GIULIO GARBI, PHD

PostDoc at University of Molise, Italy

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Research interests

My research interests are in software verification and in building reliable and secure software systems using techniques, including machine learning, deep neural networks with TensorFlow, numerical optimization, SAT solvers, code-to-code translation, and formal methods.

Education

Oct '23	**PHD IN SYSTEMS SCIENCE – TRACK IN COMPUTER SCIENCE AND SYSTEMS ENGINEERING** *IMT School for Advanced Studies Lucca, Lucca, Italy* **Dissertation title:** Automatic and Accurate Performance Prediction in Distributed Systems **Supervisors**: Prof. Mirco Tribastone and Dr. Emilio Incerto I worked on three techniques to automatically derive white-box or gray-box performance models for distributed systems, with a focus on microservice architectures (MSA), using system profiling, code analysis, deep neural networks, and queuing networks.
Dec '16	**MSc IN COMPUTER SCIENCE** *Department of Computer Science, Università degli Studi di Torino, Turin, Italy* **Dissertation title**: Adaptive Advanced Driving Assistant systems in Automotive: the HoliDeS co-pilot **Supervisors**: Prof. Susanna Donatelli and Dr. Elvio Amparore **Grade**: 110/110 cum laude and honorable mention
Jul '14	**BSc IN COMPUTER SCIENCE** *Department of Computer Science, Università degli Studi di Torino, Turin, Italy* **Dissertation title**: *Caliber: a Novel Algorithm for Text Categorization* **Supervisors**: Dr. Daniele Radicioni and Dr. Roberto Esposito **Grade**: 110/110 cum laude

Academic Positions

Apr '22 - Current	**POSTDOC IN THE PAC RESEARCH GROUP** *University of Molise, Pesche (IS), Italy* I am working on a research project that aims to develop and implement distributed model checking algorithms to find bugs in concurrent programs. The project is partially supported by Amazon Research Awards - "Program Analysis in the Clouds (PAC): a distributed symbolic algorithm to scale up bug-finding in concurrent programs" (PI: Gennaro Parlato). The project is in collaboration with Gennaro Parlato, Bernd Fischer, Salvatore La Torre and Peter Schrammel.

Academical Activities

A.Y. 2022 – 2023	**Teaching Assistant** in Computer Networking, Security, Cryptography, Theory of Computing, Data Structures and Algorithms, Program Analysis at University of Molise.

Visiting

FEB '23 – MAR '23	DIFFBLUE
	Oxford (UK)
	During this visit, I extended CBMC to introduce an approximation method to perform program analysis using reduced bit-width. Additionally, I introduced further optimizations in the SSA and clauses-and-variables encoding procedures.

Software and Tools developed

- CBMC (personal fork with various optimizations and an approximation method for BMC, https://github.com/giulio-garbi/cbmc)
- PAC: Program Analysis in the Clouds (https://github.com/Gennaro-Parlato/CSeq)
- µP: A Development Framework for Accurate Performance Predictions in Microservices Systems (https://github.com/giulio-garbi/mup)
- GoAt: Attribute-based Interaction in Google Go (https://giulio-garbi.github.io/goat/)
- GreatSPN: GRaphical Editor and Analyzer for Timed and Stochastic Petri Nets (https://github.com/greatspn/SOURCES)

Grants and Fellowships

FEB '23 – MAR '23	ERASMUS+ FOR TRAINEESHIP
	IMT School for Advanced Studies Lucca, Lucca, Italy
JUL '21 – DEC '21	RESEARCH GRANT: "SOFTWARE PERFORMANCE MODELING"
	IMT School for Advanced Studies Lucca, Lucca, Italy
JAN '21 – JUN '21	FRONTIER PROPOSAL FELLOWSHIP
	IMT School for Advanced Studies Lucca, Lucca, Italy
NOV '17 – DEC '20	3-YEAR PHD SCHOLARSHIP
	IMT School for Advanced Studies Lucca, Lucca, Italy

Prizes

In 2010, I participated to the Italian Olympiads of Informatics and ranked first.

Professional titles

JUN '17	COMPUTER ENGINEERING NATIONAL QUALIFICATION – SECTION A
	Department of Computer Engineering, Università di Pisa, Pisa, Italy
JAN '15	JUNIOR COMPUTER ENGINEERING NATIONAL QUALIFICATION – SECTION B
	Department of Computer Engineering, Università degli Studi di Padova, Padua, Italy

Publications

Giulio Garbi, Emilio Incerto, Mirco Tribastone: µP: A Development Framework for Predicting Performance of Microservices by Design. IEEE CLOUD 2023: 178-188

Yehia Abd Alrahman, **Giulio Garbi**: A distributed API for coordinating AbC programs. Int. J. Softw. Tools Technol. Transf. 22(4): 477-496 (2020)

Giulio Garbi, Emilio Incerto, Mirco Tribastone:
Learning Queuing Networks by Recurrent Neural Networks. ICPE 2020: 56-66

Elvio Gilberto Amparore, Susanna Donatelli, Marco Beccuti, **Giulio Garbi**, Andrew S. Miner: Decision Diagrams for Petri Nets: A Comparison of Variable Ordering Algorithms. Trans. Petri Nets Other Model. Concurr. 13: 73-92 (2018)

Yehia Abd Alrahman, Rocco De Nicola, **Giulio Garbi**, Michele Loreti: A Distributed Coordination Infrastructure for Attribute-Based Interaction. FORTE 2018: 1-20

Yehia Abd Alrahman, Rocco De Nicola, **Giulio Garbi**: GoAt: Attribute-Based Interaction in Google Go. ISoLA (3) 2018: 288-303

Elvio Gilberto Amparore, Susanna Donatelli, Marco Beccuti, **Giulio Garbi**, Andrew S. Miner: Decision Diagrams for Petri Nets: Which Variable Ordering? PNSE @ Petri Nets 2017: 31-50

Conference presentations

Apr '20	Learning Queuing Networks by Recurrent Neural Networks
	ICPE 2020, Virtual
	Available online: https://www.youtube.com/watch?v=LxTaV0FezgI

Nov '18	GoAt: Attribute-Based Interaction in Google Go
	ISoLA 2018, Limassol, Cyprus

Partecipation in Reaseach Projects

May '17 – Oct '17	Research Assistant in the SysMA research group
	IMT School for Advanced Studies Lucca, Lucca, Italy
	In this project, we developed the model and infrastructure, as well as the implementation of a communication scheme for Collective Adaptive Systems called Attribute-based Communication (AbC). The implementation is complemented by a domain-specific language (DSL) focused on communication aspects. The project was in collaboration with Rocco De Nicola and Yehia Abd Alrahman.

Feb '17 – Apr '17	Research Assistant in the Prof. Susanna Donatelli research group
	Department of Computer Science, Università degli Studi di Torino, Turin, Italy
	In this project, we experimented with Binary Decision Diagram (BDD) variable ordering heuristics to improve the Stochastic Petri Nets (SPN) analysis tool GreatSPN. We entered the Model Checking Contest held at the 38th International Conference on Petri Nets with GreatSPN, where we secured two gold medals among the four categories in which we participated. I worked with Susanna Donatelli, Marco Beccuti, and Elvio Amparore.

SEP '15 – DEC '16

RA: "DEVELOPMENT OF A CAR COPILOT IN THE EUROPEAN PROJECT HOLIDES"

Department of Computer Science, Università degli Studi di Torino, Turin, Italy
This project was part of the European project HoliDes. The aim was to study the cooperation between humans and machines while solving four complex tasks. We looked at the Automotive case study and developed a human-centric adaptive driving support system (copilot). The copilot reads the road condition and driver's attention level to determine the best maneuver to apply and how to display it. While working on this project, I interacted with industrial partners: Fiat Research Centre (CRF), which produced the sensor-equipped car, and RE:Lab, where I implanted the copilot in a driving simulator with the human-machine interface of the CRF's car. I worked with Susanna Donatelli, Marco Beccuti, and Elvio Amparore.

Other details

Known languages: Italian (native), English (proficient – C1, used as working language), French (basic).
Citizenship: Italian.