DIPLOMA SUPPLEMENT ATTACHMENT

POLITECNICO MILANO 1863

Person code: 10659771 | Document ID: 263419/1 | Date of issue: 26/07/2024 | Register number: 0724-0638

1 INFORMATION IDENTIFYING THE HOLDER OF THE QUALIFICATION

1.1 Last name(s)

MORO

1.2 First name(s)

GABRIELE

1.3 Date of birth (dd/mm/yyyy)

08/07/1999

1.4 Student identification number or code (if available)

996398

2 INFORMATION IDENTIFYING THE QUALIFICATION

2.1 Name of the qualification and title conferred (in the original language)

Laurea magistrale in MATHEMATICAL ENGINEERING
Dottore magistrale

2.2 Main field(s) of study for the qualification

Mathematical modelling for engineering (LM-44)
ISCED code: 0788

2.3 Name (in original language) and status of the awarding institution

Politecnico di Milano (Istituzione statale), Piazza Leonardo da Vinci 32, 20133 Milano

Description of curriculum

STOCHASTIC DYNAMICAL MODELS

Code: 054074
Credits: 8.00
Grade: 30
Date: 10/01/2022

Subject groups

MAT/06 PROBABILITY AND STATISTICS

The programme

Discrete time Markov chains. Structure of transition matrices, transient and recurrent states, Perron-Frobenius theorem, convergence towards invariant measures. Discrete time martingales, stopping theorem and applications to Markov chains, maximal inequality, Doob inequality, convergence theorems. Introduction to the general theory of continuous-time stochastic processes. Poisson process, independence of increments, exponential sojourn times. Renewal processes, law of large numbers and central limit theorem. Applications to reliability theory. Continuous time Markov chains, queues, transition rates, sojourn times. Forward and backward Kolmogorov equations. Invariant distributions and ergodic theorem. M/M/1 and M/M/k queues, stationary dynamics. General notion on stochastic processes, Kolmogorov consistency. Markov processes with continuous state space, Harris recurrence.

REAL AND FUNCTIONAL ANALYSIS

Code: 095958
Credits: 8.00
Grade: 19
Date: 17/02/2022

Subject groups

MAT/05 MATHEMATICAL ANALYSIS

The programme

Set theory: basic notions, equivalence and order relations, cardinal and ordinal numbers. Axiom of choice. Topological spaces. Metric spaces. Continuous and semicontinuous functions. Measure space and measurable functions. Positive measures and measurable spaces. Lebesgue measure. Abstract integration. Comparison between Lebesgue and Riemann integrals. Convergences. Derivative of a measure and Radon-Nikodym theorem. Fundamental theorems of Calculus. Product measures and Fubini-Tonelli theorem. Normed and Banach spaces: spaces of integrable functions, linear operators, dual spaces and Hahn-Banach theorem, weak convergences, compact operators. Hilbert spaces: scalar product and its consequences, Riesz representation theorem, orthonormal basis, L^2 space and Fourier series, spectral theorem for compact symmetric operators, Fredholm alternative, unbounded linear operators with dense domain.

MODEL IDENTIFICATION AND DATA ANALYSIS

Code: 096297
Credits: 10.00
Grade: 26
Date: 11/06/2022

Subject groups

ING-INF/04 SYSTEMS AND CONTROL ENGINEERING

The programme

The model-based approach to control systems design calls for an analytical description of the process to be controlled. Usually, the model is worked out by resorting to appropriate correlations or physical laws capturing the relationships among the variables of interest. However, it is a common experience that the obtained model suffers from uncertainty. Identification methods enable to estimate unknown parameters and/or unknown signals, or the complete process model, by squeezing the information hidden in experimental data drawn from measurements of the process variables. A main rationale to evaluate the quality of an estimated model is to assess its predictive capability. This is why prediction theory is an important preliminary step. Among the topics dealt with, Kalman filtering theory, a major engineering achievement, will be thoroughly studied as a tool for the identification of the state of a process from input-output measurements.

INSURANCE & ECONOMETRICS

Code: 055757
Credits: 8.00
Grade: 28
Date: 30/06/2022

Subject groups

SECS-S/06 MATHEMATICAL METHODS OF ECONOMICS, FINANCE AND ACTUARIAL SCIENCES

The programme

The course covers two main topics. The first deals with the insurance market, where some modelization issues that highlight the differences with the banking market are addressed. Details on the Solvency II regulation are presented. Particular attention is given to the pricing of life products and to the definition of reserves. Finally, the main features of non-life insurance are discussed. The second part deals with econometric tools for financial time series modeling. Stationary processes and the Wold theorem are described to pursue ARMA models selection, estimation and forecast. Other topics presented are: unit root processes, vector autoregressive models, cointegration, heteroskedastic (ARCH-GARCH) models, factor models and the principal component approach.

APPLIED STATISTICS

Code:	052498
Credits:	10.00
Grade:	27
Date:	12/07/2022

Subject groups

SECS-S/01 STATISTICS

The programme

Exploring a multivariate dataset: descriptive statistics and graphical displays. The geometry of a multivariate sample. The distance induced by the covariance matrix. Analysis of covariance structure: principal components and dimensional reduction. Inferences about a mean vector: Hotelling T^2 test. Confidence regions and simultaneous comparisons of component means. Multiple comparisons methods. ANOVA and MANOVA. Discrimination, classification, clustering: Statistical classification: model, miscalassification costs and prior probability. Bayesian supervised classification and the Fisher approach to discriminant analysis. Alternative approaches to classification: logistic regression, CART. Similarity measures. Unsupervised classification; hierarchical and nonhierarchical methods. Multidimensional scaling. Functional data Analysis: smoothing and representing functional data. Dimensional reduction: functional principal components. Allignment of functional data: amplitude and phase variability. Registration procedures. Classiffication with functional data. Mixed effects models: introduction to linear and generalized multilevel models. Multivariate logistic regression models for binary data: classification and prediction. Multilevel models for longitudinal data. Growth curves with autocorrelated residuals. Models for multivariate repente measures. Introduction to statistical models for the analysis of spatial data.

BAYESIAN STATISTICS

Code: 052499
Credits: 10.00
Grade: 28
Date: 31/03/2023

Subject groups

MAT/06 PROBABILITY AND STATISTICS, SECS-S/01 STATISTICS

The programme

Basics of Bayesian inference: Bayes's theorem, prior and posterior distribution, predictive distribution, prior elicitation, exchangeability. Simulation methods for Bayesian Statistics, Goodness-of-fit and model choice, linear and generalized linear models, Bayesian survival analysis with censored data, Bayesian nonparametric models, introduction to Bayesian models for longitudinal data, time series and spatial data.

for activities carried out during an international exchange period

At OTTO-VON-GUERICKE-UNIVERSITAT MAGDEBURG - MAGDEBURGO (GERMANIA)

Type of scheme: ERASMUS

Period: from 26/09/2022 to 28/03/2023

Courses:

APPLIED DISCRETE MODELING

BAYES NETWORKS

ARTIFICIAL NEURAL NETWORKS AND DEEP LEARNING

Code: 054307
Credits: 5.00
Grade: 28
Date: 31/03/2023

Subject groups

ING-INF/05 INFORMATION PROCESSING SYSTEMS

The programme

Neural networks are mature, flexible, and powerful non-linear data-driven models that have successfully solved many complex tasks in science and engineering. The advent of the deep learning paradigm, i.e., training (neural) networks to simultaneously learn an optimal data representation and a model solving the requested task, has further boosted neural networks research and development. These models nowadays achieve human-like performance in natural language processing, text modeling, gene expression modeling, and image recognition, to name a few examples. This course provides a broad introduction to artificial neural networks (ANN), starting from the traditional feedforward (FFNN) and recurrent (RNN) neural networks architectures, till the most successful deep-learning models including convolutional neural networks (CNN) and long short-term memories (LSTM). The course aims at providing students with a theoretical background and the practical skills to understand and use ANN and, at the same time, become familiar and with Deep Learning for solving complex engineering problems.

for activities carried out during an international exchange period

At OTTO-VON-GUERICKE-UNIVERSITAT MAGDEBURG - MAGDEBURGO (GERMANIA)

Type of scheme: ERASMUS

Period: from 26/09/2022 to 28/03/2023

Courses:

INTRODUCTION TO DEEP LEARNING

DATA MINING

Code: 056892
Credits: 5.00
Grade: 28
Date: 31/03/2023

Subject groups

ING-INF/05 INFORMATION PROCESSING SYSTEMS

The programme

Machine Learning techniques are very important tools of Data Mining. This course introduces the many relevant algorithms developed in this area that are applied to extract interesting knowledge from data such as decision and regression trees, classification and association rules, clustering, Bayesian networks, etc. The course also illustrates the steps of a typical Data Mining process.

for activities carried out during an international exchange period

At OTTO-VON-GUERICKE-UNIVERSITAT MAGDEBURG - MAGDEBURGO (GERMANIA)

Type of scheme: ERASMUS

Period: from 26/09/2022 to 28/03/2023

Courses:

INTRODUCTION TO DEEP LEARNING

MACHINE LEARNING

Code: 097683
Credits: 5.00
Grade: 27
Date: 31/03/2023

Subject groups

ING-INF/05 INFORMATION PROCESSING SYSTEMS

The programme

The course is an introduction to the area of Artificial Intelligence, know as Machine Learning, that deals with the development of algorithmic techniques to extract knowledge from large amount of data (e.g., retail databases, web logs, etc.). The course focuses mainly on supervised and unsupervised techniques, e.g., decision trees, decision rules, induction of Horn clauses, hierarchical clustering, etc. And it will consider mainly Data Mining applications.

for activities carried out during an international exchange period

At OTTO-VON-GUERICKE-UNIVERSITAT MAGDEBURG - MAGDEBURGO (GERMANIA)

Type of scheme: ERASMUS

Period: from 26/09/2022 to 28/03/2023

Courses:

MACHINE LEARNING

ENERGY AND CLIMATE CHANGE MODELING AND SCENARIOS

Code: 052397
Credits: 8.00
Grade: 27
Date: 07/06/2023

Subject groups

ING-IND/35 BUSINESS AND MANAGEMENT ENGINEERING

The programme

The main objective of the course is to study climate change challenge using quantitative tools. Specifically, the aim is to learn the basic elements of the global energy and climate problems, evaluate the solutions with a focus on the energy sector, and use optimization and simulation models to evaluate the emission reduction and adaptation strategies. To do so, a discussion of the fundamentals of the global economy, energy, land and climate systems will be complemented by development and applications of mathematical models which integrate these key components. The course will also teach programming languages used in energy-climate planning, such as GAMS, R and Python. The course uses innovative teaching methods, in particular it is a flipped classroom course: students will form groups of 4/5 students and work on projects to improve one or more numerical integrated models to deal with climate change solutions, either on mitigation or adaptation.

STATISTICAL LEARNING FOR HEALTHCARE DATA

Code: 056867
Credits: 5.00
Grade: 30
Date: 16/06/2023

Subject groups

ING-INF/06 ELECTRONIC AND INFORMATICS BIOENGINEERING, SECS-S/01 STATISTICS

The programme

Basics of Supervised Learning, Linear Methods for Regression and classification (LASSO, LDA), Model Assessment and Selection, Model inference (Bootstrap and ML methods), depth measures, handling outliers and missing data. Basics of unsupervised learning. Applications to the processing of biomedical data, CinC Challange.

FINTECH

Code: 055643
Credits: 8.00
Grade: 29
Date: 27/06/2023

Subject groups

SECS-S/06 MATHEMATICAL METHODS OF ECONOMICS, FINANCE AND ACTUARIAL SCIENCES

The programme

Lo scopo del corso è fornire agli studenti le principali conoscenze necessarie per governare la rivoluzione "fintech" che sta colpendo le istituzioni finanziarie. Il fintech (tecnologia in finanza) copre molte aree. In particolare, il corso prenderà in esame casi studio relativi a problemi di Machine Learning, applicazioni blockchain, utilizzo di criptovalute e Big Data, sempre con particolare attenzione alla finanza.

ALGORITHMS AND PARALLEL COMPUTING

Code: 052496
Credits: 10.00
Grade: 29
Date: 04/09/2023

Subject groups

ING-INF/05 INFORMATION PROCESSING SYSTEMS

The programme

Data-intensive applications such as data mining, recommender systems, scientific computation, financial modelling and multimedia processing have implications on the design of algorithms and provide a new challenge for the modern generation of computing platforms. Parallel processing is the only cost-effective method for the fast solution of these big-data problems. This course provides the students with all the skills necessary to write efficient algorithms, able to solve large-scale problems on parallel computers.

GAME THEORY

Code: 052503
Credits: 8.00
Grade: 30
Date: 22/01/2024

Subject groups

MAT/05 MATHEMATICAL ANALYSIS

The programme

On the main assumptions of the theory. Interactive decision theory vs classical decision theory. Two famous examples: the bargaining model by Nash and the college admissibility problem. Games in extensive form. Combinatorial games. Zero sum games and Von Neumann theorem. Games and linear programming. The non cooperative model by Nash. Correlated equilibria. Repeated games. The duopoly. Incomplete information games. Cooperative games: definition and examples. Some solution concepts: imputations, core, nucleolus, power indices. Arrow impossibility theorem.

FINAL WORK

Code: 097690
Credits: 12.00
Grade: --
Date: 01/07/2024

Subject groups

Unavailable

The programme

Unavailable