



SCHEDA DELL'INSEGNAMENTO (SI)

" STATISTICAL LEARNING FOR INDUSTRIAL ENGINEERING "

SSD SEC-S/02

DENOMINAZIONE DEL CORSO DI STUDI: INGEGNERIA MECCANICA PER LA PROGETTAZIONE E LA PRODUZIONE

ANNO ACCADEMICO 2022 - 2023

INFORMAZIONI GENERALI - DOCENTE

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INFORMAZIONI GENERALI - ATTIVITÀ

ANNO DI CORSO: I o II

PERIODO DI SVOLGIMENTO, SEMESTRE: I

CFU: 6

INSEGNAMENTI PROPEDEUTICI (se previsti dal Regolamento del CdS)

Statistica per la Tecnologia

EVENTUALI PREREQUISITI

OBIETTIVI FORMATIVI

Problem-based learning course whose aim is to train students on the application (illustrated through open-source statistical software R) of interpretable statistical learning techniques for industrial engineering, possibly scalable up to big data frameworks. Every student should choose a data analysis project gathered along the course by experts in industrial engineering fields and develop it by working in a team. Students will have the opportunity to improve their ability to recognize and implement the most suitable statistical learning technique for the problem at hand as well as communicate the results and impact of their analysis also to non-statisticians.

RISULTATI DI APPRENDIMENTO ATTESI (DESCRITTORI DI DUBLINO)

Conoscenza e capacità di comprensione

Students will have the opportunity to improve their ability to recognize and implement the most suitable statistical learning technique for the engineering problem at hand.

Capacità di applicare conoscenza e comprensione

Students will be able to work in a team, to get the skills for the decision-making developing a real-case data analysis project as well as communicate the results and impact of their analysis.

PROGRAMMA-SYLLABUS

Overview and Course Objectives. *What Is Statistical Learning. Supervised Versus Unsupervised Learning. Importance of interpretable statistical Learning. Statistical Process Monitoring and Control.*

Elements of Unsupervised Learning. *Principal Component analysis. Clustering Methods.*

Elements of supervised learning. *Multivariate Linear Regression models. Least Squares Estimation. Inferences About the Regression Model. Cross-Validation. Linear Model Selection and Regularization. Best Subset Selection. Stepwise Selection. Choosing the Optimal Model. Shrinkage Methods. Ridge Regression. The Lasso. Selecting the Tuning Parameter. Dimension Reduction Methods. Principal Components Regression. Partial Least Squares. Considerations in High Dimensions. An Overview of Classification methods.*

Engineering Approach to Modern Process Monitoring and Control. *The multivariate quality-control problem. The Hotelling control chart. Regression adjustment. Interpretation of out-of-control signals. Latent structure methods.*

Beyond multivariate data analysis. *Introduction to functional data analysis. Statistical monitoring of functional data. Engineering examples through software environment.*

MATERIALE DIDATTICO

Johnson, R.A., Wichern, D.W. (2007) Applied Multivariate Statistical Analysis (6th edition), Prentice Hall, Upper Saddle River.

Montgomery, D. C. (2014) Introduction to Statistical Quality Control. 7th edition. John Wiley & Sons.

James, G., Witten, D., Hastie, T., Tibshirani, R. (2013) An introduction to statistical learning. New York: Springer.

MOOC Industry 4.0 Big Data e Data Analytics III - a cura di B. Palumbo e M. L. Chiusano (2019)
<https://landing.federica.eu/industria40/>

Lepore, A., Palumbo, B., Sansone, C. (2021). *Machine Learning e Data Mining in R*. Coursera - Federica Web Learning. Università degli Studi di Napoli Federico II. <https://www.coursera.org/learn/machine-learning-data-mining-con-r>

MODALITÀ DI SVOLGIMENTO DELL'INSEGNAMENTO

Problem-based learning. Flipped classroom. Lectures. Lab Sessions and Seminars. Peer-grading. Team work. Interactive and anonymous quiz games.

VERIFICA DI APPRENDIMENTO E CRITERI DI VALUTAZIONE

a) Modalità di esame:

L'esame si articola in prova	
scritta e orale	X
solo scritta	
solo orale	
discussione di elaborato progettuale	X
Altro	

Per la prova scritta i quesiti sono	A risposta multipla	X
	A risposta libera	
	Esercizi numerici	X

b) Modalità di valutazione:

The final grade is formulated by the Examination Committee according to the scores achieved by the student in the peer-graded project discussion, the written exam, and the successive discussion during the oral exam. The final evaluation is discussed and highlighted to each student.