Curriculum vitae

PERSONAL INFORMATION

Lorenzo Vannini

WORK EXPERIENCE

September 2022 – December 2023

Sant'Anna School of Advanced Studies Research Collaborator

Center ICT for Complex Industrial Systems and Processes (ICT-COISP) Scuola Superiore Sant'Anna- TeCIP Institute Via Moruzzi,1, 56124 Pisa, ITALY

I had the opportunity to work with Sant'Anna School of Advanced Studies on an european research project called SMARTER (SteaM and gAs networks Revamping for the sTeElworks of the futuRe),which is cofunded by the European Union through the Research Fund for Coal and Steel. The project aimed at optimising the management and the structure of the steam and gas networks inside integrated steelworks for improving energy efficiency and reducing CO2 emissions as well as energy and management costs. In order to achieve such ambitious aim, our team has developed and implemented advanced control and optimization techniques and Machine Learning-based approaches furthermore we have analysed and modelled the entire system for more effective energy distribution and optimization of the processes.

PROJECTS

July 2022 – July 2022

Firenze Race Team

Via di Santa Marta 50139 Firenze FI

The Control Team has developed an advance control system for an automous vehicle. The objective was to obtain mathematical models and efficient algorithms in order to create a control strategy for the AV, using the state of the art of Control theory, Machine learning and Mathematical optimization.

October 2023-December 2023

Robotics and Automation Project

Via di Santa Marta 50139 Firenze FI

In this project, my colleagues and I have created from scratch a prototype-Segway robot and we have designed and implemented an algorithm that combines the Extended Kalman Filter (for state estimation) and the Linear Quadratic Regulator (for control).

July 2022 – July 2022

Presentation of the Control Algorithms and models

Via di Santa Marta 50139 Firenze FI

In our work we have developed and implemented a mathematical model and a control strategy for the autonomous vehicle and at the end of the project we had to provide a technical documentation where we had to describe as precise as possible our work. I have then created a technical documentation using LATEX, where i have devised a comparative technical analysis between the algorithms and the mathematical models that we have used, describing every single choice made by the team, in order to ensure optimal performances.

June 2023- July 2023

Information Fusion Projects

Via di Santa Marta 50139 Firenze FI

In this project, I dealt with merging the spatial information of various robots in order to obtain a single 2D map through information fusion algorithms. Information-theoretic approach to data fusion is adopted by solving a consensus problem on the Kullback–Leibler average of the local probability density functions. These algorithms allow multi robot teams to efficiently generate the occupancy grid map using a Bayesian approach.

May 2023- June 2023

Machine Learning General Projects

Via di Santa Marta 50139 Firenze FI

I have attended Masters-level course on the Fundamentals of Machine Learning.

The primary learning objective of the course was to provide students with the essential theoretical and practical foundations of machine learning. I had to complete practical Laboratory exercises assigned during the course, in order to boost my understanding of neural networks and Machine Learning algorithms. The projects covered a variety of domains such as: MNIST Handwritten Digit Classification, Sales Prediction, Iris Flowers Classification and so on.

April 2023 – May 2023

Machine Learning techniques for parameter identification of an underwater robot

Via di Santa Marta 50139 Firenze FI

The principal goal of the project is to identify the parameter of an underwater robot using machine learning techniques. Control system design typically needs an accurate model of the system in order to increase performances, by means of several different machine learning techniques i've estimated the parameters of the robot and compared the results in order to find the optimal differential equation describing the system.

June 2022 – July 2022

Tracking of an Aircraft using Kalman Filter

Via di Santa Marta 50139 Firenze FI

During our System Identification course we studied how to estimate the parameters of a non-linear system by using dedicated algorithms such as Extended Kalman Filter, UKF, Particle Filter and Monte-Carlo based algorithms. In this project i had to estimate the position of a 2-D aircraft by using Nonlinear Filtering Theory. The main goal was to track the position of an airplane using only the provided measurements and compare the results with the real values.

June 2019 – June 2019

Python Projects

Via di Santa Marta 50139 Firenze FI

During our "Laboratorio di tecnologia dell'informazione " (Information Technology laboratory) course we have acquired general Python skills.

December 2019 – December 2019

Design of a MOSFET Amplifier

Via di Santa Marta 50139 Firenze FI

During our "Elettronica generale" course (Fundamental of Electronics) i have designed 3 Mosfet Amplifier using the 3 basic configurations: common-source, common-gate, and common-drain in the LTSPICE environment. Each of these configurations exhibit certain characteristics that make them more desirable in certain circuit applications than the others.

PUBLICATIONS

2023 "A Decision Support System for Off-Gas and Steam Optimal Management in Integrated Steelworks"

Publication Title: 2023 12th International Conference on Control, Automation and Information Sciences (ICCAIS)

Author(s): Dr. Stefano Dettori, Dr. Ismael Matino, Dr. Ruben Matino, Mr. Angelo Castellano, Mrs. Valentina Colla, Mr. **Lorenzo Vannini**, Dr. Andreas Wolff, Mr. Dustin Schroeder and Mr. Valentin Baric. (In press).

2023 “Smart revamping of gas and steam networks for the steelworks of the future”

17th International Conference on Society and Materials, SAM17, Karlsruhe (Germany), May 9-10, 2023

Author(s): V. Colla, I. Matino, S. Dettori, C. Mocci, **L. Vannini**, R. Matino, V. Baric, D. Schröder, P. Issing, A. Wolff, N. Holzknecht, A. Goldbach, C. Angerer, K. Rechberger, N. Kieberger, C. Muehlegger, O. Maier. “Smart revamping of gas and steam networks for the steelworks of the future”, 17th International Conference on Society and Materials, SAM17, Karlsruhe (Germany).

EDUCATION AND TRAINING

October 2022-present

Master in Robotics and Automation (Current Average 29/30) Artificial intelligence focus

University of Florence

Control Theory, Nonlinear Control theory, Nonlinear dynamical systems, Linear Optimization, Nonlinear optimization,Robotics, Machine learning, Deep learning, Reinforcement Learning, System identification,Robotics, Software engineering,Computer Vision.

October 2018-October 2021

Bachelor in Electrical engineering (Full marks cum laude)

University of Florence

Specialized in Robotics.

Thesis Title : "Design of reduced order L1 optimal controllers for unstable plants subject to delay" Supervisor : Alberto Tesi. The aim of my thesis was to analyze the problems relating to optimal controlling LTI systems (linear, time-invariant), causal, finite dimensional, characterized by an unstable plant $P(s)$. The main idea is to find, among all the stabilizing controllers,the one that minimizes the effect of an unknown disturbance $d(t)$ in the ouput $y(t)$.

Bachelor degree's Exams and marks

Exams	Marks
Analisi Matematica I/II	30L/30
Chimica	25/30
Fisica I/II	24/30
Fondamenti di Informatica	28/30
Fondamenti di Internet	Idoneo
Geometria e Algebra Lineare	24/30
Calcolo numerico	25/30
Laboratorio di tecnologia dell'informazione	Idoneo
Fondameneti di Internet	Idoneo
Campi elettromagnetici	30/30
Elettronica generale	28/30
Elettrotecnica	27/30
Fondamenti di Automatica	30/30
Metodi Matematici e probabilistici	28/30
Misure Elettriche	30/30
Teoria dei Segnali	30/30
VERIFICA LINGUA INGLESE (B2)	Idoneo
Affidabilità e controllo qualità	28/30
Applicazioni di Matematica	30/30
Elettronica Applicata	30L/30
Elettronica dei sistemi digitali	28/30
Fondamenti di elaborazione numerica dei segnali	30/30
Fondamenti di Ricerca Operativa	30/30
Meccanica Razionale/Robotica Industriale	30L/30
Sistemi di controllo	30/30
Average (MEDIA)	28.55/30
Final Valuation (Voto di Laurea)	110L/110

PERSONAL SKILLS

Mother tongue: Italian

Other languages

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C1	C1	C1	C1	C1

Levels: A1 and A2: Basic user – B1 and B2: Independent user – C1 and C2: Proficient user
Common European Framework of Reference for Languages

Skills — Tools: C, C$_{++}$, $Python$, $Matlab$, $\LaTeX$, $HTML$

Driving licence: B

CERTIFICATIONS

April 2018

Cambridge Assessment English

English assessment level B2

AWARDS

The Firenze Race Team has achieved the 1st place in the class 3 category at Formula SAE Italy 2022 which took place from 13th to 17th July in Varano de'Melegari. We have presented the project of an autonomus car with an internal combustion engine. As a member of the control group i have actively participated to the development of the project

HOBBIES