Olga Napolitano

Pisa, Italy
+39 3932924239
olga.napolitano@phd.unipi.it

Education

Nov 2020 – now
3rd year PhD Student in the PhD Program Smart Industry, *Department of Information Engineering and Research Center "E. Piaggio",*, University of Pisa, http://smartindustry.unipi.it/
- Supervisors: Prof. Paolo SALARIS, Prof. Lucia PALLOTTINO
  Description: My research focuses on the development of model-based and hybrid Active Sensing Control strategies. In this context, two major contributions of my Ph.D. research take place: i) the study and identification of suitable metrics that quantify the amount of information related to the environment where a robot moves ii) the design of optimal control strategies in model-based and model-free architecture that maximize the above-mentioned metrics and hence the information need to efficiently execute a given task.

1st Jul 2023 – 31st Oct 2023
Ph.D. Visiting Period, *Laboratory for Analysis and Architecture of Systems-CNRS*, Toulouse
- Supervisor: Prof Marco COGNETTI
  Description: The main idea is to test a Hybrid Active Sensing control strategy on aerial vehicles (i.e., drones) for which the state estimation problem is very hard to be tackled.

1st Apr 2023 – 30th Jun 2023
Ph.D. Visiting Period, *Robot Perception and Learning Lab*, University Colledge of London
- Supervisors: Prof Dimitrios KANOULAS, Dr. Valerio MODUGNO
  Description: My research focuses on the development of a Hybrid Active Sensing control strategy. The main idea is to exploit the information maximization of the Active Sensing approach for improving the learning of a model. The learning part is based on a Gaussian Process approach. The improved model will be used inside a Model Predictive Control for the generation of robust walking patterns in quadrupedal robots.

Oct 2017 – Sept 2020
Master's Degree in Robotics and Automation Engineering, *University of Pisa, Pisa (Italy)*, 110/110 cum Laude
- Thesis title: "Optimal Active Sensing Control with Process and Measurement Noise Under Intermittent Measurements".
  Supervisors: Prof. Lucia PALLOTTINO, Prof. Paolo SALARIS
  Description: The problem of having a good estimation of the state of the robot and the environment is crucial for navigation problems. For this reason, it is important to determine inputs/trajectories that make all states and calibration parameters as observable as possible by maximizing the information gathered along the trajectory by sensors. My thesis work was about the development of active sensing strategies for nonlinear systems which consist in planning trajectories able to maximize the amount of information gathered by on-board sensors despite both process and measurement noises with intermittent measurements.

Sept 2014 – Oct 2017
Bachelor's Degree in Electronic for Automation and Telecommunications Engineering, *University of Sannio, Benevento (Italy)*, 105/110
- Thesis title: "State estimation for a nano-quadcopter".
  Supervisors: Prof. Luigi IANNELLI, Dr. Giuseppe SILANO

Sep 2009 – Jul 2014
Scientific High School Diploma, *High school P.S. Mancini, Avellino (Italy)*, 96/100

Languages

Italian Mother tongue

English Intermediate (speaking, reading); advanced (writing)

Technical Skills

- Advanced knowledge of MATLAB and Simulink, ROS (Robot Operating System), Python, Microsoft Office, CasADi, Latex
- Basic knowledge of Java, C, C++, SolidWorks

Personal Skills

Through my work and research experience, I developed a strong sense of responsibility and autonomy. More importantly, I learned to organize my work efficiently, geared toward the pursuit of short, medium, and long-term goals. I am confident in my ability to deal with unexpected and complex problems, also collaborating with other people. Thanks to the numerous projects I was involved in, I developed a good handling of stress and a spirit of initiative, which I have often used to respect strict and competing deadlines.

Main Scientific Interests

- Path planning and control for robots
- Observability analysis
- Optimal estimation
- Optimal control
- Active sensing control
- Deep Learning
- Model Predictive Control

Current participation to research projects

DARKO "Dynamic Agile production Robots that learn and optimise Knowledge and Operations" (Research Centre E. Piaggio, Univeristy of Pisa) – project starting in January 2021
DARKO sets out to realize a new generation of agile production robots that have energy-efficient elastic actuators to execute highly dynamic motions; are able to operate safely within unknown, changing environments; are easy (cost-efficient) to deploy; have predictive planning capabilities to decide for most efficient actions while limiting associated risks; and are aware of humans and their intentions to smoothly and intuitively interact with them. I work on WP6 in charge of the predictive and safe motion planning of the mobile DARKO platform. My role in the project is the development of an active sensing control layer for the risk-aware planner aiming at reduce the risk sources when no free-risk path are available. I took part to the first two milestones for the code integration on the robotic platform.

Teaching Experiences

a.y. 2021–22 **Teaching assistant (Con assegno per l'incentivazione delle attività di tutorato e delle attività didattico-integrative, propedeutiche e di recupero – Codice DESTEC - 5 – Disposizione del Direttore del Dipartimento n. 102/2022 prot. n. 977/2022 del 09/03/2022, 20 ore)**, *Course of "Systems Theory"*, Prof. Paolo Salaris, University of Pisa, Pisa (Italy)

Co-supervision of students

Alfio Di Paola	Master Thesis "Strategie di percezione attiva orientate al compito per sistemi robotici", *2012*, with Prof. Paolo Salaris and Prof. Lucia Pallottino, The aim of this thesis was to design a control architecture combining feedback and feedforward control strategies. The feedback component delineates the task's description and goals, while the feedforward element is an active sensing control strategy aiming at reducing the degrading effect of measurement and process noises on the correct execution of the task. A Lyapunov-based Model Predictive Control is employed to implement this strategy.
Valentina La Gamba	Master Thesis "Probabilistic strategy for collision risk assessment and management under uncertainties", *with Prof. Paolo Salaris, Prof. Lucia Pallottino, Elisa Stefanini and Elena Stracca*, a.y. 2021/22, This thesis tackles the problem of avoiding collisions for autonomous robots operating in indoor environments with uncertain sensors. Two sources of uncertainty are considered: measurement errors from laser sensors and errors in estimating the robot's position. A method that creates two maps showing where obstacles and moving objects might be is exploited to manage this uncertainty. These maps help us understand the likelihood of collisions. We also consider how uncertainty changes over time. For example, when the robot hasn't visited a part of the environment for a while, its understanding of that area becomes less reliable. An RRT* algorithm that minimizes the risk of collisions is used. At each step, the path is modified according to future possible collisions..
Aurora Polla	Tutoring for the Robotic course "EK-Like Filter of a Non-Linear System: Planar quadrotor ", *with Prof. Paolo Salaris*
Francesca Piana	Tutoring for the Robotic course "Ottimizzazione offline delle traiettorie di un veicolo uniciclo tramite la massimizzazione della traccia del Gramiano di Costruibilità ", *with Prof. Paolo Salaris*
Francesco Vezzi	Tutoring for the Robotic course "Valutazione di una nuova metrica basata su Gramiano Empirico per stimare l'informazione ottenuta su variabili di stato", *with Prof. Paolo Salaris*
Lucia Riccio	Tutoring for the Robotic course "Adaptive Model Predictive Control", *with Prof. Paolo Salaris*
Elia Zuccaro	Tutoring for the Robotic course "Design of a data association algorithm in ROS", *with Prof. Paolo Salaris and Elisa Stefabibi*
Pietro Gori, Vincenzo Degiacomo, Salvatore Fiorentino	Tutoring for the Robotic course "Implementazione di un sistema di localizzazione e algoritmi distribuiti su veicoli uniciclo", *with Prof. Paolo Salaris, Prof. Lucia Pallottino and Elisa Stefanini*

Formative Experience

Deep Learning for Signal Processing – 5 CFU, *Univeristy of Pisa*

- Prof. Davide Bacciu.
  Description: This course aims to provide an introduction to the design and use of deep learning models and reinforcement learning approaches for sensor data processing, machine vision and robotics.

Linear and Nonlinear Kalman Filtering: theory and applications – 4 CFU, *Univeristy of Pisa*

- Prof. Luigi Chisci.
  Description: This course aims to provide both theoretical and practical tools to tackle estimation problems encountered in several areas of engineering and science.

Etics for information – 4 CFU, *Univeristy of Pisa*

- Prof. Andrea Tomasi.
  Description: This course provides an introduction to the main concept about ethics, related to norms, both in deontological and in behavioral meaning.

English for Research Purposes – 10 CFU, *Univeristy of Pisa*

- Prof. Joanne Spataro.
  Description: It is a course offered by the "Centro Linguistico" of Pisa University to PhD Candidates aiming at providing awareness of the basic linguistic skills for writing and publishing scientific articles in English, as well as the presentation skills necessary to ensure an interactive participation in international academic contexts.

Gender Issues and University. Research, education and institutional engagement – 1 CFU, *Univeristy of Pisa*

- Prof. Lucia Pallottino.

EECI Ph.D Summer School 2021 Learning to Control – 3 CFU, *Online*

- Prof. Simone Formentin
  Description: The course is dedicated to the direct synthesis of control systems from data.

SIDRA 2021 Ph.D. Summer School – 36 CFU, Bertinoro, Italy

- Description: It is a one-week event organized every year by S.I.D.R.A., the Italian Control Systems Society. The Summer School takes place in Bertinoro. The school comprised an intensive program of lectures and seminars organized around two topical research themes. The first theme, developed in the first half of the week, concerned"Game Theory and Network Systems" coordinated and taught by professors Giacomo Como e Fabio Fagnani (Politecnico di Torino, Turin, Italy) The second theme, presented in the second half of the week, focused on "Modeling and Control of Soft Robots", coordinated by professors Antonio Bicchi (University of Pisa and IIT, Pisa, Italy), Alessandro De Luca (University of Rome, La Sapienza, Rome, Italy), Bruno Siciliano (University of Naples Federico II, Naples, Italy) and taught by professors Cosimo Della Santina (TU Delft, Delft, Netherlands) and Stanislao Grazioso (University of Naples Federico II, Naples, Italy)

EECI Ph.D Summer School 2022 Learning-based Model Predictive Control – 3 CFU, *ETH Zurich*

- Prof. Melanie N. Zeilinger, Prof. Lorenzo Fagiano and Prof. Lukas Hewig.
  Description: After a brief review of the fundamentals of MPC, the course presents an overview of existing learning-based MPC methods, followed by a deep-dive into the theory and applications of selected techniques for different problem settings. These include stochastic and unknown-but-bounded uncertainty and reactive techniques. A discussion on advanced topics and active research direction concludes the module.

List of Publications

International Journal

Feb 2022 **O. Napolitano**, D. Fontanelli, L. Pallottino and P. Salaris, *"Information-Aware Lyapunov-Based MPC in a Feedback-Feedforward Control Strategy for Autonomous Robots"*, IEEE Robotics and Automation Letters, vol. 7, no. 2, pp. 4765-4772, April 2022, doi: 10.1109/LRA.2022.3149299.

International Conference Papers

Jun 2021 **O. Napolitano**, D. Fontanelli, L. Pallottino and P. Salaris, *"Gramian-based optimal active sensing control under intermittent measurements"*, 2021 IEEE International Conference on Robotics and Automation (ICRA), Xi'an, China, 2021, pp. 9680-9686, doi: 10.1109/ICRA48506.2021.9561008.

National Conference Contributions

Oct 2021 **O. Napolitano**, D. Fontanelli, L. Pallottino and P. Salaris, *"On-line Optimal information-aware path planning with actuation noise and intermittent noisy measurements"*, Italian Conference Automatica.it 2021

Oct 2021 **O. Napolitano**, D. Fontanelli, L. Pallottino and P. Salaris, *"On-line Optimal information-aware path planning with actuation noise and intermittent noisy measurements"*, 3rd Italian Conference on Robotics and Intelligent Machines (I-RIM) 2021

Oct 2022 **O. Napolitano**, D. Fontanelli, L. Pallottino and P. Salaris, *"An Information-aware Lyapunov-based MPC for autonomous robots"*, 4th Italian Conference on Robotics and Intelligent Machines (I-RIM) 2022

Submitted Papers

Sept 2023 **O. Napolitano**, M. Cognetti, L. Pallottino, P. Salaris, D. Kanoulas and V. Modugno, *"Active Sensing for Data Quality Improvement in Model Learning"*, under review on IEEE Internation Conference of Robotics and Automation 2024 (ICRA 2024)

Oct 2023 **O. Napolitano**, D. Fontanelli, L. Pallottino and P. Salaris, *"Constructibility and Reachability-based Optimal Information-Aware Motion Generator"*, under review on IEEE Transactions on Systems, Man and Cybernetics: Systems

Conference Presentations

"Gramian-based optimal active sensing control under intermittent measurements", *Oral presentation*, 2021 IEEE International Conference on Robotics and Automation (ICRA) – Virtual

"Information-Aware Lyapunov-Based MPC in a Feedback-Feedforward Control Strategy for Autonomous Robots,"", *Oral and poster presentation*, 2022 IEEE International Conference on Robotics and Automation (ICRA) – Philadelphia

"Optimal information-aware path planning with actuation noise and intermittent noisy measurements", *Poster presentation*, 2021 I-RIM Conference – Rome and Oral presentation, Automatica.it 2021 – Virtual

"An Information-aware Lyapunov-based MPC for autonomous robots," Poster presentation", *Oral and poster presentation*, 2022 I-RIM Conference – Rome

Reviewer Activities

Journals IEEE Robotics and Automation Letter

Conferences IEEE Conference on Robotics and Automation

Privacy

I allow the use and processing of my personal data according to the Dlgs 196/2003 concerning the handling of personal data.