Matteo Biagiola

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About me

My research primarily focuses on automating system-level testing to enhance the quality of complex software. In particular, I develop computational techniques and tools to automate manual and error-prone testing activities. Detecting failures at the system level is crucial, as these failures directly impact the end users, especially for business-critical and safety-critical applications, such as Web applications and Self-driving cars. While system-level testing is computationally expensive, my concrete goal is to improve its efficiency without compromising effectiveness.

Employment

2020 - present **Postdoctoral Fellow at Software Institute**, *Università della Svizzera italiana, Lugano*, Switzerland
During my PostDoc, I focused both on testing learning-based systems, i.e., Reinforcement Learning and Deep Learning, and on using such techniques to test other systems (such as Web applications, and Self-driving cars).

Education

2016 - 2020 **PhD in Computer Science and Systems Engineering**, *Università di Genova*, Italy, joint PhD with Fondazione Bruno Kessler (FBK), Trento, Italy
During my PhD, I worked on testing Web applications from a functional perspective. I focused on automatically generating User Interface (UI) tests to thoroughly explore the Web application under test and exercise its functionalities.

August 2018 **Visiting student**, *University of British Columbia (UBC), Vancouver*, Canada

2016 **MSc in Computer Science and Systems Engineering**, *Università Politecnica delle Marche, Ancona*, Italy, grade 110/110 cum laude

2014 **BSc in Computer Science and Systems Engineering**, *Università Politecnica delle Marche, Ancona*, Italy, grade 110/110

Main Advising Experience

2024 **Gianluca Ghislotti**, *MSc at Università della Svizzera italiana*, Lugano, Switzerland
Thesis co-advisor: *the topic of Gianluca's thesis is to improve the readability of automatically generated tests using Large Language Models (LLMs).*

2023-present **Luca Giamattei**, *PhD Candidate at Università degli Studi di Napoli Federico II*, Naples, Italy
Collaborator: *with Luca we work on testing Self-driving car software using Reinforcement Learning combined with Causal Inference.*

2022-present **Andrèa Doreste**, *PhD Candidate at Università della Svizzera italiana*, Lugano, Switzerland
Formal co-advisor: *Andrèa's topic concerns the use of Reinforcement Learning algorithms to create adversarial agents for Self-driving car software.*

2022 **Giorgio Macauda**, *MSc at Università della Svizzera italiana*, Lugano, Switzerland
Thesis co-advisor: *Giorgio's thesis was about training a Reinforcement Learning agent to drive a small-scale electric vehicle along a real track.*

Publications

I published 18 articles, including 6 top-ranked Q_1 journal papers based on SCIMAGO [1] (two TOSEM, two EMSE and one TSE), and 9 top-level A*/A Class conferences according to the CORE conference ranking [2].

Service

I served in 20+ program committees of international conferences and workshops, such as ICSME and ICST, and I regularly review papers for major international journals such as TOSEM, TSE and EMSE. For my reviewing work, I was awarded four distinguished reviewer awards at ICSME 2024, ICST 2024, ICSME 2023, and TOSEM 2023.

Outreach

I am in the organization committee of two software engineering workshops, namely DEEPTEST, since three editions (2023, 2024, and 2025), and Search Based and Fuzz Testing (SBFT), since 2025. I co-organized for two consecutive editions, i.e., in 2023 and 2024, of the Cyber-Physical System competition in the context of SBFT. Both workshops are colocated with the most prestigious software engineering conference, i.e., International Conference on Software Engineering (ICSE).
I also co-chaired the FORMULAUSI [3] hackathon on self-driving, held in Lugano in both 2021 and 2022. This two-day, time-based, competition required participants to develop a Deep Learning model to autonomously drive a small-scale electric vehicle on a real track. Each edition of the hackathon reached its maximum capacity of 40 participants and featured a total prize pool of 14,000 CHF (5,000 CHF for the first edition and 9,000 CHF for the second).

[1] https://www.scimagojr.com
[2] https://portal.core.edu.au/conf-ranks/
[3] https://formulausi.si.usi.ch

Selected Publications

[1] Matteo Biagiola, Filippo Ricca, and Paolo Tonella. "Search Based Path and Input Data Generation for Web Application Testing". In: *Search Based Software Engineering - 9th International Symposium, SSBSE 2017, Paderborn, Germany, September 9-11, 2017, Proceedings*. Ed. by Tim Menzies and Justyna Petke. Vol. 10452. Lecture Notes in Computer Science. Springer, 2017, pp. 18–32. DOI: 10.1007/978-3-319-66299-2_2. URL: https://doi.org/10.1007/978-3-319-66299-2_2.

[2] Matteo Biagiola and Paolo Tonella. "Boundary State Generation for Testing and Improvement of Autonomous Driving Systems". In: *IEEE Trans. Software Eng.* 50.8 (2024), pp. 2040–2053. DOI: 10.1109/TSE.2024.3420816. URL: https://doi.org/10.1109/TSE.2024.3420816.

[3] Matteo Biagiola and Paolo Tonella. "Testing of Deep Reinforcement Learning Agents with Surrogate Models". In: *ACM Trans. Softw. Eng. Methodol.* 33.3 (2024), 73:1–73:33. DOI: 10.1145/3631970. URL: https://doi.org/10.1145/3631970.

[4] Matteo Biagiola and Paolo Tonella. "Testing the Plasticity of Reinforcement Learning-based Systems". In: *ACM Trans. Softw. Eng. Methodol.* 31.4 (2022), 80:1–80:46. DOI: 10.1145/3511701. URL: https://doi.org/10.1145/3511701.

[5] Matteo Biagiola et al. "Dependency-Aware Web Test Generation". In: *13th IEEE International Conference on Software Testing, Validation and Verification, ICST 2020, Porto, Portugal, October 24-28, 2020*. IEEE, 2020, pp. 175–185. DOI: 10.1109/ICST46399.2020.00027. URL: https://doi.org/10.1109/ICST46399.2020.00027.

[6] Matteo Biagiola et al. "Diversity-based web test generation". In: *Proceedings of the ACM Joint Meeting on European Software Engineering Conference and Symposium on the Foundations of Software Engineering, ESEC/SIGSOFT FSE 2019, Tallinn, Estonia, August 26-30, 2019*. Ed. by Marlon Dumas et al. ACM, 2019, pp. 142–153. DOI: 10.1145/3338906.3338970. URL: https://doi.org/10.1145/3338906.3338970.

[7] Matteo Biagiola et al. "Two is better than one: Digital siblings to improve autonomous driving testing". In: *Empirical Software Engineering* 29.4 (2024), pp. 1–33. DOI: 10.1007/s10664-024-10458-4. URL: https://doi.org/10.1007/s10664-024-10458-4.

[8] Matteo Biagiola et al. "Web test dependency detection". In: *Proceedings of the ACM Joint Meeting on European Software Engineering Conference and Symposium on the Foundations of Software Engineering, ESEC/SIGSOFT FSE 2019, Tallinn, Estonia, August 26-30, 2019*. Ed. by Marlon Dumas et al. ACM, 2019, pp. 154–164. DOI: 10.1145/3338906.3338948. URL: https://doi.org/10.1145/3338906.3338948.

[9] Andréa Doreste, Matteo Biagiola, and Paolo Tonella. "Adversarial Testing with Reinforcement Learning: A Case Study on Autonomous Driving". In: *IEEE Conference on Software Testing, Verification and Validation, ICST 2024, Toronto, ON, Canada, May 27-31, 2024*. IEEE, 2024, pp. 293–304. DOI: 10.1109/ICST60714.2024.00034. URL: https://doi.org/10.1109/ICST60714.2024.00034.

[10] Luca Giamattei et al. "Reinforcement learning for online testing of autonomous driving systems: a replication and extension study". In: *Empirical Software Engineering* 30.1 (2024), p. 19. ISSN: 1573-7616. DOI: 10.1007/s10664-024-10562-5. URL: https://doi.org/10.1007/s10664-024-10562-5.

[11] Deepak-George Thomas et al. "muPRL: A Mutation Testing Pipeline for Deep Reinforcement Learning based on Real Faults". In: *CoRR* abs/2408.15150 (2024). *To appear in proceedings of International Conference on Software Engineering 2025*. DOI: 10.48550/ARXIV.2408.15150. arXiv: 2408.15150. URL: https://doi.org/10.48550/arXiv.2408.15150.