Nicholas Cartocci

PhD Student

September 30, 2024

Interests

Nicholas Cartocci's current interests include Biomedical Signals Processing, specifically for Fall Detection, Fall Prediction and Injury Prevention, and Artificial Intelligence (AI), particularly Machine Learning and Deep Learning.

Research Experiences

06/2022 - Ongoing

XoLab, Advanced Robotics, Italian Institute of Technology (IIT).
PhD Student in the research theme: "Data processing using ML techniques for fall detection and prediction".
Tutors: Dr. J. Ortiz and Prof. D.G. Caldwell

5-month fellow researcher in the project: "Machine Learning for Fall Detection and Prediction".
Supervisors: Dr. J. Ortiz and Dr. A.E. Gkikakis.

04/2020 - 05/2022

ISARLab, Department of Engineering, University of Perugia.
1-year research assistant in the project: "Development and validation of algorithms for the perception, localization, navigation, control and security of electric autonomous vehicles".

1-year esearch assistant in the project: "Development of tools for the elaboration of time series and video streams with application to the precision farming"

2- month research contract for the project: "Models and algorithms for detection and classification of anomalies and faults in time series and signals".
Supervisor: Prof. M.L. Fravolini.

10/2018 - 03/2019

Benjamin M. Statler College of Engineering and Mineral Resources, West Virginia University.
3- month scholarship for the research project: "Data-Driven Residuals and Bayesian Filtering for Robust Aircraft Sensor Fault Isolation applied to Tecnan P92 aircraft".

3-month scholarship for the internship project: "Implementation and comparison of data-based sensor fault isolation techniques for aircraft systems".
Supervisor: Prof. M.R. Napolitano.

Journal publications

2022 — *Cartocci N.*, Crocetti F., Costante G., Valigi P., Fravolini M. L., "*Robust Multiple Fault Isolation Based on Partial-Orthogonality Criteria*", International Journal of Control, Automation and Systems, 20, 2148–2158, DOI.

2022 — *Cartocci N.*, Napolitano M. R., Crocetti F., Costante G., Valigi P., Fravolini M. L., "*Data-Driven Fault Diagnosis Techniques: Non-Linear Directional Residual vs. Machine-Learning-Based Methods*", Sensors, 22(7), 2635, DOI.

2022 — *Cartocci N.*, Napolitano M. R., Costante G., Valigi P., Fravolini M. L., "*Aircraft Robust Data-Driven Multiple Sensor Fault Diagnosis Based on Optimality Criteria*", Mechanical Systems and Signal Processing, 170, DOI.

2021 — *Cartocci N.*, Fravolini M. L., Napolitano M. R., Costante G., "*A Comprehensive Case Study of Data-Driven Methods for Robust Aircraft Sensor Fault Isolation*", Sensors, 21(5), 1645, DOI.

Conference publications

2024   *Cartocci N.*, Gkikakis A.E., Pera F., Settino M.T., Caldwell D.G., Ortiz J., "*Fall-KAN: Fall impact time estimation Kolmogorov-Arnold Network*", 2024 4th International Conference on Electrical, Computer, Communications and Mechatronics Engineering (ICECCME), 2024, ACCEPTED, LINK.

2024   Pitzalis R. F., *Cartocci N.*, Di Natali C., Caldwell D.G., Berselli G., Ortiz J., "*Development of a ML-Control Strategy for a Wrist Exoskeleton based on EMG and Force measurements with Sensor Strategy Optimisation*", 2024 10th IEEE RAS/EMBS International Conference for Biomedical Robotics and Biomechatronics (BioRob), 2024, PRESENTED, LINK.

2024   *Cartocci N.*, Gkikakis A.E., Caldwell D.G., Ortiz J., "*Recognition of Physiological Patterns during Activities of Daily Living Using Wearable Biosignal Sensors*", 2024 22nd Triennial Congress of the International Ergonomics Association (IEA), 2024, PRESENTED, LINK.

2024   Pitzalis R. F., *Cartocci N.*, Di Natali C., Caldwell D.G., Berselli G., Ortiz J., "*Ergonomic Assessment of Work Activities for an Industrial-oriented Wrist Exoskeleton*", 2024 22nd Triennial Congress of the International Ergonomics Association (IEA), 2024, PRESENTED, LINK.

2024   *Cartocci N.*, Pitzalis R. F., Ortiz J., Jaramillo J. M., Yucelen T., Fravolini M. L., "*Directional thrust control of a powered wingsuit for assisted gliding*", AIAA 2024-0754. AIAA Scitech 2024 Forum. January 2024, DOI.

2023   Leomanni M., Ferrante F., *Cartocci N.*, Costante G., Fravolini M. L., Dogan K. M., Yucelen T., "*Robust Output Feedback Control of a Quadrotor UAV for Autonomous Vision-Based Target Tracking*", AIAA 2023-1632. AIAA Scitech 2023 Forum. January 2023, DOI.

2022   *Cartocci N.*, Monarca A., Costante G., Fravolini M. L., Dogan K. M., Yucelen T., "*Linear Control of a Nonlinear Aerospace System via Extended Dynamic Mode Decomposition*", AIAA 2022-2046. AIAA Scitech 2022 Forum. January 2022, DOI.

2021   *Cartocci N.*, Crocetti F., Costante G., Valigi P., Napolitano M. R., Fravolini M. L., "*Data-Driven Sensor Fault Isolation Based on Nonlinear Additive Models and Local Fault Sensitivity*", 2021 20th International Conference on Advanced Robotics (ICAR), 2021, pp. 750-756, DOI.

2021   *Cartocci N.*, Napolitano M. R., Costante G., Valigi P., Crocetti F., Fravolini M. L., "*A Robust Data-Driven Fault Diagnosis scheme based on Recursive Dempster-Shafer Combination Rule*", 2021 29th Mediterranean Conference on Control and Automation (MED), 2021, pp. 1070-1075, DOI.

2021   Fravolini M. L., *Cartocci N.*, Dogan K. M., Yucelen T., "*A Safe Learning Model Reference Adaptive Controller for Uncertain Aircrafts Models*", AIAA 2021-0532. AIAA Scitech 2021 Forum. January 2021, DOI.

2020   *Cartocci N.*, Napolitano M. R., Costante G., Valigi P., Crocetti F., Fravolini M. L., "*PCA Methods and Evidence Based Filtering for Robust Aircraft Sensor Fault Diagnosis*", 2020 28th Mediterranean Conference on Control and Automation (MED), 2020, pp. 550-555, DOI.

2020	Fravolini M. L., _Cartocci N._, Dogan K. M., Yucelen T., "_Quantification of Tolerable Parametric and Dynamic Uncertainty for Robust MRAC Systems_", AIAA 2020-1338. AIAA Scitech 2020 Forum. January 2020, DOI.

Sci entific Talks

2023	_Cartocci N._, Gkikakis A.E., Caldwell D.G., Ortiz J., "_Deep Learning-based wearable device to prevent fall from height injuries_", 2023 5th Italian Conference on Robotics and Intelligent Machines (IRIM), 2023, DOI.
2023	_Cartocci N._, Pitzalis R.F., Ortiz J., Fravolini M.L., "_Bidirectional assistive logic for longitudinal glide dynamics of a wingsuit_", 2023 5th Italian Conference on Robotics and Intelligent Machines (IRIM), 2023, DOI.
2023	_Cartocci N._, Gkikakis A.E., Caldwell D.G., Ortiz J., "_Artificial intelligence-based wearable solution to prevent fall from heights injuries for the next generation of workers_", 2023 Slips, Trips and Falls (STF) International Conference, LINK.
2022	_Cartocci N._, Gkikakis A. E., Caldwell D. G., Ortiz J., "_Real-time Fall Prevention system for the Next-generation of Workers_", Workshop on Assistive Robotic Systems for Human Balancing and Walking: Emerging Trends and Perspectives @IROS 2022, LINK.
2022	Leomanni M., Ferrante F., _Cartocci N._, Costante G., Fravolini M.L., "_Output feedback control of a UAV for vision-based target tracking_", 2022 4th Italian Conference on Robotics and Intelligent Machines (IRIM), 2022, DOI.
2021	_Cartocci N._, Napolitano M. R., Costante G., Crocetti F., Valigi P., Fravolini M. L., "_A Robust Data-Driven Fault Diagnosis scheme based on Recursive Dempster– Shafer Combination Rule_", AUTOMATICA.IT 2021, LINK.
2020	Bellocchio E., Bruni A., _Cartocci N._, Costante G., Crocetti G., Longhi A., Pacicco L., Palliotti A., Petacchi R., Radicioni F., Rinaldi M., Santucci G., Sdoga A., Tosi G., Valigi P., Bisio M., "_Agrobot: autonomous robots to support economic growth and environmental sustainability of Umbria's agriculture_", 2020 2nd Italian Conference on Robotics and Intelligent Machines (IRIM), 2020, DOI.

Rev iews

Journal:	Aerospace, Automatica, Control Engineering Practice, Diagnostics, Electronics, Engineering Applications of Artificial Intelligence (EAAI), IEEE Robotics and Automation Letters (RA-L), IET Control Theory & Applications, Journal of Experimental & Theoretical Artificial Intelligence (JETAI), Mechanical Systems and Signal Processing (MSSP), Mathematics, NeuroSci, Robotics Reports.
Conference:	2024 IEEE International Conference on Automation Science and Engineering (CASE), 2023 International Conference on Artificial Intelligence of Things and Systems (AIoTSys), 2023 International Conference on Electrical, Computer, Communications and Mechatronics Engineering (ICECCME), 2023 Mediterranean Conference on Control and Automation (MED), 2023 IEEE International Conference on Robotics and Automation (ICRA), 2022 International Conference on Electrical, Computer, Communications and Mechatronics Engineering (ICECCME), 2022 European Control Conference (ECC), 2021 American Control Conference (ACC).

App ointments

2023-2024	Lecturer
	Lecturer of the Basic Computer Science course at the University of Genoa Senior.

2023-2024	Practitioner
	Teaching support for the master's course "Machine learning for automated driving" at the University of Genoa.
2020-2022	Subject Expert
	Expert from the Scientific Disciplinary Area ING-INF/04 (Automation) to profit examination committees at the University of Perugia.

Projects

2024-2027	Falling from Heights 2	Link
	The project is focused on designing and developing innovative strategies and solutions to prevent accidents and protect workers who work at heights. It focuses on advances in wearable sensing and actuation technologies, including technologies to reduce the impact of falls and intelligent monitoring systems.	
	Sponsor: Italian Workers' compensation Authority (INAIL)	
2022-2023	Falling from Heights	Link
	The project aims to design and develop novel strategies and solutions aimed at preventing accidents and protecting workers working at heights. The project focuses on advances in wearable sensing and actuation technologies, including technologies for falling impact reduction, intelligent monitoring, and new paradigms in immersive training for workers.	
	Sponsor: Italian Workers' compensation Authority (INAIL), project: EPTR0007	
2022	Digital Value Chain (DVC): Research and application of machine learning solutions for the digitization of retail spaces	
2022	SEAL: Smart&safe Energy-aware Assisted Living, The Learning Meters Network	Link
	The SEAL project aims to develop new knowledge, products and services to put domotic systems on the market that implement services aimed at safety and sustainability. SEAL is related to the Smart Cities initiative, which involves the integration of units that each operate intelligently.	
	Executive project: SCN_00398, social innovation projects: SIN_00968	
2020-2021	Agrobot: autonomous robots to support economic growth and environmental sustainability of Umbria's agriculture	Link
	The AGROBOT project aims to realize and validate an autonomous robot to support innovative agricultural approaches on fields located in hilly areas belonging to small farms. It is based on state-of-the-art methods for perception, control and navigation.	
	Project funded by the Umbria Region PSR program 2014-2020.	

Awards

2023	"Advancing Technology for Humanity – Most Promising Researcher in Robotics and AI" award finalist	Link
	The award was announced by the Fondazione Mondo Digitale and the Rome Campus Bio-Medico University.	
2020	"Renato Mariani" award participant	
	The award was announced by the Italian Association of Electrical, Electronics, Automation, Information and Communication Technology (AEIT).	
2017	UniPG - Student contribution	
	50% reduction of fees for the first year of the master's degree program.	

Courses

2024	Machine Learning of Wearables in Large Scale Biomedical Studies	Link
	University of Oxford, United Kingdom (UK).	
2024	Bumblekite machine learning summer school in health, care and biosciences	Link
	ETH Zürich and University Hospital Balgrist, Switzerland.	

2024	Sciencepreneurship Summer School: Sustainability & AI	Link
	EPFL Lausanne, Switzerland.	
2021	From Data to Decisions: the Scenario Approach (with Applications to Systems, Control and Machine Learning)	Link
	EECI 2021 International Graduate School on Control	
	Instructors: Prof. M.C. Campi and Prof. S. Garatti.	

Education

2022-...	PhD in Bioengineering and Robotics	University of Genoa
	Advanced and Humanoid Robotics.	
2020	Professional title of Engineer	MUR
	Information Engineer.	
2017-2019	Master's degree with vote 110/110 cum laude	University of Perugia
	Computer Engineering and Robotics.	
2013-2016	Bachelor's degree with vote 107/110	University of Perugia
	Computer Science and Electronic Engineering.	
2007-2012	High school	ITIS "Galileo Galilei" Arezzo
	Specialization in Electronics, Information Technology and Telecommunications.	

Thesis

Master	*Data-Driven Residuals and Bayesian Filtering for Robust Aircraft Fault Isolation*	LINK
	Supervisors: Prof. M. L. Fravolini & Prof. M. R. Napolitano.	
	Examiner: Prof. A. Moschitta.	
Bachelor	*Design and Assembly of a UAV below 300 grams with a fixed budget* LINK	
	Supervisor: Prof. P. Valigi.	

Technological knowledge

Base	Computer Hardware, C++, R, Java, JavaScript, Adobe Photoshop, Apache Giraph, Apache Hadoop, Apache Spark, MySQL, NoSQL databases (Riak, MongoDB, Cassandra, Neo4j), Node-RED, OpenDayLight and OpenStack.
Medium	Linux OS, MacOS, Simulink, Robot Operating System (ROS), Programmable Logic Controller (PLC) languages, Python, PyTorch, and LaTeX.
Advanced	MATLAB, Microsoft Office and Microsoft Windows.

Experiences

09/2023	Next Tech
	Social media manager for Next Tech
2020-2022	iCrewPlay.com
	COO of iCrewPlay with management and coordination responsibilities; PR Executive for iCrewPlay's Tech division with international PR tasks; Editor for iCrewPlay's Tech newsroom with over 200 articles and reviews.
2014-2020	Nital (iRobot), Canon, TomTom, Alcatel, Bayer
	Technical consultant in intelligent sensors, smart devices, computers, wearable technology, phones, and crop science.
2016-2020	Editanet S.r.l.
	Delegate for the supervision of public tenders for third parties.
2016-2017	Casio
	Technical consultant and demonstrator for Eastern Tuscany on projectors, smart cameras and high-quality cameras.
2012-2013	Sacchi Giuseppe S.p.A. - Arezzo branch
	Technical consultant and seller in the following areas: electrical distribution, lighting, electrical and electronic components, wiring, industrial automation and special systems (e.g., photovoltaic).

Languages

Italian	Native language.
English	Advanced.
French	Studied at middle school.