

Syllabus

Course Description

Course Title	Machine Learning for Econometric Applications
Course Code	29123
Course Title Additional	
Scientific-Disciplinary Sector	NN
Language	English
Degree Course	PhD Programme in Economics and Finance
Other Degree Courses (Loaned)	
Lecturers	Prof. Davide Ferrari, Davide.Ferrari2@unibz.it https://www.unibz.it/en/faculties/economics-management/academic-staff/person/39001
Teaching Assistant	
Semester	First semester
Course Year/s	2026/27
CP	2
Teaching Hours	10
Lab Hours	0
Individual Study Hours	0
Planned Office Hours	0
Contents Summary	The course begins with the foundations of machine learning in economics, proceeds to modern statistical learning methods for high-dimensional and nonlinear models, and concludes with applied case studies in causal inference, forecasting, and text analysis. Practical implementation will be carried out in R
Course Topics	Part 1: Introduction to machine learning for economists (3 hours): Statistical tools for high-dimensional problems, causal inference framework, post-selection inference. Part 2: High-dimensional econometrics (4 hours): Endogeneity in high dimensions and sparse IV methods;

	extensions to complex models, inference on heterogeneous treatment effects, optimal policy learning with machine learning estimators. Part 3: Applications (3 hours): Synthetic control for policy evaluation; forecasting in high-dimensional macroeconomic and financial settings; text analysis in economics, from bag-of-words to embeddings and modern language models
Keywords	High-Dimensional Statistics; Econometric; Causal Machine Learning; Sparse Estimation; Post-Selection Inference
Recommended Prerequisites	
Propaedeutic Courses	
Teaching Format	Lectures with methodological examples, guided discussion of econometric applications, and short hands-on demonstrations using the statistical software R.
Mandatory Attendance	Required
Specific Educational Objectives and Learning Outcomes	The courses aim to train researchers with strong quantitative and theoretical skills, capable of analyzing economic and financial phenomena. Candidates' dissertations are expected to adhere to the highest standards of scientific rigor and to demonstrate innovative features that make them suitable for publication in leading international peer-reviewed journals. The programme therefore seeks to contribute to the international scientific debate in economics and finance. To this end, candidates will be encouraged to employ state-of-the-art methodologies and to adopt a multidisciplinary approach. The advanced training provided by the programme, together with the research methods required to complete the dissertation, prepares candidates both for an academic career and for high-level professional positions involving policy analysis and policymaking.
Specific Educational Objectives and Learning Outcomes (additional info.)	Upon completion of this course, students should be able to: • Understand the role of machine learning in modern econometrics and distinguish between predictive and causal approaches. • Apply high-dimensional regression, variable selection, and nonlinear ML methods to economic data. • Conduct valid inference and policy evaluation in high-dimensional

	settings, including causal and heterogeneous treatment effects. • Implement methods in R and interpret empirical results from macroeconomics, finance, and text-based applications.
Assessment	- Written Assignments (2 short problem sets after Modules 1 and 3): 40% - Written Project (empirical application after Module 3): 50% - Active Participation: 10%
Evaluation Criteria	The two written assignments will be evaluated on the basis of the correctness of the proposed solutions, the rigor of the analytical reasoning, the appropriate use of methods, and the clarity with which results are explained and interpreted. The written project will consist of an empirical application of one or more methods covered in the course. It will be assessed according to the relevance and appropriateness of the chosen methodology, the quality of the empirical implementation, the interpretation of the results, and the student's ability to discuss the advantages and limitations of the adopted approach. Particular attention will be given to the coherence of the research question, the transparency of the analysis, and the overall clarity and organization of the written report. Active participation, will be evaluated on the basis of students' engagement during lectures and applied sessions. This includes attendance, contributions to class discussions, participation in practical exercises, and the ability to critically engage with methodological and empirical issues discussed during the course.
Required Readings	• Gaillac, C., & L'Hour, J. (2025). Machine Learning for Econometrics. Oxford University Press.
Supplementary Readings	
Further Information	
Sustainable Development Goals (SDGs)	No poverty, Partnerships for the goals, Good health and well-being, Quality education, Gender equality, Clean water and sanitation, Affordable and clean energy, Decent work and economic growth, Industry, innovation and infrastructure, Reduced inequalities, Sustainable cities and communities, Responsible consumption and production, Climate action, Life below water, Life on land, Peace, justice and strong institutions, Zero hunger