Syllabus

Course Description

Course Title	Statistical Methods for Business Analysis
Course Code	25559
Course Title Additional	
Scientific-Disciplinary Sector	STAT-01/A
Language	English
Degree Course	Master in Entrepreneurship and Innovation
Other Degree Courses (Loaned)	
Lecturers	Prof. Alessandro Casa, Alessandro.Casa@unibz.it https://www.unibz.it/en/faculties/economics-management/academic-staff/person/46549 dr. Giulia Bertagnolli, Giulia.Bertagnolli@unibz.it https://www.unibz.it/en/faculties/economics-management/academic-staff/person/49312
Teaching Assistant	
Semester	Second semester
Course Year/s	1
CP	6
Teaching Hours	36
Lab Hours	18
Individual Study Hours	-
Planned Office Hours	18
Contents Summary	This course begins with a review of key principles of statistical inference and then introduces core concepts in statistical learning. Topics include linear regression and its extensions, advanced regression techniques such as decision trees, logistic regression, classification methods, model selection strategies, and unsupervised learning approaches like principal component analysis and clustering. Throughout the course, students will work hands-

	on in R, applying techniques to real-world datasets drawn from business scenarios. By the end, students will be able to choose suitable statistical models, apply them to a range of business problems, and effectively communicate their analytical insights.
Course Topics	- Review of statistical inference: random variables, confidence intervals, and hypothesis testing. - Introduction to statistical learning concepts: basic vocabulary and notions, parametric and nonparametric approaches, predictive and inferential objectives, bias-variance trade off, supervised and unsupervised learning - Linear regression and extensions: simple and multiple linear regression, model estimation and assessment, model assumptions, inferential tools, qualitative predictors, interaction effects, polynomial regression, basic notions on nonparametric regression - Classification: introduction to classification, logistic regression, model estimation, evaluation of classifiers - Other supervised learning techniques: trees, splines, additive models - Model selection/assessment and evaluation of model complexity: resampling methods, cross-validation and information criteria - Unsupervised learning: clustering tools such as k-means and hierarchical clustering, principal component analysis - Applications with the R software
Keywords	statistical learning, regression, classification, clustering, dimensionality reduction, model selection
Recommended Prerequisites	No formal prerequisites are required. Nonetheless, knowledge of basic concepts in descriptive and inferential statistics is useful, and attending a pre-course in mathematics/statistics is recommended.
Propaedeutic Courses	
Teaching Format	In-person lectures and computer labs. Whenever possible, lectures will be structured to prioritize in-class time for discussions, and practical applications.
Mandatory Attendance	
Specific Educational Objectives and Learning Outcomes	INTENDED LEARNING OUTCOMES (ILO) ILO 1: KNOWLEDGE AND UNDERSTANDING ILO 1.a The student acquires advanced knowledge and understanding of

	the theories and tools for the economic analysis of business decisions; ILO 1.b The student acquires knowledge and understanding of the theories and tools of statistical analysis for making market forecasts; ILO 1.c The student acquires advanced knowledge and understanding of business analysis tools and solutions for the development of innovations and organisational knowledge; ILO 1.d The student acquires knowledge of quantitative models for the formulation of forecasts necessary to guide management decisions and to predict the life cycle of a product and a sector. ILO2: ABILITY TO APPLY KNOWLEDGE AND UNDERSTANDING ILO 2.a Ability to acquire and select information that may be relevant from an entrepreneurial point of view, also in economic-productive contexts different from those studied; ILO 2.b Ability to select business economics models, suitable for the appropriate analysis of a specific economic-social and productive context; ILO 3: AUTONOMY OF JUDGEMENT ILO 3.a Acquire the ability to make predictions, such as analysing the future consequences of entrepreneurial, managerial and operational choice; ILO 3.b Autonomy of judgement is developed in the training activities carried out for the preparation of the thesis, as well as in the exercises that accompany the lectures and that involve group discussions and the comparison of individual analyses carried out by students in preparation for the lecture. ILO 4: COMMUNICATION SKILLS ILO 4.a Acquire the ability to describe and communicate in an intercultural context, in a clear and precise manner, problematic situations

	typical of the management of a new enterprise and the development of innovation, such as, for example, the conditions for the validation of a problem or solution, the prospects and risks associated with a business model or an innovation project. The development of communication competences assumes heterogeneous situations such as, for example, the presence of internal stakeholders (e.g. colleagues, managers, owners), or external stakeholders (e.g. potential investors, suppliers and other business partners) and the ability to sustain an adversarial process; ILO 4.b The achievement of these objectives is assessed in the course of the training activities already mentioned, as well as in the discussion of the final thesis. ILO 5: LEARNING SKILLS ILO 5.a Acquire the ability to study independently, to prepare summaries; ILO 5.b Acquire the ability to identify thematic connections and to establish relationships between different cases and contexts of analysis; ILO 5.c Acquire the ability to frame a new problem systematically and to generate appropriate taxonomie; ILO 5.d Acquire the ability to develop general models from the phenomena studied.
Specific Educational Objectives and Learning Outcomes (additional info.)	
Assessment	Assessment (for both attending and non-attending students): - Written Exam: Exercises and review questions (65% of the final grade) (ILOs 1.e, 1.g, 1.h, 3.a, 3.b, 5.a, 5.b). - Data Analysis Project: Group project in which students select and analyze an interesting dataset using the tools learned in the course. Groups will present their work at the end of the course (35% of the final grade; optional) (ILOs 2.a, 2.c, 4,a, 5.c, 5.d). Notes: - For students who do not complete the project, the written exam

	will count for 100% of the final grade. - Project grades remain valid for one academic year.
Evaluation Criteria	Written exam: understanding of statistical concepts, correct interpretation of results of statistical analyses, clarity and precision of explanations. Data Analysis Project: Quality and clarity of the presentation, adequacy and appropriateness of analyses with respect to dataset characteristics
Required Readings	James, G., Witten, D., Hastie, T., Tibshirani, R. An Introduction to Statistical Learning with Applications in R. Springer, 2013. Freely available at http://www- bcf.usc.edu/~gareth/ISL/ Slides and lecture notes provided
Supplementary Readings	Bishop, C. M. (2006). *Pattern recognition and machine learning*. New York: Springer. Agresti, A., Finlay, B. Statistica per le scienze sociali, Pearson, 2009. Hyndman, R.J. and Athanasopoulos, G. Forecasting: principles and practice, 2nd edition, OTexts: Melbourne, 2018. Cicchitelli, Giuseppe. Statistica. Principi e metodi. Pearson, 2008. Azzalini, Adelchi, and Bruno Scarpa. Data analysis and data mining: An introduction. OUP USA, 2012. Grigoletto, Matteo, Laura Ventura, and Francesco Pauli. Modello lineare: teoria e applicazioni con R. G Giappichelli Editore, 2017. Johnson, Richard A., and Dean W. Wichern. "Applied multivariate statistical analysis." New Jersey 405 (1992).

Further Information	
Sustainable Development Goals (SDGs)	Good health and well-being, Climate action, Reduced inequalities, Decent work and economic growth