advanced data analysis (77742)