Libera Università Internazionale
degli Studi Sociali Guido Carli

LUISS

Syllabus

Academic Year	2026/2027
Program	Data Science and Management
Course	Statistical Learning
Term	I semester
Year	2
SSD	SECS-S/01
Credits	6

INSTRUCTIONAL GOALS	The course provides an advanced treatment of statistical learning methods for regression and classification, with an emphasis on flexible modeling of complex data. The focus is on nonparametric approaches, kernel-based methods, Gaussian processes, and Reproducing Kernel Hilbert Spaces (RKHS). Particular attention is devoted to interpretation, theoretical foundations, and applications to problems arising in business, economics, and management.
INTENDED LEARNING OUTCOMES They describe what a learner is expected to know, understand and be able to demonstrate after completion of a learning path.	**Knowledge and understanding**: Students will acquire an in-depth understanding of modern statistical learning techniques for supervised learning. In particular, they will understand the theoretical principles underlying nonparametric regression and classification, kernel methods, Gaussian processes, and regularization in high-dimensional settings. The strengths, limitations, and appropriate use cases of each method will be discussed. **Applying knowledge and understanding**: On successful completion of this course, students will be able to: • Apply advanced regression and classification methods to complex and high-dimensional datasets. • Select appropriate kernel functions and regularization strategies for specific learning tasks. • Implement and interpret kernel-based models and Gaussian process models in practical applications. • Evaluate model performance using appropriate validation and model selection techniques. **Making judgements**: Students will be able to critically assess the suitability of different statistical learning methods given the structure of the data, modeling goals, and computational constraints. They will be able to balance flexibility, interpretability, and predictive performance, and to justify modeling choices in applied settings. **Communication skills:** Students will develop the ability to clearly communicate advanced statistical learning concepts and results, both orally and in written form.

	Emphasis will be placed on explaining modeling assumptions, methodological choices, and empirical findings to a non-technical audience when appropriate. **Learning skills:** The course will enable students to independently deepen their knowledge of statistical learning methods and to adapt learned techniques to new problems and application domains.
Pre-requisites	Solid knowledge of linear and logistic regression, basic statistical inference, and probability theory is required. Familiarity with R or Python is expected.
Course content	• Review of supervised learning and model assessment • Bias–variance trade-off and regularization • Nonparametric regression and classification • Kernel methods and kernel ridge regression • Support Vector Machines • Reproducing Kernel Hilbert Spaces (RKHS) • Gaussian processes for regression and classification • Model selection and hyperparameter tuning • Applications to business, economics, and management data
Reference Books	• Hastie T., Tibshirani R., Friedman J. (2009). ***The Elements of Statistical Learning***. 2nd Ed. Springer. [**main**] • Rasmussen C. E., Williams C. K. I. (2006). ***Gaussian Processes for Machine Learning***. MIT Press. • Schölkopf B., Smola A. (2002). ***Learning with Kernels***. MIT Press. • Bishop C. (2006). ***Pattern Recognition and Machine Learning***. Springer. • James G., Witten D., Hastie T., Tibshirani R. (2021). ***An Introduction to Statistical Learning***. 2nd Ed. Springer.
Teaching Methods	• Lectures • Lab sessions • Group project
Assessment	• Group project (1/3 • Written final exam (2/3).