1. Course name and code: Mesterséges intelligencia és gépi tanulás módszertana

2. Programme name/ level of training	**3. Language of instruction:** English
4. Course classification:	**5. Assessment:**
6. Number of lessons per week: 1	**7. ECTS:**
8. Fall / Spring	**9. Programme:**

10. Pre-requirements:

11. Department in charge of the course:

12. Person in charge of the course:

13. Instructor of the course: Chen Chaoyi

14. Course description

The course introduces the basic ideas underlying the group of statistical estimators often referred to as "machine learning" (ML) methods. We will begin with review of the standard linear model and a least square method and then extend to a more flexible model (e.g., incorporating the structural break). We will discuss the curse of dimensionality and study some approaches to reduce dimension. Though the course focuses on theory, there will be seminars discussing some applications.

Aims and content of the course:

Session 1: Review and introduction
a). The linear regression model and conditional mean function.
b). The structural break model and the autoregressive regression model and the threshold models
c). Quantile regression
d). Traditional local averaging estimators (nearest neighbor, kernel-based)
e). The curse of dimensionality.

Session 2: Dimension reduction
a). Penalized regression: RIDGE
b). Penalized regression: LASSO
c). Regularization and bias-variance trade-off
d). Principal components

Session 3: Machine Learning
a). Unsupervised vs. supervised learning
b). Introduction to Neural Networks, Deep Learning, and Classification.

Professional competencies to be acquired (knowledge, skills, attitude, autonomy and responsibility)

Knowledge: Understand the traditional nonparametric regression methods and their limitation (curse of dimensionality), know how regularization deals with the bias-variance trade-off

Skills: Students will be able to apply appropriate empirical methods on real applications.

Attitude: Apply an evidence and data-based approach to knowledge and understanding.

Autonomy: Do individual literature review and perform independent analysis

13. Requirements:

Points	Grade
86-100	5

76-85	4
61-75	3
50-60	2
0-49	1

Semester requirements:

14. Auxiliary materials, tools required:

15. Compulsory and recommended reading list:

Compulsory:

A list with references to journal articles will be distributed at the beginning of the course, along with corresponding textbook chapters if necessary. Lecture slides will be provided, and students are expected to familiarize themselves with those materials.

Recommended:

Mullainathan, S. and J. Spiess (2017): "Machine Learning: An Applied Econometric Approach," Journal of Economic Perspectives, 31, pp. 87-106.

James, G., D. Witten, T. Hastie, R. Tibshirani: An Introduction to Statistical Learning. Springer. A very accessible introduction to machine learning methods.