

University Academic Curriculum Vitae

Personal information Name: Matteo Camilli
Place of birth: Vizzolo Predabissi (MI), Milano, Italy
Date of birth: December 19, 1986
Nationality: Italian
Number of children: 0
Year of birth of the children: -
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Education since leaving school

- 2005 - 2008. B.Sc. in Computer Science, Università degli Studi di Milano, Milan, Italy
- 2009 - 2011. M.Sc. in Computer Science, Università degli Studi di Milano, Milan, Italy
- 2012 - 2015. Ph.D. in Computer Science, Dept. of Computer Science, Università degli Studi di Milano, Milan, Italy

Present appointment

- 2015 - present. Postdoctoral Research Fellow
- Dept. of Computer Science, Università degli Studi di Milano, Milan, Italy
- I'm currently a postdoctoral research fellow at the Computer Science department of the University of Milan. Since June 2018 I'm in the computer science dept. board as delegate of postdoctoral researchers.

Subject area: Computer Science, Mathematics, Engineering.
OrcID: <http://orcid.org/0000-0003-2491-5267>.

Professional experience

Chronological list of all previous employments

2012–2013. Research grant holder. Università degli Studi di Milano, Milan, Italy. Distributed analysis of internet traffic for protocol and structure independent botnet detection.

2014–2015. Research and Development, Collaboration with Bialetti Industrie S.p.A, Brescia, Italy. Requirements and use case analysis. Definition of the interactions between roles and components in the Smart break project: <http://www.smartbreakproject.it>.

2014–2015. Research grant holder, Università degli Studi di Bergamo, Bergamo, Italy. Research activities in the macro areas of Software Engineering, formal methods, formal Verification, self-adaptive systems, real-time systems, parallel and distributed Systems

2015 - present. Postdoctoral research fellow, Università degli Studi di Milano, Italy. Research activities in the macro areas of Formal methods in Software Engineering: modeling and analysis of adaptable and evolvable complex systems

Participation in exhibitions (where applicable)

Invited seminars

2019. DEIB - Politecnico di Milano, Italy, I was invited by Prof. Pierluigi San Pietro to talk about my research activity carried out during my postdoctoral fellowship. The seminar was entitled "My past, present (and ulterior) research activity".

2015. DIGIP - Università degli Studi di Bergamo, Italy, I was invited by the head of the FOSE Lab, Prof. Angelo Gargantini to talk about the application of formal methods leveraging modern parallel architectures. The seminar was entitled "Coping with the State Explosion Problem in Formal Methods: Advanced Abstraction Techniques and Big Data Approaches".

2014. DEIB - Politecnico di Milano, Italy, I was invited by the head of the DEEPSE group, Prof. Carlo Ghezzi, to talk about my research activity carried out during my Ph.D. program. The seminar was entitled "Formal verification problems in a big data world: Towards a mighty synergy".

2014. DEIB - Politecnico di Milano, Italy, I was invited by the head of the DEEPSE group, Prof. Carlo Ghezzi, to discuss and exchange ideas on common research interests and directions. The seminar was about "Distributed model checking on large clusters".

Experience in academic teaching

Teacher (responsibility role)

From a.y. 2016-2017 to 2018-2019. Software Engineering (Ingegneria del software), Fundamental course for undergraduate students, Dipartimento di Scienze e Innovazione Tecnologica (DiSIT), Università degli Studi del Piemonte Orientale.Vercelli, Italy

Laboratory Teacher

From a.y. 2012-2013 to 2017-2018. Software Engineering (Ingegneria del software), Fundamental course for undergraduate students, Dipartimento di Informatica, Università degli Studi di Milano, Italy

A.y. 2015-2016. Operating Systems (Sistemi Operativi), Fundamental course for undergraduate students, Dipartimento di Ingegneria gestionale, dell'informazione e della produzione (DIGIP), Università degli Studi di Bergamo, Italy

A.y. 2011-2012. Software design (Progettazione del software), Fundamental course for undergraduate students, Dipartimento di Informatica, Università degli Studi di Milano, Italy

Tutor

From a.y. 2015-2016 to 2018-2019. Computer Systems and Networks Security (Sicurezza dei Sistemi e delle Reti Informatiche), Fundamental course for graduate students, Dipartimento di Informatica, Università degli Studi di Milano, Italy

Other academic responsibilities

Internal appointments

2018-2019. Member of the computer science dept. board as delegate of postdoctoral researchers

External appointments

2020. FAACS 2019, 4th International Workshop on Formal Approaches for Advanced Computing Systems. Co-located with the 14th European Conference on Software Architecture (ECSA 2020), In Organizing Committee: program co-chair

2020. SA-TTA 2020, 8th ACM SAC track on Software Architecture: Theory, Technology, and Applications. Technical track of the 35th ACM/SIGAPP Symposium on Applied Computing (SAC). In Organizing Committee: program co-chair

2019. FAACS 2019, 3rd International Workshop on Formal Approaches for Advanced Computing Systems. Co-located with the 13th European Conference on Software Architecture (ECSA 2019), In Organizing Committee: program co-chair

Memberships

Program committee member of international conferences

2020. CLOSER 2020, 10th International Conference on Cloud Computing and Services Science, In PC

2019. CLOSER 2019, 9th International Conference on Cloud Computing and Services Science

2018. FAACS 2018, 2nd International Workshop on Formal Approaches for Advanced Computing Systems. Co-located with the 12th European Conference on Software Architecture (ECSA 2018)

2018. MSE 2018, 3rd International Workshop on Microservices: Science and Engineering. Co-located with STAF (Software Technologies: Applications and Foundations) 2018

2017. FAACS 2017, 1st International Workshop on Formal Approaches for Advanced Computing Systems. Co-located with the 15th Int. conference on Software Engineering and Formal Methods (SEFM 2017)

2017. MSE 2017, 2nd International Workshop on Microservices: Science and Engineering. Co-located with the 15th Int. conference on Software Engineering and Formal Methods (SEFM 2017)

External reviewer for international conferences

2019. COP 2019, The 11th International Workshop on Context-Oriented Programming and Advanced Modularity (COP)

2018. SOCA 2018, The 11th IEEE International Conference on Service Oriented Computing and Applications

2016. MEDI 2016, 6th International Conference on Model and Data Engineering

2015. 13th ACM-IEEE International Conference on Formal Methods and Models for System Design

Referee Services for International 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
- Wiley SPE: Software: Practice and Experience
- Wiley CPE: Concurrency and Computation: Practice and Experience

Research and scholarships

Research areas

My main research interests cover the macro-areas of formal methods and software engineering with particular focus on:

- Software requirements specification, analysis and verification; Model-based testing;
- Uncertainty quantification along the software lifecycle;
- Design-time and runtime verification of software systems;
- Formal modeling using Markov models;

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

Scientific Results

I'm co-author of a number of scientific publications on peer-reviewed international conferences/workshops and journals. During my Ph.D. program I have been selected by the ACM Student Research competition at the 39th International Conference on Software Engineering (ICSE 2012). I have been awarded twice by Amazon.com, Inc. AWS Research grant. According to Google Scholar (September 2019), my h-index is 7 with 134 as a total number of citations. Currently, my major research contributions concern: the usage of massively parallel distributed architectures to verify efficiently correctness of complex software systems; the definition of a methodology to deal with the Inverse Uncertainty Quantification (IUQ) problem during the development lifecycle and its usage in the area of service-oriented applications; the definition of formal models to specify and verify distributed (time-dependent) self-adaptive systems having decentralized adaptation control.

Research grants

2015-2016. Amazon.com, Inc. AWS Research grant, AWS Cloud Credits 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

2014. ACM SIGSOFT CAPS, Travel grant recipient to participate in the Doctoral Symposium of the International Conference on Software Engineering (ICSE) 2014

2012. ACM SIGSOFT CAPS, Travel grant recipient to participate in the ACM student research competition of the International Conference on Software Engineering (ICSE) 2012

Publications

Refereed International Journal Articles

[JR.1] 2018, L. Capra, M. Camilli, Towards Evolving Petri Nets: a Symmetric Nets-based Framework, IFAC-PapersOnLine - Elsevier, Volume 51, Issue 7, 2018, Pages 480- 485, ISSN 2405-8963, <https://doi.org/10.1016/j.ifacol.2018.06.343>

[JR.2] 2018, M. Camilli, A. Gargantini, and P. Scandurra. Zone-based formal specification and timing analysis of real-time self-adaptive systems. Science of Computer Programming - Elsevier, 159:28-57, 2018

[JR.3] 2016, C. Bellettini, M. Camilli, L. Capra, and M. Monga. Distributed CTL model checking using MapReduce: Theory and practice. Concurrency and Computation: Practice and Experience - Wiley, 28(11):3025-3041, August 2016

Refereed International Conference and Workshop Papers

[IC.1] 2019, M. Camilli, and L. Capra. Formalizing Distributed Self-adaptive Systems using High-level Petri Nets. In Proceedings of the Summer Simulation Multi-Conference (SummerSim'19). Society for Computer Simulation International, San Diego, CA, USA. To appear

[IC.2] 2019, Camilli M., Capra L., Bellettini C. (2019) PNemu: An Extensible Modeling Library for Adaptable Distributed Systems. In: Donatelli S., Haar S. (eds) Application and Theory of Petri Nets and Concurrency. PETRI NETS 2019. Lecture Notes in Computer Science, vol 11522. Springer, Cham

[IC.3] 2018, M. Camilli, C. Bellettini, A. Gargantini and P. Scandurra, "Online Model-Based Testing under Uncertainty," 2018 IEEE 29th International Symposium on Software Reliability Engineering (ISSRE), Memphis, TN, USA, 2018, pp. 36-46. doi: 10.1109/ISSRE.2018.00015.

[IC.4] 2018, M. Camilli, L. Capra. A Symmetric Nets Emulator for Adaptive P/T Nets. In 2018 20th International Symposium on Symbolic and Numeric Algorithms for Scientific Computing, To appear.

[IC.5] 2018, M. Camilli, C. Bellettini, and L. Capra. A high-level petri net-based formal model of distributed self-adaptive systems. In 12th European Conference on Software Architecture: Companion Proceedings (ECSA '18), volume ACM, New York, NY, USA, September 24-28 2018

[IC.6] 2018, M. Camilli, C. Bellettini, and L. Capra. Design-time to runtime verification of microservices based applications. In Antonio Cerone and Marco Roveri, editors, Software Engineering and Formal Methods, pages 168-173, Cham, 2018. Springer International Publishing

[IC.7] 2018, M. Camilli, C. Bellettini, L. Capra, and M. 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, 2018. Springer International Publishing

[IC.8] 2017, M. Camilli, A. Gargantini, P. Scandurra, and C. 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, 2017. Springer International Publishing

[IC.9] 2017, M. Camilli, A. Gargantini, P. Scandurra, and C. 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, 2017. Springer International Publishing.

[IC.10] 2016, M. Camilli, C. Bellettini, L. Capra, and M. 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, Sept 2016

[IC.11] 2015, M. Camilli, A. Gargantini, and P. Scandurra. Specifying and verifying real- time self-adaptive systems. In 2015 IEEE 26th International Symposium on Software Reliability Engineering (ISSRE), pages 303-313, Nov 2015

[IC.12] 2014, M. Camilli, C. Bellettini, L. Capra, and M. 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, Sept 2014

[IC.13] 2014, M. 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, pages 638-641, New York, NY, USA, 2014. ACM.

[IC.14] 2013, C. Bellettini, M. Camilli, L. Capra, and M. 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

[IC.15] 2012, C. Bellettini, M. Camilli, L. Capra, and M. 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, Sept 2012

[IC.16] 2012, M. Camilli. Petri nets state space analysis in the cloud. In 2012 34th International Conference on Software Engineering (ICSE), pages 1638-1640, June 2012

Submissions Under Review

[UR.1] 2019, M. Camilli, A. Gargantini and P. Scandurra. Uncertainty Quantification in Software Development Combining Model-based Testing and Bayesian Inference. Invited Special Issue Paper. Software Testing Verification and Reliability - Wiley. Submitted for publication

[UR.2] 2019, M. Camilli, L. Capra. Modeling and Verification of Self-adaptive Distributed Discrete-event Systems Using Symmetric Nets. Invited Special Issue Paper. Discrete-event Dynamic Systems - Springer. Submitted for publication

[UR.3] 2020, M. Camilli, A. Gargantini, P. Scandurra, C. Trubiani. Evaluating Uncertainty-aware Testing Methods by Delivered Confidence. ICSE 2020. Submitted for publication

Further data

Participation as speaker at International Conferences (last 3 years)

2019. FAACS 2019. 3rd International Workshop on Formal Approaches for Advanced Computing Systems @ ECSA 2019. Paris, France. 10 September, 2019

2019. PETRI NETS 2019, The 40th International Conference on Application and Theory of Petri Nets and Concurrency. June 23-28, 2019. Aachen, Germany

2018. ISSRE 2018, The 29th IEEE International Symposium on Software Reliability Engineering. October 15-18, 2018. Memphis, TN, USA

2018. SYNASC 2018, 20th International Symposium on Symbolic and Numeric Algorithms for Scientific Computing (SYNASC). September 20 - 23 2018, Timisoara, Romania, Logic and Programming track

FAACS 2018, 2nd International Workshop on Formal Approaches for Advanced Computing Systems @ ECSA 2018. Madrid, Spain. 24 September, 2018

2018. WODES 2018, 14th International Workshop on Discrete Event Systems. May 30 - June 1, 2018. Sorrento Coast, Italy

2017. FAACS 2017, 1st International Workshop on Formal Approaches for Advanced Computing Systems @ MSE 2017. Trento, Italy. September 4th, 2017

2017. MSE 2017, 2nd International Workshop on Microservices: Science and Engineering @ MSE 2017. Trento, Italy. September 4th, 2017

2017. SEFM 2017, 15th International Conference on Software Engineering and Formal Methods. September 4 - 8 2017. Trento, Italy

2017. NFM 2017, 9th NASA Formal Methods International Symposium. Moffett Field, CA, USA May 16 - 18, 2017

2016. SYNASC 2016, 18th International Symposium on Symbolic and Numeric Algorithms for Scientific Computing (SYNASC). Timisoara, Romania, 24 - 27 September 2016, Logic and Programming track

Statement of interest Expected contribution to the advertised position are in different fields belonging to the macro area of software engineering. In particular some details about my recent (and still open) research activities follow:

- Distributed formal verification using cloud computing:

Massively parallel Cloud computing platforms represent a great opportunity to run heavy time-consuming tasks dealing with the state explosion problem in many formal verification activities. The idea is that classical formal verification tools and techniques should undergo a deep technological transition to take advantage of the available powerful architectures. Namely, we developed distributed approaches to verification of Computation Tree Logic (CTL) requirements on very large state spaces. Our approach exploits and integrates a parametric state-space builder so called *Mardigras* [IC12], [IC13], we designed to ease the adoption of “big data” platforms. The whole framework, composed by the state-space builder and the model-checker, leverages Hadoop Map-Reduce as its computational engine and can be easily specialized to deal with explicit model checking on huge state spaces generated from different formalisms. We successfully exploited it to perform verification of several benchmarking system examples, as shown in the following works [IC.11], [IC.12], [IC.13], [IC.14], [IC.15], accepted for presentation at different international conferences, such as the International Conference on Software Engineering (ICSE) 2012, 2014, and the International Symposium on Symbolic and Numeric Algorithms for Scientific Computing (SYNASC) 2012, 2015. Major results of this line of research have been published also in the invited special issue paper of “Concurrency and Computation: Practice and Experience” journal by Wiley [JR.3]. In 2015 and 2016 I've been awardee by the Amazon.com, Inc. AWS Research grant to perform proof of concept/benchmarking activities to evaluate the efficacy of leveraging Cloud computing facilities to create formal verification tasks as a service.

- Uncertainty Quantification in Software Development:

The problem of uncertainty quantification is recently gaining attention in the software engineering community since it has a significant impact on the ability of a software system to satisfy its objectives. The Inverse Uncertainty Quantification (IUQ) problem deals with estimation of the discrepancy between measured data at runtime and initial imperfect mathematical models (bias correction) to estimate values of unknown parameters (parameter calibration). We revisited the IUQ problem in software development and we proposed an approach for quantifying system uncertainty before the deployment, during integration testing activity. Namely, we propose a methodology to quantify and mitigate uncertainty combining Model-based testing (MBT) techniques and Bayesian inference. Major contributions in this field appeared in the proceedings of international conferences [IC.2], [IC.7], such as the international conference on Software Engineering and Formal Methods (SEFM), and the International Symposium on Software Reliability Engineering (ISSRE). We currently have an invited special issue paper submitted for possible publication in the journal of “Software Testing Verification and Reliability” by Wiley [UR.1].

Formal Verification of Distributed and time-dependent Self-adaptive Systems:

During our research activity in this area, we developed a formal framework to specify and verify the behavior of real-time self-adaptive systems. In particular, our main target systems are self-adaptive systems that exhibit a self-healing behavior. We define a specification formalism based on Petri nets extended with time. The proposed formalism provides enhancements to model self-adaptive systems with real-time constraints. In particular, we formalize and verify self-adaptation with temporal constraints.

Major contributions has been published in the proceedings of international conferences, such as the International Symposium on Software Reliability Engineering (ISSRE) and as journal article in "Science of Computer Programming" by Elsevier [IC.10], [JR.2]. Other research directions in this field were conducted to deal with formal specification and verification of distributed self- adaptive systems having decentralized adaptation control. Namely, we developed a formalism that leverages the theoretical foundation of High-level Petri nets and takes inspiration from reflective systems to realize a two-layered modeling framework. The approach allows both concurrency and adaptation aspects to be easily represented. We also support formal verification activities through existing off-the-shelf state space builders and model checkers. Major contributions in this field appeared in the proceedings of international conferences and workshops [IC.1], [IC.2], [IC.3], [IC.4], such as International Conference on Application and Theory of Petri Nets and Concurrency (Petri Nets), the international Workshop on Discrete Event Systems (WODES), the International Symposium on Symbolic and Numeric Algorithms for Scientific Computing (SYNASC), and the European Conference on Software Architecture (ECSA). We currently have an invited special issue paper submitted for possible publication in the journal of "Discrete-event Dynamic Systems" by Springer [UR.3].

**Language
competence**

- Italian: Mother tongue
- English: Professional working proficiency
- CERF levels: Listening B2, Reading C1, Spoken interaction B2, Spoken production B2, Writing C1

Date 12/09/2019

Signature
