

COMPUTER ENGINEERING (LM55)

(Lecce - Università degli Studi)

Insegnamento ESTIMATION AND DATA ANALYSIS WITH APPLICATIONS

GenCod A004569

Insegnamento ESTIMATION AND DATA ANALYSIS WITH APPLICATIONS

Insegnamento in inglese ESTIMATION AND DATA ANALYSIS WITH

Settore disciplinare ING-INF/04

Corso di studi di riferimento COMPUTER ENGINEERING

Tipo corso di studi Laurea Magistrale

Crediti 9.0

Ripartizione oraria Ore Attività frontale: 81.0

Per immatricolati nel 2019/2020

Erogato nel 2020/2021

Anno di corso 2

Lingua INGLESE

Percorso PERCORSO COMUNE

Docente DANIELA DE PALMA

Sede Lecce

Periodo Secondo Semestre

Tipo esame Orale

Valutazione Voto Finale

Orario dell'insegnamento

<https://easyroom.unisalento.it/Orario>

BREVE DESCRIZIONE DEL CORSO

This course offers a broad overview of fundamental and emerging topics in the area of estimation theory and data analysis; furthermore, a set of applications are illustrated in the fields of robotics, multi-agent and cyber-physical systems, and social systems. It is aimed at providing principles and tools to state and solve estimation problems in technological systems, and the solution is numerically sought with the aid of a suitable software (Mathworks Matlab).

PREREQUISITI

Sufficiency in calculus, probability theory, linear algebra.

OBIETTIVI FORMATIVI

Learning Outcomes. After the course the student should be able to:

(Knowledge and understanding)

Describe and explain the main peculiarities (both advantages and disadvantages) of each mathematical framework for the estimation problems considered in the course.

(Applying knowledge and understanding) + (Communication) + (Making judgements)

Be aware of, describe and explain practical problems of bad data gathering and robustness issues in the framework of estimation theory.

(Applying knowledge and understanding) + (Learning skills)

For a given practical problem at hand, be able to state an estimation problem in a natural mathematical setting, either stochastic or deterministic, based on the problem assumptions.

(Applying knowledge and understanding) + (Communication) + (Making judgements)

Build a simulation framework to find a computer-aided solution of the stated mathematical problem with the use of a suitable software.

METODI DIDATTICI

Frontal lessons and lectures.

MODALITA' D'ESAME

Oral exam and development of a project.

The objective of the exam is to determine to what extent the student has: 1) the ability to identify and use data to formulate responses to well-defined problems, 2) problem solving abilities to seek a solution through an algorithm.

PROGRAMMA ESTESO

Introduction. Mathematical background and connections with other courses.

Set membership estimation: introduction, fundamental results and theorems. Set membership estimation: some applications.

Stochastic Estimators: definitions, properties, performances and fundamental limitations. Foundations of maximum likelihood estimation. The Bayesian approach to the estimation problem. Kalman filter: discrete-time stochastic state models, (two-steps) structure, computation of the optimal gain, the alternative geometric approach. Steady-state behavior. Extended Kalman Filter. Applications of Kalman Filter. Smoothing Algorithms. Robust estimation: introduction, fundamental definitions, estimator classes and performances.

Applications of the previous issues and results to various fields.

TESTI DI RIFERIMENTO

1. Yaakov Bar-Shalom, X. Rong Li, Thiagalingam Kirubarajan "Estimation with Applications to Tracking and Navigation: Theory Algorithms and Software", 2001 John Wiley & Sons, Inc.
2. D. Simon, "Optimal State Estimation: Kalman, H-infinity, and Nonlinear Approaches", John Wiley & Sons, 2006
3. Anderson, Brian D.O., and John B. Moore. "Optimal Filtering", 1979.
4. L. Ljung, "System Identification: Theory for the User", Prentice Hall PTR, Upper Saddle River, NJ, 1999.
5. Rousseeuw PJ, Leroy AM. "Robust Regression and Outlier Detection". John Wiley & Sons: Hoboken, NJ, USA, 2003.
6. Huber PJ, Ronchetti EM. "Robust Statistics" - Second Edition. Wiley: New York, 2009.
7. Milanese, M., Norton, J., Piet-Lahanier, H., Walter, E. (Eds.). (2013). "Bounding approaches to system identification" Springer Science & Business Media.
8. Zaki, Mohammed J., and Wagner Meira Jr. "Data mining and analysis: fundamental concepts and algorithms", Cambridge University Press, 2014.