MATTEO CAMILLI, PH.D.

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CONTACT INFORMATION

Name: Matteo Camilli
Date of birth: Dec. 19, 1986
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Faculty of Computer Science
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EDUCATION

University of Milan, Italy *2012-2015*
PhD in Computer Science
PhD thesis title: "Coping with the State Explosion Problem in Formal Methods: Advanced Abstraction Techniques and Big Data Approaches"
Supervisor: Prof. Carlo Bellettini
Co-supervisor: Prof. Mattia Monga

University of Milan, Italy *2009-2011*
Master Degree in Computer Science
Thesis title: "Parallel and Distributed Formal Verification of Real-Time Systems"
Supervisor: Prof. Carlo Bellettini
Grade: **110/110 cum Laude**

University of Milan, Italy *2005-2008*
Bachelor Degree in Computer Science
Thesis title: "Design and Implementation of a Reachability Analysis Technique for Real-time Systems"
Supervisor: Prof. Carlo Bellettini
Grade: **110/110 cum Laude**

EXPERIENCE

Free University of Bozen-Bolzano October 2019 - Present
Junior Assistant professor (RTDA) *Bolzano, Italy*

· Main activities: co-supervision of bachelor students, master students; supervision of post-doc researchers; tutoring service for bachelor students in Computer Science; development of research methodologies applied to the PRIN research project "GAUSS: Governing Adaptive and Unplanned Systems of Systems" (2015KWREMX_004) funded by the Italian Ministry of Research (MIUR); lecturer for the courses "Systems Engineering" (for undergraduate students in Computer Science), "Verification and Reliability for Dependable Systems" (for graduate students in Software Engineering for Information Systems) and "Development of Data Products" (for graduate students in Computational data Science).

Gran Sasso Science Institute March 2020
Visiting researcher *L'Aquila, Italy*

- Invited by Dr. Catia Trubiani
- Main activities: invited lecturer for the course "Formal Methods at Work" provided to PhD students as part of their programme at the Gran Sasso Science Institute. Collaboration on development of model-based testing methods for software systems under uncertain environment conditions. Results of the collaboration are reported in the proceedings of the IEEE International Conference on Software Testing, Verification and Validation (ICST 2021), authored by Matteo Camilli, Angelo Gargantini, Patrizia Scandurra, and Catia Trubiani entitled: "Uncertainty-aware Exploration in Model-based Testing".

University of Innsbruck February 2020
Visiting researcher *Innsbruck, Austria*

- Invited by Prof. Michael Felderer
- Main activities: collaboration on definition of assurance methods and testing techniques for AI-based systems (systems equipped with Machine Learning components). Preliminary results are reported: in the Proceedings of the Workshop on AI Engineering - Software Engineering for AI (WAIN 2021) co-located with the International Conference on Software Engineering (ICSE 2021), authored by Matteo Camilli, Michael Felderer, Andrea Giusti, Anna Perini, Barbara Russo, and Angelo Susi entitled: "Towards Risk Modeling for Collaborative AI"; in the proceedings of the 27th International Working Conference on Requirement Engineering: Foundation for Software Quality (REFSQ 2021), authored by Matteo Camilli, Michael Felderer, Andrea Giusti, Dominik Tobias Matt, Anna Perini, Barbara Russo, Angelo Susi entitled "Risk-driven Compliance Assurance for Collaborative AI Systems: A Vision Paper". In the context of our ongoing collaboration we co-authored two project proposal currently under review: "ROOTML: Risk-driven Offline and Online Testing of Machine Learners" submitted to the Austrian Science Fund (FWF) funding organization; "RICAML: Risk-driven Compliance Assurance of ML-based Systems" submitted to the Euregio Science Fund – 4th call.

University of Milan September 2017 - August 2019
Post-doc researcher *Milano, Italy*

- Main activities: co-supervision of bachelor students, master students; delegate for post-doc researchers in the computer science dept. board; lecturer for the courses "Software Engineering" provided to undergraduate students as part of their programme at the University of Milan.

University of Milan September 2015 - August 2017
Post-doc researcher *Milano, Italy*

- Main activities: co-supervision of bachelor students, master students; lecturer for the course "Software Engineering" provided to undergraduate students as part of their programme at the University of Milan; lecturer for the course "Computer Systems and Network Security" provided to graduate students as part of their programme at the University of Milan.

University of Bergamo September 2014 - August 2015
Research fellow *Bergamo, Italy*

- Main activities: development of research methodologies applied to the industrial research project "Smart Break: SMART Bialetti Restoration Adaptive Kit" funded by the Lombardy region; lecturer for the courses "Distributed systems" provided to undergraduate students as part of their programme at the University of Bergamo.

University of Milan February 2012 - October 2012
Research fellow *Milano, Italy*

- Main activities: development of research methodologies applied to the PRIN research project "Botnet Self-protection" (2008XY2W2B_002) funded by the Italian Ministry of Research (MIUR); lecturer for the courses "Distributed systems" provided to undergraduate students as part of their programme at the University of Bergamo.

RESEARCH INTERESTS

My main research interests cover the macro-areas of formal methods and software engineering with particular focus on quantitative specification, modelling and analysis of software systems. I'm particularly interested in the application of formal methods to address software engineering problems occurring at different stages of the lyfe-cycle, such as:

- Software requirements specification, analysis and verification;
- Model-based testing;
- Use of models at runtime;
- Uncertainty mitigation;
- Risk assessment and management;
- Design-time and runtime verification of software systems;
- Formal modeling and simulation (e.g., by using Markov models, automata-based formalisms, and Petri nets);

and the application of methodologies, theories, approaches and techniques specific to the above research areas to distributed, time-dependent, service-oriented, component-based, cyber-physical, self-adaptive and AI-based systems.

HONORS AND AWARDS

Best paper candidate 2021

· ACM/SPEC International Conference on Performance Engineering (ICPE 2021). The paper entitled: "A Multivariate Characterization and Detection of Software Performance Antipatterns" received the nominee for the best paper award.

Amazon.com, Inc. AWS Research Grant 2015–2016

· Amazon.com, Inc. offered to make available the Amazon Web Services Platform for one year to perform proof of concept/benchmark tests evaluating the efficacy of moving formal verification activities to the cloud in order to tackle the state explosion problem. The results have been published in the Proceedings of International Symposium on Symbolic and Numeric Algorithms for Scientific Computing (SYNASC 2016) and in the journal "Concurrency and Computation: Practice and Experience" edited by Wiley.

ACM SIGSOFT CAPS 2014

· Travel grant to attend the 36th International Conference on Software Engineering (ICSE 2014) and participate in the Doctoral Symposium to present the research abstract "Formal verification problems in a big data world: Towards a mighty synergy".

ACM Student Research Competition at ICSE 2012 2012

· Selected to participate in the main competition at the 34th International Conference on Software Engineering (ICSE 2012) with the research abstract "Petri Nets State Space Analysis in the Cloud".

ACM SIGSOFT CAPS 2012

· Travel grant to attend the 34th International Conference on Software Engineering (ICSE 2012) and participate in the ACM Student Research Competition.

INVITED TALKS

SFScon Bolzano, Italy 2021
Online due to COVID-19

· The South Tyrol Free Software Conference promoting the use of Free Software in digital infrastructures as a tool to achieve greater innovation and competitiveness in the region.
Talk title: "Performance assessment of microservices with strong guarantees"

University of Twente, The Netherlands 2021
Research visit organized by Maya Daneva (online due to COVID-19)

· Talk title: "Risk-driven Compliance Assurance for Collaborative AI Systems".

University of Turin, Italy 2017
Research visit organized by Susanna Donatelli

· Talk title: "Coping with the State Explosion Problem in Formal Methods: Advanced Abstraction Techniques and Big Data Approaches".

Politecnico di Milano, Italy 2015
Research visit organized by Carlo Ghezzi

· Talk title: "Formal verification problems in a big data world: Towards a mighty synergy".

Politecnico di Milano, Italy 2014
Research visit organized by Carlo Ghezzi

· Talk title: "Distributed model checking on large clusters".

TUTORIALS AT INTERNATIONAL CONFERENCES

32nd IEEE International Symposium on Software Reliability Engineering 2021

· Title: "Continuous Dependability Assessment and Improvement in DevOps".
· Speakers: Alberto Avritzer, Matteo Camilli, Barbara Russo, Andrea Janes, André van Hoorn, Catia Trubiani.

SPEAKER AT INTERNATIONAL CONFERENCES

2nd IEEE International Conference on Autonomic Computing and Self-Organizing Systems 2021

· Presented paper: "Runtime Equilibrium Verification for Resilient Cyber-Physical Systems".

12th ACM/SPEC International Conference on Performance Engineering 2021

· Presented paper: "A multivariate characterization and detection of software performance antipatterns".

14th IEEE Conference on Software Testing, Verification and Validation 2021

· Presented paper: "Uncertainty-aware Exploration in Model-based Testing".

27th International Working Conference on Requirement Engineering: Foundation for Software Quality 2021

· Presented paper: "Risk-driven Compliance Assurance for Collaborative AI Systems: A Vision Paper".

18th International Conference on Software Engineering and Formal Methods 2020

· Presented paper: "Model-based testing under parametric variability of uncertain beliefs".

15th International Conference on Integrated Formal Methods 2019

· Presented paper: "HYPpOTesT: Hypothesis Testing Toolkit for Uncertain Service-Based Web Applications".

40th International Conference on Application and Theory of Petri Nets 2019

· Presented paper: "PNemu: an extensible modeling library for adaptable distributed systems".

20th International Symposium on Symbolic and Numeric Algorithms for Scientific Computing 2018

· Presented paper: "A Symmetric Nets Emulator for Adaptive P/T Nets".

29th IEEE International Symposium on Software Reliability Engineering 2018

· Presented paper: "Online model-based testing under uncertainty".

15th International Conference on Software Engineering and Formal Methods 2017

· Presented paper: "Towards inverse uncertainty quantification in software development".

9th NASA Formal Methods Symposium 2017

· Presented paper: "Event-based runtime verification of temporal properties using time basic Petri nets".

18th International Symposium on Symbolic and Numeric Algorithms for Scientific Computing 2016

· Presented paper: "Coverability analysis of time basic Petri nets with non-urgent behavior".

26th IEEE International Symposium on Software Reliability Engineering 2015

· Presented paper: "Specifying and verifying real-time self-adaptive systems".

16th International Symposium on Symbolic and Numeric Algorithms for Scientific Computing 2014

· Presented paper: "CTL model checking in the cloud using mapreduce".

36th ACM/IEEE International Conference on Software Engineering (Doctoral Symposium) 2014

· Presented paper: "Formal verification problems in a big data world: towards a mighty synergy".

14th International Symposium on Symbolic and Numeric Algorithms for Scientific Computing 2012

· Presented paper: "Symbolic state space exploration of RT systems in the cloud".

34th ACM/IEEE International Conference on Software Engineering (ACM Student Research Competition) 2012

· Presented paper: "Petri nets state space analysis in the cloud".

SPEAKER AT INTERNATIONAL WORKSHOPS

1st Workshop on AI Engineering – Software Engineering for AI at the International Conference on Software Engineering (ICSE) 2021

· Presented paper: "Towards Risk Modeling for Collaborative AI".

2nd International Workshop on Governing Adaptive and Unplanned Systems of Systems at the International Symposium on Software Reliability Engineering (ISSRE) 2021

· Presented paper: "Domain Metric Driven Decomposition of Data-Intensive Applications".

1st Uncertainty in Modeling Workshop at the ACM/IEEE International Conference on Model Driven Engineering Languages and Systems (MODELS) 2020

· Presented paper: "Towards Model-based Reinforcement Learning to Test Uncertain Software Systems".

1st International Workshop on Model Driven Engineering for Software Architecture at the European Conference on Software Architecture (ECSA) 2020

· Presented paper: "Continuous Formal Verification of Microservice-Based Process Flows".

2nd International Workshop on Formal Approaches for Advanced Computing Systems at the European Conference on Software Architecture (ECSA) 2018

· Presented paper: "A high-level petri net-based formal model of distributed self-adaptive systems".

14th IFAC Workshop on Discrete Event Systems 2018

· Presented paper: "Towards evolving petri nets: a symmetric nets-based framework".

1st International Workshop on Formal Approaches for Advanced Computing Systems at the International Conference on Software Engineering and Formal Methods (SEFM) 2017

· Presented paper: "A formal framework for specifying and verifying microservices based process flows".

1st International Workshop on Microservices Science and Engineering at the International Conference on Software Engineering and Formal Methods (SEFM) 2017

· Presented paper: "Design-time to run-time verification of microservices based applications".

7th International workshop on reachability problems 2013

· Presented paper: "MaRDiGraS: Simplified Building of Reachability Graphs on Large Clusters".

SESSION/TRACK CHAIR AT INTERNATIONAL EVENTS

36th ACM/SIGAPP Symposium On Applied Computing 2021
Technical track on Software Architecture: Theory, Technology, and Applications

· Track chair.

36th ACM/SIGAPP Symposium On Applied Computing 2021
Technical track on Software Architecture: Theory, Technology, and Applications

· Poster session chair.

14th European Conference on Software Architecture (ECSA) 2020
4th International Workshop on Formal Approaches for Advanced Computing Systems

· Invited talk session chair: "Performance Learning for Uncertainty of Software Systems" by Catia Trubiani, Gran Sasso Science Institute (GSSI), Italy.

14th European Conference on Software Architecture (ECSA) 2020
4th International Workshop on Formal Approaches for Advanced Computing Systems

· Conclusion and remarks session chair.

6th International Summer School on Software Engineering (ISE) 2020
Summer school co-organized by the Free University of Bozen-Bolzano (Italy) and the Department of Computer Science of the University of Innsbruck (Austria)

· Tutorial chair: "Systematic Software Testing for Deep Learning Applications" by Baishakhi Ray, Columbia University, US.

6th International Summer School on Software Engineering (ISE) 2020
Summer school co-organized by the Free University of Bozen-Bolzano (Italy) and the Department of Computer Science of the University of Innsbruck (Austria)

· Ph.D. student session chair.

13th European Conference on Software Architecture (ECSA) 2019
3rd International Workshop on Formal Approaches for Advanced Computing Systems

· Round table discussion session chair.

35th ACM/SIGAPP Symposium On Applied Computing 2020
Technical track on Software Architecture: Theory, Technology, and Applications

· Track chair.

13th European Conference on Software Architecture (ECSA) 2019
3rd International Workshop on Formal Approaches for Advanced Computing Systems

· Opening session chair.

13th European Conference on Software Architecture (ECSA) 2019
3rd International Workshop on Formal Approaches for Advanced Computing Systems

· Invited talk session chair: "Model Integration and Decision-Making for Self-Adaptation in Mobile Robotics" by Javier Cámara, University of York, UK.

13th European Conference on Software Architecture (ECSA) 2019
3rd International Workshop on Formal Approaches for Advanced Computing Systems

· Round table discussion session chair.

PROGRAM COMMITTEE MEMBER

47th EUROMICRO Conference on Software Engineering and Advanced Applications (SEAA) 2021
Technical track AI4DevOps: AI-Enabled Software Development and Operations

· PC member.

10th International Conference on Cloud Computing and Services Science 2020

· PC member.

9th International Conference on Cloud Computing and Services Science 2019

· PC member.

2nd International Workshop on Formal Approaches for Advanced Computing Systems at the European Conference on Software Architecture 2018

· PC member.

3rd International Workshop on Microservices Science and Engineering at the International Conference on Software Technologies: Applications and Foundations (STAF) 2018

· PC member.

2nd International Workshop on Formal Approaches for Advanced Computing Systems at the International Conference on Software Engineering and Formal Methods (SEFM) 2017

· PC member.

2nd International Workshop on Microservices Science and Engineering at the International Conference on Software Engineering and Formal Methods (SEFM) 2017

· PC member.

REVIEWER FOR INTERNATIONAL CONFERENCES

32nd IEEE International Symposium on Software Reliability Engineering (ISSRE) 2021

· Invited as sub-reviewer.

11th International Workshop on Context-Oriented Programming and Advanced Modularity at the European Conference on Object-Oriented Programming (ECOOP) 2019

· Invited as sub-reviewer.

11th IEEE International Conference on Service Oriented Computing and Applications 2018

· Invited as sub-reviewer.

6th International Conference on Model and Data Engineering (MEDI) 2016

· Invited as sub-reviewer.

13th ACM/IEEE International Conference on Formal Methods and Models for System Design (MEMOCODE) 2015

· Invited as sub-reviewer.

EDITORIAL SERVICE

Springer Computing 2021

· Guest editor for a Special Issue on "Architecting Dependable Multi-paradigm Computing Systems", Link: `https://www.springer.com/journal/607/updates/19611520`. Co-Editors of this special issue are: Raffaela Mirandola, Politecnico di Milano, Italy; Sungwon Kang, Korea Advanced Institute of Science and Technology, South Korea; Patrizia Scandurra, University of Bergamo, Italy.

REFEREE SERVICES FOR INTERNATIONAL JOURNALS

I regularly serve as a reviewer for the following journals:

- IEEE SMC, IEEE Transactions on Systems, Man, and Cybernetics: Systems
- IEEE TSC, IEEE Transactions on Services Computing
- IEEE Access, IEEE Multidisciplinary Open Access Journal
- Elsevier SCP, Science of Computer Programming
- Elsevier RESS, Reliability Engineering & System Safety
- Elsevier JSS, Journal on Systems and Software
- Springer EMSE, Empirical Software Engineering Journal
- Wiley SPE, Software: Practice and Experience
- Wiley CPE, Concurrency and Computation: Practice and Experience
- Wiley JSME, Journal of Software: Evolution and Process
- Wiley IJCS, International Journal of Communication Systems

CO-ORGANIZER OF INTERNATIONAL WORKSHOP/CONFERENCES

19th IEEE International Conference on Software Architecture (ICSA) 2022
Organizing committee

· Student volunteer co-chair, together with Aurora Macías (University of Castilla-La Mancha, Spain).

37th Annual ACM Symposium on Applied Computing (SAC) 2022
10th technical track on Software Architecture: theory, technology, and applications

· Co-organizer, together with Patrizia Scandurra (University of Bergamo, Italy) and Sungwon Kang (Korea Advanced Institute of Science and Technology).

36th Annual ACM Symposium on Applied Computing (SAC) 2021
9th technical track on Software Architecture: theory, technology, and applications

· Co-organizer, together with Patrizia Scandurra (University of Bergamo, Italy) and Sungwon Kang (Korea Advanced Institute of Science and Technology).

5th Workshop on Formal Approaches for Advanced Computing Systems (FAACS) at the European Conference on Software Architecture (ECSA) 2021

· Co-organizer, together with Marcello Bersani (Politecnico di Milano, Italy), Diego Perez-Palacin (Linnaeus University, Sweden), Tsutomu Kobayashi (National Institute of Informatics, Japan).

35th Annual ACM Symposium on Applied Computing (SAC) 2020
8th technical track on Software Architecture: theory, technology, and applications

· Co-organizer, together with Patrizia Scandurra (University of Bergamo, Italy) and Sungwon Kang (Korea Advanced Institute of Science and Technology).

4th Workshop on Formal Approaches for Advanced Computing Systems (FAACS) at the European Conference on Software Architecture (ECSA) 2020

· Co-organizer, together with Stéphanie Challita (Inria, France).

3rd Workshop on Formal Approaches for Advanced Computing Systems (FAACS) at the European Conference on Software Architecture (ECSA) 2019

· Co-organizer, together with Patrizia Scandurra (University of Bergamo, Italy) and Alessandro Bianchi (University of Bari, Italy).

CO-ORGANIZER OF INTERNATIONAL SUMMER SCHOOLS

7th International Summer School on Software Engineering (ISE) 2021

· Co-organizer, together with Barbara Russo, Andrea Janes, Claus Pahl, Ilenia, fronza, Romain Robbes (University of Bozen-Bolzano, Italy), Michael Felderer, and Florian Auer (University of Innsbruck, Austria).

6th International Summer School on Software Engineering (ISE) 2020

· Co-organizer, together with Barbara Russo, Andrea Janes, Claus Pahl, Romain Robbes (University of Bozen-Bolzano, Italy), and Michael Felderer (University of Innsbruck, Austria).

CO-AUTHOR OF RESEARCH PROJECT PROPOSALS

Embrace: Ensuring Resilience of Cloud-native, Socio-technical Systems via (Anti)pattern Characterization, Detection, and Resolution 2021

Joint Project Germany-South Tyrol under the international DFG's funding programmes

· Objective: In Embrace we aim at studying the transient behavior of cloud-native, socio-technical systems and assuring system's change tolerance even though the inherent uncertainty of the surrounding environment. By pursuing this major goal, Embrace will first deal with the lack of engineering methodologies for systematic design, validation, and maintenance of resilient socio-technical systems integrating software, engineered physical elements, and human beings. The activities of Embrace will then contribute to advance the state-of-the-art in engineering resilient systems by developing methodologies and techniques for interactive characterization, detection, diagnosis, and resolution of resilience anti-patterns.

· Role: Principal Investigator for the Free University of Bozen-Bolzano unit

· Partners: co-PI – André van Hoorn (University of Stuttgart, Germany), Mercator fellow module – Catia Trubiani (Gran Sasso Science Institute, Italy)

· Submitted to Funding Agency (currently under review)

CyberPaaS: managing the Computing Continuum in next generation cyber-physical systems 2021

PRIN project proposal

· Objective: CyberPaaS proposes novel solutions to engineer the upcoming generation CPSs leveraging the Edge-to-Cloud computing continuum, while ensuring optimal resources allocation and Quality of Service. The aim is to support the engineering of CPS applications that can be pervasively deployed on a large scale, highly virtualized distributed systems, where expanded resource distribution and tightly integrated computing-networking capabilities exist from the edge of the network to the back-end cloud infrastructure, as well as at computing nodes in between.

· Role: co-author of the proposal and team member of the Free University of Bozen-Bolzano unit

· Partners: PI – Henry Muccini (University of L'Aquila, Italy), Eugenio Zimeo (University of Sannio, Italy), Alberto Ceselli (University of Milan, Italy), Giuseppe Anastasi (University of Pisa, Italy)

· Submitted to Funding Agency (currently under review)

RiCAML: Risk-driven Compliance Assurance for ML-based Systems 2020

Euregio Science Fund - 4th call 2020 Europaregion Euregio Tirol South-Tyrol Trentino

· Objective: This project aims at conceiving and validating an approach to verify the behavior of ML systems by taking a risk management perspective. In the context of the project the partners will explore risk modeling techniques tailored to ML systems, as well as risk analysis and risk mitigation during compliance assurance.
· Role: co-Investigator for the Free University of Bozen-Bolzano unit
· Principal Investigator: Barbara Russo (Free University of Bozen-Bolzano, Italy)
· Partners: Michael Felderer (University of Innsbruck, Austria), Dominik Matt (Fraunhofer Italia), Angelo Susi and Anna Perini (Fondazione Bruno Kessler, Italy)
· Submitted to Funding Agency (currently under review)

ROOTML: Risk-driven Offline and Online Testing of Machine Learners 2020
Joint Project Austria-South Tyrol under the international FWF's funding programmes

· Objective: the overall objective of the project ROOTML is to develop an efficient and effective ML testing framework that supports both offline testing before and online testing after deployment. To properly handle huge and various data the ML testing activities we aim at guiding offline and online testing by risk analysis. The framework will be integrated into a continuous development/integration pipeline to fully automate the testing activities and to provide a rapid feedback to engineers.
· Role: co-Investigator for the Free University of Bozen-Bolzano unit
· Partners: PI – Michael Felderer (University of Innsbruck, Austria)
· Submitted to Funding Agency (currently under review)

PRINCIPAL INVESTIGATOR OF RESEARCH PROJECTS

Automated Performance and Scalability Analysis of Microservices Systems 2021
RTD Projects 2021 call funded by the Free University of Bozen-Bolzano

· Objective: The main goal of AMPERE is to study the theoretical foundations and the associated engineering methods able to provide strong, ideally provable, assurances of performance and scalability requirements for microservices systems. To pursue this high level goal, we will follow different research directions in order to conceive and develop novel methods and tools to support: (i) quantitative approaches for the assessment of microservice architecture configuration alternatives; (ii) automated and active performance model learning to enable formal verification activities; and (iii) software performance antipattern detection for microservice systems.
· Role: Principal Investigator
· Funding: 25000 EUR by the Free University of Bozen-Bolzano

Mining user-intensive applications to support value-based engineering decisions 2020
RTD Projects 2020 call funded by the Free University of Bozen-Bolzano

· Objective: the goal of this project is to develop methods and tools supporting the creation of behavior models from user-intensive applications. The inferred models represent a general abstraction that can be used to analyze technical as well as non-technical and domain-specific aspects of the target application. By analyzing the models we can extract key characteristics of users and identify the most valuable features as well as obsolete features. Furthermore, the model can guide progressive and automatic analysis of large and complex systems as soon as new data become available to guide engineering decisions.
· Role: Principal Investigator
· Funding: 6500 EUR by the Free University of Bozen-Bolzano

USED: Uncertainty Quantification in Software Development 2019
RTD Projects 2019 call funded by the Free University of Bozen-Bolzano

- Objective: The main goal of the project is to devise methods and tools to aid software engineers in understanding and mitigating sources of uncertainty during integration and system testing. Thus, this proposal outlines a research agenda for addressing the challenges identified by this investigation by means of model-based testing techniques that takes into account uncertain aspects emerging from the surrounding environment.
- Role: Principal Investigator
- Funding: 5000 EUR by the Free University of Bozen-Bolzano

PARTICIPATION IN RESEARCH PROJECTS

GAUSS: Governing Adaptive and Unplanned Systems of Systems 2020
PRIN project funded by the Italian Ministry of Education, University and Research (MIUR)

- Role: researcher at the Free University of Bozen-Bolzano unit
- Principal Investigator: Leonardo Mariani (University of Milano-Bicocca, Italy)
- Partners: Free University of Bozen-Bolzano, Fondazione Bruno Kessler, University of Milano-Bicocca, University of Sannio, University of Naples Federico II, University of L'Aquila

SmartBreak: Bialetti Restoration Adaptive Kit 2014
Industrial project funded by the Lombardy region under the call for research and innovation projects in the context of smart cities and communities (B.U.R.L. n. 14 April 4, 2013)

- Role: researcher at the University of Bergamo unit
- Coordinator: Luca Ongaretti (Bialetti Industrie s.p.a, Italy)
- Partners: Bialetti Industrie, Marchesi, Elemaster group, Connexxalife, Signal Lampia, Synergie CAD Instruments, S@it, SAEF, University of Bergamo, University of Brescia

Autonomic Security 2012
PRIN project funded by the Italian Ministry of Education, University and Research (MIUR)

- Role: researcher at the University of Milan unit
- Principal Investigator: Alberto Montresor (University of Trento, Italy)
- Partners: University of Trento, University of Milan, University of Bologna

TEACHING

Formal Methods at Work 2020–2021
4 hours PhD lectures at Gran Sasso Science Institute, Italy (teaching in English)

- Topics: Markov Decision Process, model-based testing, uncertainty mitigation

Verification and Reliability for Dependable Systems (Lab) 2020–2021
20 hours MSc course at Free University of Bozen-Bolzano, Italy (teaching in English)

- Audience: MSc students in Software Engineering for Information Systems
- Topics: dependable properties of systems, software and software systems testing, techniques for verification of software systems, advances in test design and implementation, reliability models

Systems Engineering 2020–2021
40 hours BSc course at Free University of Bozen-Bolzano, Italy (teaching in English)

- Audience: BSc students in Computer Science
- Topics: engineering processes, requirements engineering, specification, informal and formal approaches to validation and verification

Formal Methods at Work 2019–2020

4 hours PhD lectures at Gran Sasso Science Institute, Italy (teaching in English)

- Audience: PhD students in Computer Science
- Topics: Markov Decision Process, model-based testing, uncertainty mitigation

Verification and Reliability for Dependable Systems (Lab) 2019–2020

20 hours MSc course at Free University of Bozen-Bolzano, Italy (teaching in English)

- Audience: MSc students in Software Engineering for Information Systems
- Topics: dependable properties of systems, software and software systems testing, techniques for verification of software systems, advances in test design and implementation, reliability models

Development of Data Products 2019–2020

40 hours MSc course at Free University of Bozen-Bolzano, Italy (teaching in English)

- Audience: MSc students in Computational Data Science
- Topics: data centric software engineering, methods and practices for data product development, domain engineering for data product, managing the software quality of data products, methods for testing, maintenance of software

Software Engineering 2018–2019

48 hours BSc course at University of Eastern Piedmont, Italy (teaching in Italian)

- Audience: BSc students in Computer Science
- Topics: software engineering lifecycle, software quality, requirements, specification, software architecture, design patterns, validation and verification, unit testing

Computer Systems and Networks Security 2018–2019

MSc course at University of Milan, Italy (teaching in Italian)

- Audience: MSc students in Systems and Network Security
- Topics: network protocols, network attacks at different levels of the stack, usage of basic tools (netstat, iproute, nc, nmap), network traffic analysis (tcpdump, wireshark), filtering (iptables)

Software Engineering 2017–2018

48 hours BSc course at University of Eastern Piedmont, Italy (teaching in Italian)

- Audience: BSc students in Computer Science
- Topics: software engineering lifecycle, software quality, requirements, specification, software architecture, design patterns, validation and verification, unit testing

Computer Systems and Networks Security 2017–2018

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- Audience: MSc students in Systems and Network Security
- Topics: network protocols, network attacks at different levels of the stack, usage of basic tools (netstat, iproute, nc, nmap), network traffic analysis (tcpdump, wireshark), filtering (iptables)

Software Engineering (Lab) 2017–2018

48 hours BSc course at University of Milan, Italy (teaching in Italian)

- Audience: BSc students in Computer Science
- Topics: design patterns, Test Driven Development, black-box unit testing, system testing, white-box testing (code coverage), debugging

Software Engineering 2016–2017

48 hours BSc course at University of Eastern Piedmont, Italy (teaching in Italian)

- Audience: BSc students in Computer Science
- Topics: software engineering lifecycle, software quality, requirements, specification, software architecture, design patterns, validation and verification, unit testing

Computer Systems and Networks Security 2016–2017
MSc course at University of Milan, Italy (teaching in Italian)

- Audience: MSc students in Systems and Network Security
- Topics: network protocols, network attacks at different levels of the stack, usage of basic tools (netstat, iproute, nc, nmap), network traffic analysis (tcpdump, wireshark), filtering (iptables)

Software Engineering (Lab) 2016–2017
48 hours BSc course at University of Milan, Italy (teaching in Italian)

- Audience: BSc students in Computer Science
- Topics: design patterns, Test Driven Development, black-box unit testing, system testing, white-box testing (code coverage), debugging

Computer Systems and Networks Security 2015–2016
MSc course at University of Milan, Italy (teaching in Italian)

- Audience: MSc students in Systems and Network Security
- Topics: network protocols, network attacks at different levels of the stack, usage of basic tools (netstat, iproute, nc, nmap), network traffic analysis (tcpdump, wireshark), filtering (iptables)

Software Engineering (Lab) 2015–2016
48 hours BSc course at University of Milan, Italy (teaching in Italian)

- Audience: BSc students in Computer Science
- Topics: design patterns, Test Driven Development, black-box unit testing, system testing, white-box testing (code coverage), debugging

Operating Systems (Lab) 2015–2016
48 hours BSc course at University of Milan, Italy (teaching in Italian)

- Audience: BSc students in Computer Science
- Topics: concurrency principles, threads and processes, parallel and distributed computing

Software Engineering (Lab) 2014–2015
48 hours BSc course at University of Milan, Italy (teaching in Italian)

- Audience: BSc students in Computer Science
- Topics: design patterns, Test Driven Development, black-box unit testing, system testing, white-box testing (code coverage), debugging

Software Engineering (Lab) 2013–2014
48 hours BSc course at University of Milan, Italy (teaching in Italian)

- Audience: BSc students in Computer Science
- Topics: design patterns, Test Driven Development, black-box unit testing, system testing, white-box testing (code coverage), debugging

Software Engineering (Lab) 2012–2013
48 hours BSc course at University of Milan, Italy (teaching in Italian)

- Audience: BSc students in Computer Science

· Topics: design patterns, Test Driven Development, black-box unit testing, system testing, white-box testing (code coverage), debugging

Software Engineering (Lab) 2011–2012
48 hours BSc course at University of Milan, Italy (teaching in Italian)

· Audience: BSc students in Computer Science
· Topics: design patterns, Test Driven Development, black-box unit testing, system testing, white-box testing (code coverage), debugging

STUDENTS CO-SUPERVISION OF THESIS

Bhuiyan Sadmanfuad 2021
BSc student in Computer Science at the Free University of Bozen Bolzano, Italy

· Co-advisor: Andrea Janes
· Thesis: "Decomposition from Monolithic systems to Microservices: a Process Mining Approach"

Gaetano D'Agostino 2019
MSc student in Computer Science at the University of Milan, Italy

· Advisor: Walter Cazzola
· Thesis: "Evil: a Domain Specific Language to Model Reflective Petri Nets"

Silvia Pedersoli 2018
MSc student in Computer Science at the University of Milan, Italy

· Advisor: Carlo Bellettini
· Thesis: "A Formal Framework to Model and Verify Microservices Process Flows"

Stefano Tagliabue 2016
BSc student in Computer Science at the University of Milan, Italy

· Advisor: Carlo Bellettini
· Thesis: "Coverability Analysis of Time Basic Petri Nets with Non-urgent Behavior"

Silvia Pedersoli 2016
BSc student in Computer Science at the University of Milan, Italy

· Advisor: Carlo Bellettini
· Thesis: "Runtime Verification of Time-dependent Java Applications"

Antonio Monaca 2013
MSc student in Computer Science at the University of Milan, Italy

· Advisor: Mattia Monga
· Thesis: "Distributed Botnet Detection using Clustering Algorithms"

STUDENTS CO-SUPERVISION OF RESEARCH PROJECTS

Mubashir Ali Cheema 2021
PhD student at the University of Bergamo, Italy

· Advisor: Patrizia Scandurra
· Project: Resilience assurance of Cyber-Physical Systems using multi-objective optimizing search

PH.D. STUDENTS CO-SUPERVISION

Jubril Adigun 2021

PhD student in Computer Science at the University of Innsbruck, Austria

· Advisor: Michael Felderer

· Thesis: "Online Testing of Software Systems under Uncertain Environment Conditions"

POSTDOCTORAL RESEARCHERS SUPERVISION

Sandeep Gupta 2021

Free University of Bozen-Bolzano, Italy

· Postdoc position in the context of the research project "AMPERE: Automated Performance and Scalability Analysis of Microservices Systems" funded by the Free University of Bozen-Bolzano (Principal Investigator: Matteo Camilli).

PUBLICATIONS

Refereed International Journal Articles

- Matteo Camilli, Andrea Janes, and Barbara Russo. Automated test-based learning and verification of performance models for microservices systems. *Journal of Systems and Software, Elsevier*, 2021d. To appear

- Matteo Camilli and Lorenzo Capra. Formal specification and verification of decentralized self-adaptive systems using symmetric nets. *Discrete Event Dynamic Systems*, Aug 2021. ISSN 1573-7594. doi: 10.1007/s10626-021-00343-3. URL `https://doi.org/10.1007/s10626-021-00343-3`

- Matteo Camilli, Angelo Gargantini, and Patrizia Scandurra. Model-based hypothesis testing of uncertain software systems. *Software Testing, Verification and Reliability*, 30(2):e1730, 2020b. doi: https://doi.org/10.1002/stvr.1730. URL `https://onlinelibrary.wiley.com/doi/abs/10.1002/stvr.1730`. e1730 stvr.1730

- Matteo Camilli, Angelo Gargantini, and Patrizia Scandurra. Zone-based formal specification and timing analysis of real-time self-adaptive systems. *Science of Computer Programming*, 159:28–57, 2018e. ISSN 0167-6423. doi: https://doi.org/10.1016/j.scico.2018.03.002. URL `https://www.sciencedirect.com/science/article/pii/S0167642318300753`

- Carlo Bellettini, Matteo Camilli, Lorenzo Capra, and Mattia Monga. Distributed ctl model checking using mapreduce: theory and practice. *Concurrency and Computation: Practice and Experience*, 28(11):3025–3041. doi: https://doi.org/10.1002/cpe.3652. URL `https://onlinelibrary.wiley.com/doi/abs/10.1002/cpe.3652`

Peer-reviewed Conference papers

- Matteo Camilli, Raffaela Mirandola, and Patrizia Scandurra. Runtime equilibrium verification for resilient cyber-physical systems. In *2021 2nd IEEE International Conference on Autonomic Computing and Self-Organizing Systems (ACSOS)*, 2021f. To appear

- Matteo Camilli, Angelo Gargantini, Patrizia Scandurra, and Catia Trubiani. Uncertainty-aware exploration in model-based testing. In *2021 14th IEEE Conference on Software Testing, Verification and Validation (ICST)*, pages 71–81, 2021c. doi: 10.1109/ICST49551.2021.00019

- Alberto Avritzer, Ricardo Britto, Catia Trubiani, Barbara Russo, Andrea Janes, Matteo Camilli, André van Hoorn, Robert Heinrich, Martina Rapp, and Jörg Henß. A multivariate characterization and detection of software performance antipatterns. In *Proceedings of the ACM/SPEC International Conference on Performance Engineering*, ICPE '21, page 61–72, New York, NY, USA, 2021a. Association for Computing Machinery. ISBN 9781450381949. doi: 10.1145/3427921.3450246. URL `https://doi.org/10.1145/3427921.3450246`. **Best paper nominee**

- Alberto Avritzer, Matteo Camilli, Andrea Janes, Barbara Russo, Jasmin Jahič, André van Hoorn, Ricardo Britto, and Catia Trubiani. PPTAM$^{\lambda}$: What, where, and how of cross-domain scalability assessment. In *2021 IEEE 18th International Conference on Software Architecture Companion (ICSA-C)*, pages 62–69, 2021b. doi: 10.1109/ICSA-C52384.2021.00016

- Matteo Camilli, Michael Felderer, Andrea Giusti, Dominik Tobias Matt, Anna Perini, Barbara Russo, and Angelo Susi. Risk-driven compliance assurance for collaborative AI systems: A vision paper. In Fabiano Dalpiaz and Paola Spoletini, editors, *Requirements Engineering: Foundation for Software Quality*, pages 123–130, Cham, 2021b. Springer International Publishing. ISBN 978-3-030-73128-1

- Matteo Camilli and Barbara Russo. Model-based testing under parametric variability of uncertain beliefs. In Frank de Boer and Antonio Cerone, editors, *Software Engineering and Formal Methods*, pages 175–192, Cham, 2020. Springer International Publishing. ISBN 978-3-030-58768-0

- Matteo Camilli, Angelo Gargantini, Rosario Madaudo, and Patrizia Scandurra. Hyppotest: Hypothesis testing toolkit for uncertain service-based web applications. In Wolfgang Ahrendt and Silvia Lizeth Tapia Tarifa, editors, *Integrated Formal Methods*, pages 495–503, Cham, 2019b. Springer International Publishing. ISBN 978-3-030-34968-4

- Lorenzo Capra and Matteo Camilli. Formalizing distributed self-adaptive systems using high-level petri nets. In *Proceedings of the 2019 Summer Simulation Conference*, SummerSim '19, San Diego, CA, USA, 2019. Society for Computer Simulation International

- Matteo Camilli, Lorenzo Capra, and Carlo Bellettini. Pnemu: An extensible modeling library for adaptable distributed systems. In Susanna Donatelli and Stefan Haar, editors, *Application and Theory of Petri Nets and Concurrency*, pages 80–90, Cham, 2019a. Springer International Publishing. ISBN 978-3-030-21571-2

- Matteo Camilli, Carlo Bellettini, Angelo Gargantini, and Patrizia Scandurra. Online model-based testing under uncertainty. In *2018 IEEE 29th International Symposium on Software Reliability Engineering (ISSRE)*, pages 36–46, 2018d. doi: 10.1109/ISSRE.2018.00015

- Lorenzo Capra and Matteo Camilli. A symmetric nets emulator for adaptive p/t nets. In *2018 20th International Symposium on Symbolic and Numeric Algorithms for Scientific Computing (SYNASC)*, pages 183–190, 2018b. doi: 10.1109/SYNASC.2018.00038

- Matteo Camilli, Angelo Gargantini, Patrizia Scandurra, and Carlo Bellettini. Towards inverse uncertainty quantification in software development (short paper). In Alessandro Cimatti and Marjan Sirjani, editors, *Software Engineering and Formal Methods*, pages 375–381, Cham, 2017b. Springer International Publishing. ISBN 978-3-319-66197-1

- Matteo Camilli, Angelo Gargantini, Patrizia Scandurra, and Carlo Bellettini. Event-based runtime verification of temporal properties using time basic petri nets. In Clark Barrett, Misty Davies, and Temesghen Kahsai, editors, *NASA Formal Methods*, pages 115–130, Cham, 2017a. Springer International Publishing. ISBN 978-3-319-57288-8

- Matteo Camilli, Carlo Bellettini, Lorenzo Capra, and Mattia Monga. Coverability analysis of time basic petri nets with non-urgent behavior. In *2016 18th International Symposium on Symbolic and Numeric Algorithms for Scientific Computing (SYNASC)*, pages 165–172, 2016. doi: 10.1109/SYNASC.2016.036

- Matteo Camilli, Angelo Gargantini, and Patrizia Scandurra. Specifying and verifying real-time self-adaptive systems. In *2015 IEEE 26th International Symposium on Software Reliability Engineering (ISSRE)*, pages 303–313, 2015. doi: 10.1109/ISSRE.2015.7381823

- Matteo Camilli, Carlo Bellettini, Lorenzo Capra, and Mattia Monga. Ctl model checking in the cloud using mapreduce. In *2014 16th International Symposium on Symbolic and Numeric*

Algorithms for Scientific Computing, pages 333–340, 2014. doi: 10.1109/SYNASC.2014.52

- Matteo Camilli. Formal verification problems in a big data world: Towards a mighty synergy. In *Companion Proceedings of the 36th International Conference on Software Engineering*, ICSE Companion 2014, page 638–641, New York, NY, USA, 2014. Association for Computing Machinery. ISBN 9781450327688. doi: 10.1145/2591062.2591088. URL `https://doi.org/10.1145/2591062.2591088`

- Carlo Bellettini, Matteo Camilli, Lorenzo Capra, and Mattia Monga. Symbolic state space exploration of rt systems in the cloud. In *2012 14th International Symposium on Symbolic and Numeric Algorithms for Scientific Computing*, pages 295–302, 2012. doi: 10.1109/SYNASC.2012.18

- Matteo Camilli. Petri nets state space analysis in the cloud. In *Proceedings of the 34th International Conference on Software Engineering*, ICSE '12, page 1638–1640. IEEE Press, 2012. ISBN 9781467310673

Peer-reviewed Workshop papers

- Matteo Camilli, Michael Felderer, Andrea Giusti, Dominik T. Matt, Anna Perini, Barbara Russo, and Angelo Susi. Towards risk modeling for collaborative ai. In *2021 IEEE/ACM 1st Workshop on AI Engineering - Software Engineering for AI (WAIN)*, pages 51–54, 2021a. doi: 10.1109/WAIN52551.2021.00014

- Matteo Camilli, Carmine Colarusso, Barbara Russo, and Eugenio Zimeo. Domain metric driven decomposition of data-intensive applications. In *2020 IEEE International Symposium on Software Reliability Engineering Workshops (ISSREW)*, pages 189–196, 2020a. doi: 10.1109/ISSREW51248.2020.00071

- Matteo Camilli. Continuous formal verification of microservice-based process flows. In Henry Muccini, Paris Avgeriou, Barbora Buhnova, Javier Camara, Mauro Caporuscio, Mirco Franzago, Anne Koziolek, Patrizia Scandurra, Catia Trubiani, Danny Weyns, and Uwe Zdun, editors, *Software Architecture*, pages 420–435, Cham, 2020. Springer International Publishing. ISBN 978-3-030-59155-7

- Matteo Camilli, Raffaela Mirandola, Patrizia Scandurra, and Catia Trubiani. Towards model-based reinforcement learning to test uncertain software systems. In *1st Uncertainty in Modeling Workshop 2020 co-located with the ACM/IEEE 23rd International Conference on Model Driven Engineering Languages and Systems (MODELS)*, 2020c

- Lorenzo Capra and Matteo Camilli. Emulating self-adaptive stochastic petri nets. In Marco Gribaudo, Mauro Iacono, Tuan Phung-Duc, and Rostislav Razumchik, editors, *Computer Performance Engineering*, pages 33–49, Cham, 2020. Springer International Publishing. ISBN 978-3-030-44411-2

- Matteo Camilli, Carlo Bellettini, and Lorenzo Capra. A high-level petri net-based formal model of distributed self-adaptive systems. In *Proceedings of the 12th European Conference on Software Architecture: Companion Proceedings*, ECSA '18, New York, NY, USA, 2018a. Association for Computing Machinery. ISBN 9781450364836. doi: 10.1145/3241403.3241445. URL `https://doi.org/10.1145/3241403.3241445`

- Lorenzo Capra and Matteo Camilli. Towards evolving petri nets: a symmetric nets-based framework. *IFAC-PapersOnLine*, 51(7):480–485, 2018a. ISSN 2405-8963. doi: https://doi.org/10.1016/j.ifacol.2018.06.343. 14th IFAC Workshop on Discrete Event Systems WODES 2018

- Matteo Camilli, Carlo Bellettini, Lorenzo Capra, and Mattia Monga. A formal framework for specifying and verifying microservices based process flows. In Antonio Cerone and Marco Roveri, editors, *Software Engineering and Formal Methods*, pages 187–202, Cham, 2018c. Springer International Publishing. ISBN 978-3-319-74781-1

- Matteo Camilli, Carlo Bellettini, and Lorenzo Capra. Design-time to run-time verification of

microservices based applications. In Antonio Cerone and Marco Roveri, editors, *Software Engineering and Formal Methods*, pages 168–173, Cham, 2018b. Springer International Publishing. ISBN 978-3-319-74781-1

- Carlo Bellettini, Matteo Camilli, Lorenzo Capra, and Mattia Monga. Mardigras: Simplified building of reachability graphs on large clusters. In Parosh Aziz Abdulla and Igor Potapov, editors, *Reachability Problems*, pages 83–95, Berlin, Heidelberg, 2013. Springer Berlin Heidelberg. ISBN 978-3-642-41036-9

Editorial Messages

- Matteo Camilli, Sungwon Kang, and Patrizia Scandurra. Session details: Theme: Software design and development: Satta - software architecture: Theory, technology, and applications track. In *Proceedings of the 36th Annual ACM Symposium on Applied Computing*, SAC '21, New York, NY, USA, 2021e. Association for Computing Machinery. ISBN 9781450381048. doi: 10.1145/3462431. URL `https://doi.org/10.1145/3462431`

- Matteo Camilli and Patrizia Scandurra. Session details: Theme: Software design and development: Satta - software architecture: Theory, technology, and applications track. In *Proceedings of the 35th Annual ACM Symposium on Applied Computing*, SAC '20, New York, NY, USA, 2020. Association for Computing Machinery. ISBN 9781450368667. doi: 10.1145/3389670. URL `https://doi.org/10.1145/3389670`

- A. Bianchi, M. Camilli, and P. Scandurra. 3rd workshop on formal approaches for advanced computing systems (FAACS). In *ACM International Conference Proceeding Series*, 2019

CITATION INDICES

Google Scholar (last update: Oct 2021)

- Citations: 274
- H-index: 11
- i10-index: 12

Scopus (last update: Oct 2021)

- Citations: 170
- H-index: 9