David Issa Mattos

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SHORT INTRODUCTION

I'm a doctoral candidate in Software Engineering in the Department of Computer Science and Engineering at Chalmers University of Technology. I will conclude my PhD in August 2021. My doctoral research project is funded by the Wallenberg AI, Autonomous Systems and Software program (WASP).

I have a strong foundation in software engineering, artificial intelligence, statistics and research methods.

- My PhD research concerns the use experiments (e.g. A/B testing) for data-driven development
- I have a broad experience of using Bayesian Data Analysis (linear, non-linear, item response theory and mixed effects models) in different domains (software engineering, online experimentation, transportation research, behavior research and evolutionary computing).
- I am the main author of the *bpcs* package in R (using Stan) to draw Bayesian inference on paired comparison data with the Bradley-Terry model (and many of its extensions).
- I have developed machine learning models (dynamic pricing, reinforcement learning, online optimization) used in multiple industries in Sweden (including Ericsson, Sony Mobile and Ellos).
- I have taught applied statistics and research methods for software engineers for four years in the Master program at Chalmers and Gothenburg University

In my research, I have collaborated with 12 companies, 24 collaborators in over 20 peer-reviewed publications.

EDUCATION

- Ph.D. candidate in Software Engineering at Chalmers University of Technology, Sweden (04.2016 – Expected 08.2021).
  - Project: Data-driven evolution of software systems.
  - Main supervisor: Jan Bosch – Chalmers University of Technology
  - Co-supervisor: Helena Holmström Olsson – Malmö University

- Licentiate of Engineering in Computer Science and Engineering at Chalmers University of Technology, Sweden (2016.04.01– 2018.10.26).
  - Project: Data-driven evolution of software systems.
  - Licentiate Thesis: "Towards Automated Experiments in Software Intensive Systems"
  - Main supervisor: Jan Bosch – Chalmers University of Technology
  - Co-supervisor: Helena Holmström Olsson – Malmö University

- M.Sc. in Electronic Systems and Devices at the Aeronautics Institute of Technology, Brazil (2015.03 – 2016.03.).
  - Master Thesis: "Autonomy implementations for a low-cost autonomous surface vehicle using the MOOS-IvP software".
  - Foundation of Personnel and Training Coordination (CAPES) scholarship from the Brazilian Government.

    - Main supervisor: Cairo Lucio Nascimento Jr. - Aeronautics Institute of Technology
    - Co-supervisor: Douglas Soares dos Santos – Aeronautics Institute of Technology

- B.Sc. in Electronics Engineering at the Aeronautic Institute of Technology, Brazil (2010.01 – 2014.12).
    - Study emphasis: embedded systems, autonomous navigation and control systems.
    - Honors in the Human Studies Department
    - Main supervisor: Cairo Lucio Nascimento Jr. - Aeronautics Institute of Technology
    - Co-supervisor: Douglas Soares dos Santos – Aeronautics Institute of Technology

RESEARCH

The overall objective of my Ph.D. research is to analyze how different types of field experiments can be automated in different domains in collaboration with industrial partners. I analyze how companies in different domains plan and run their experimentation activities and look how different aspects of their experimentation pipeline can be automated and supported in the organization. I have explored the topic of automating field experiments from the perspectives of the software architecture, the algorithms for the experiment execution, and the experimentation process, and focused on two main application domains: the online and the embedded systems domain.

In addition to my Ph.D. research, I am also researching Bayesian statistical methods for the analysis of benchmark experiments in the context of evolutionary computing. In collaboration with other researchers at both industry and academia, I have also been actively involved in other areas of computer science such as, automatically labelling, data pipelines, test case evaluation and continuous integration. More recently, I have been collaborating with researchers from psychology in transportation research and developing statistical methods for the analysis of pairwise forced-choice assessment.

In 2020, I have been nominated by the faculty at Chalmers as one the 5 young researchers to represent Chalmers University at the Global Young Scientist Summit (GYSS) 2021. In this event, I had the opportunity to listen and engage with globally recognized scientific leaders, who are recipients of the Nobel Prize, Fields Medal and Turing award.

TEACHING

- Empirical Software Engineering (DAT246/DIT278) for the Master Program at Chalmers University of Technology (2017-2020)
    - Classes in statistics, experimental design and group supervision
- Research Methods in Software Engineering (DIT831) for the Bachelor Program in Software Engineering and Management at Gothenburg University (2017-2021)
    - Classes on survey and experimental design analyses
    - Group supervision for experiments and case studies
- Quality Management (DIT845) for the Bachelor Program in Software Engineering and Management at Gothenburg University (2017)
    - Group supervision, guest lectures and assignments

THESIS SUPERVISION

Master Thesis

- (2020) Evaluating the applicability of benchmark functions on optimization algorithms, (On-going),

- (2020) Developing and analyzing a Bayesian Python package for the Plackett-Luce model. (On-going)
- (2019) "Continuous experimentation for software organizations with low control of roadmap and a large distance to users: A case study" - Resulted in a full paper presented at PROFES 2019 [FC10]
- (2017) “An evaluation of automated continuous experimentation”

Bachelor Thesis

- (2019) An analysis of software engineering practices in R packages available in the CRAN (On-going)

PROFESSIONAL EXPERIENCE

- Internship at the Intelligent Machines Laboratory at the Aeronautics Institute of technology. Research on autonomous vehicles and autonomous navigation (08.2014 – 11.2014).
- Internship at EMBRAER. Feed-forward strategies for disturbance rejection (07.2014 – 08.2014).
- Internship at EMBRAER. Research on control laws for an air intake thermal valve aiming at disturbance rejection in aircrafts (01.2014 – 03.2014)
- Internship at Itaú-Unibanco. Economic research in vehicle leasing in Brazil in one the ten largest banks in the world (01.2012 – 03.2012).
- Reserve Military Officers Preparation Center of the Brazilian Air Force (01.2010 – 12.2010).

SKILLS

- Team-working skills
- Good communication skills and at translating research results to other stakeholders
- Electronics engineering (signal processing, autonomous systems and control systems)
- Knowledge on different programming languages (C, C++, Python, R, Javascript etc..) and frameworks (Vue, ROS, MOOS-IvP, Hugo, Flask, Shiny etc…)
- Bayesian and frequentist statistics (R, Python and Stan)
- Artificial Intelligence and Machine Learning (Keras, TensorFlow, ScikitLearn etc)
- Machine learning (supervised and reinforcement learning)
- Research (case studies, action research, design science, controlled experiments, quasi experiments, experimental design)

LANGUAGES

- Portuguese – Native
- English - Professional proficiency
- Spanish – Advanced
- Swedish – (SFI D)

REFERENCES

- Prof. Dr. Jan Bosch
  - Main supervisor
  - Professor in Software Engineering at Chalmers University of Technology
  - jan.bosch@chalmers.se
- Prof. Dr. Helena Holmström Olsson
  - Co-supervisor
  - Professor in Software Engineering at Malmö University
  - helena.holmstrom.olsson@mau.se
- Prof. Dr. Ivica Crnkovic
  - Examiner in of my PhD

- Professor in Software Engineering at Chalmers University of Technology
- ivica.crnkovic@chalmers.se

PUBLICATIONS

Below is a complete list of my publications by year. I utilize the following notation to indicate the type of publication. T = Thesis, FC = Full Conference paper (peer-reviewed), SC = Short Conference paper (peer-reviewed), J = Journal (peer-reviewed), NP = non peer-reviewed

Work in Progress

[J] Ramos, E., **Mattos, D**. Bergstad, C. Round-trip, free-floating and peer-to-peer: A behavior Bayesian analysis of car-sharing topologies.

[FC] Fredriksson, T., **Mattos, D.**, Bosch, J., & Olsson, H. Machine Learning Models for Automatic Labeling: A Systematic Literature Review

[J] Mattos, D. I. "Item response theory for Evolutionary Computing"

Work in Submission

[J] **Mattos, D**., Ramos, E. Bayesian Paired-Comparison with the bpcs Package. (In submission to the Behavior Research Methods journal) [Preprint]

[J] **Mattos, D.**, Dakkak, A., Bosch, J., & Olsson, H. The HURRIER Process for Experimentation in Business-to-Business Mission-Critical Systems. (In submission to the Journal of Software: Evolution and Process)

[J] **Mattos, D.**, Bosch, J., & Olsson, H. Statistical Models for the Analysis of Optimization Algorithms with Benchmark Functions. arXiv preprint arXiv:2010.03783. (In submission to the IEEE Transactions on Evolutionary Computing) [Preprint]

[FC] Dakkak, A., **Mattos, D.**, & Bosch, J. Transitioning to Continuous Deployment: A Case study on benefits and Success factors in Software-Intensive Embedded Systems (to be submitted to the 45th IEEE COMPSAC Conference)

[FC] Fredriksson, T., **Mattos, D.**, Bosch, J., & Olsson, H. An Empirical Evaluation of Algorithms for Data Labeling (to be submitted to the 45th IEEE COMPSAC Conference)

2020

[FC16] Fredriksson, T., **Mattos, D.**, Bosch, J., & Olsson, H. (2020). Data Labeling: An Empirical Investigation into Industrial Challenges and Mitigation Strategies. In International Conference on Product-Focused Software Process Improvement (pp. 202–216). [Paper]

[FC15] **Mattos, D.,** Bosch, J., Olsson, H., Korshani, A., & Lantz, J. (2020). Automotive A/B testing: Challenges and Lessons Learned from Practice. In 2020 46th Euromicro Conference on Software Engineering and Advanced Applications (SEAA) (pp. 101–109). [Paper]

[FC14] Diamantopoulos, N., Wong, J., **Mattos, D**., Gerostathopoulos, I., Wardrop, M., Mao, T., & McFarland, C. (2020). Engineering for a science-centric experimentation platform. In Proceedings of the ACM/IEEE 42nd International Conference on Software Engineering: Software Engineering in Practice (pp. 191–200). [Paper]

[FC13] Oliveira Neto, F., Horkoff, J., Svensson, R., **Mattos, D.**, & Knauss, A. (2020). Evaluating the Effects of Different Requirements Representations on Writing Test Cases. In International Working Conference on Requirements Engineering: Foundation for Software Quality (pp. 257–274). [Paper]

[FC12] **Mattos, D.**, Dakkak, A., Bosch, J., & Olsson, H. (2020). Experimentation for Business-to-Business Mission-Critical Systems: A Case Study. In Proceedings of the International Conference on Software and System Processes (pp. 95–104). [Paper]

[FC11] Munappy, A., **Mattos, D.,** Bosch, J., Olsson, H., & Dakkak, A. (2020). From Ad-Hoc Data Analytics to DataOps. In Proceedings of the International Conference on Software and System Processes (pp. 165–174). [Paper]

2019

[FC10] Sveningson, R., **Mattos, D**., & Bosch, J. (2019). Continuous Experimentation for Software Organizations with Low Control of Roadmap and a Large Distance to Users: An Exploratory Case Study. In International Conference on Product-Focused Software Process Improvement (pp. 528–544). [Paper]

[FC9] **Mattos, D**., Bosch, J., Olsson, H., Dakkak, A., & Bergh, K. (2019). Automated Optimization of Software Parameters in a Long Term Evolution Radio Base Station. In 2019 Annual IEEE Systems Conference (SysCon). [Paper]

[J1] **Mattos, D.**, Bosch, J., & Olsson, H. (2019). Multi-armed bandits in the wild: pitfalls and strategies in online experiments Information and Software Technology, 113, 68–81. [Paper]

[FC8] **Mattos, D.**, Bosch, J., & Olsson, H. (2019). ACE: Easy Deployment of Field Optimization Experiments. In European Conference on Software Architecture (pp. 264–279). [Paper]

[SC1] **Mattos, D.**, Bosch, J., & Olsson, H. (2019). Leveraging Business Transformation with Machine Learning Experiments. In International Conference on Software Business (pp. 183–191). [Paper]

[NP1] Gerostathopoulos, I., Konersmann, M., Krusche, S., **Mattos, D.,** Bosch, J., Bures, T., Fitzgerald, B., Goedicke, M., Muccini, H., Olsson, H., & others (2019). Continuous Data-driven Software Engineering-Towards a Research Agenda: Report on the Joint 5th International Workshop on Rapid Continuous Software Engineering (RCoSE 2019) and 1st International Workshop ACM SIGSOFT Software Engineering Notes, 44(3), 60–64. [Paper]

2018

[FC7] **Mattos, D**., Bosch, J., & Olsson, H. (2018). Challenges and Strategies for Undertaking Continuous Experimentation to Embedded Systems: Industry and Research Perspectives. In 19th International Conference on Agile Software Development. [Paper]

[FC6] **Mattos, D.,** Mårtensson, E., Bosch, J., & Olsson, H. (2018). Optimization experiments in the continuous space. In International Symposium on Search Based Software Engineering (pp. 293–308). [Paper]

[T3] **Mattos, D.** (2018). Towards Automated Experiments in Software Intensive Systems. (Licentiate Thesis, Chalmers University of Technology). Main supervisor: Jan Bosch. Co-supervisor: Helena Holmström Olsson. [Thesis]

[FC5] **Mattos, D.,** Dmitriev, P., Fabijan, A., Bosch, J., & Olsson, H. (2018). An activity and metric model for online controlled experiments. In International Conference on Product-Focused Software Process Improvement (pp. 182–198). [Paper]

2017

[FC4] **Mattos, D.,** Bosch, J., & Olsson, H. (2017). Your system gets better every day you use it: towards automated continuous experimentation. In 2017 43rd Euromicro Conference on Software Engineering and Advanced Applications (SEAA) (pp. 256–265). [Paper]

[FC3] **Mattos, D.,** Bosch, J., & Olsson, H. (2017). More for less: automated experimentation in software-intensive systems. In International Conference on Product-Focused Software Process Improvement (pp. 146–161). [Paper]

2016

[FC2] Vianna, W., Rodrigues, L., Yoneyama, T., & **Mattos, D.** (2016). Troubleshooting optimization using multi-start simulated annealing. In 2016 Annual IEEE Systems Conference (SysCon) (pp. 1–6). [Paper]

[FC1] **Mattos, D.,** Santos, D., & Nascimento, C. (2016). Development of a low-cost autonomous surface vehicle using MOOS-IvP. In 2016 Annual IEEE Systems Conference (SysCon) (pp. 1–6). [Paper]

[T2] **Mattos, D.** (2016). Autonomy Implementations for a Low-Cost Autonomous Surface Vehicle Using the MOOS-IvP software. (Master Thesis, Instituto Tecnológico de Aeronáutica, Brasil). Main supervisor: Cairo Lúcio Nascimento Jr. Co-supervisor: Douglas Soares do Santos

2014

[T1**] Mattos, D.** (2014). Implementação do software MOOS-IvP em um barco autônomo. (Bachelor Thesis, Instituto Tecnológico de Aeronáutica, Brasil). Main supervisor: Cairo Lúcio Nascimento Jr. Co-supervisor: Douglas Soares do Santos

Oral presentations

Below is a list of oral presentations I gave in conferences in addition to the peer-reviewed paper publications.

- **D. I. Mattos**, J. Bosch, and H. H. Olsson (2018). "Adding Value to Customers: Data-Driven Optimization of Software Parameters" Swedsoft STEW, Lund, Sweden (17-18 October 2018)
- **Mattos, D. I.**, Nascimento Jr, C. L., dos Santos, D. S. (2015). "Developing an autonomous low-cost boat using MOOS-IvP". Presentation at MOOS Development and Applications Working Group 2015 (MOOS-DAWG'15), MIT, Cambridge, MA, USA (22-23rd July 2015).

ORGANIZATION IN SCIENTIFIC EVENTS

- Co-organizer of the RCoSE/DDrEE 2019 workshop at ICSE 2019, Montreal, CA.
- Proceedings chair and web master for the 1st Workshop on AI Engineering – Software Engineering for AI – WAIN'21@ICSE'21
- Virtualisation committee of the 16th International Symposium on Software Engineering for Adaptive and Self-Managing Systems SEAMS'21
- Editor for the ICSA 2017 and ICSE 2018 Program Brochure

REVIEWER

- Journal of Systems and Software
- IEEE Access
- Expert Systems with Applications
- DDrEE workshop
- Psycometrika
- Journal of Software: Process and Evolution
- 1st Workshop on AI Engineering – Software Engineering for AI (WAIN)