Facundo MOLINA

Postdoctoral Researcher
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EMPLOYMENT HISTORY

SINCE 2022   **Postdoctoral Researcher**
Research area: Software testing and analysis.
IMDEA Software Institute, Madrid, Spain.

2018 - 2022   **Teaching Assistant**
Department of Computer Science, University of Río Cuarto, Argentina.

2014 - 2017   **Student Teaching Assistant**
Department of Computer Science, University of Río Cuarto, Argentina.

EDUCATION

2017 - 2022   **Ph.D., Computer Science**
Dissertation: Techniques based on Learning and Search for Specification Inference.
Faculty of Mathematics, Astronomy, Physics and Computing - FaMaF
University of Córdoba - Argentina

2012 - 2017   **Computer Science Licenciate**
(5-year + thesis undergraduate program of study)
Department of Computer Science - FCEFQyN
University of Río Cuarto - Argentina
THESIS PROJECT: Automatic Learning of Relational Specifications using
Evolutionary Computation.
AVERAGE SCORE: 9.43 out of 10

2012 - 2014   **B.S. in Computer Science**
Department of Computer Science - FCEFQyN
University of Río Cuarto - Argentina
THESIS PROJECT: Project in the course of Distributed and Outsourced
Software Engineering.
AVERAGE SCORE: 9.33 out of 10

PUBLICATIONS

MAY 2024   **Improving Patch Correctness Analysis via Random Testing
and Large Language Models**
Facundo Molina, Juan Manuel Copia and Alessandra Gorla.
*To appear in the 17th IEEE International Conference on Software Testing,
Verification and Validation, ICST 2024, Toronto, Canada, May 27 - 31, 2024.*

OCTOBER 2023   **Enabling Efficient Assertion Inference**
Aayush Garg, Renzo Degiovanni, Facundo Molina, Maxime Cordy,
Nazareno Aguirre, Mike Papadakis, and Yves Le Traon.
*IEEE 34th International Symposium on Software Reliability Engineering,
ISSRE 2023, Florence, Italy, October 9 - 12, 2023.*

OCTOBER 2023   **Precise Lazy Initialization for Programs with Complex Heap Inputs**
Juan Manuel Copia, Facundo Molina, Nazareno Aguirre, Marcelo F. Frias,
Alessandra Gorla, and Pablo Ponzio.
IEEE 34th International Symposium on Software Reliability Engineering,
ISSRE 2023, Florence, Italy, October 9 - 12, 2023.

APRIL 2023   **Efficient Bounded Exhaustive Input Generation from Program APIs**
Mariano Politano, Valeria Bengolea, Facundo Molina, Marcelo F. Frias,
Nazareno Aguirre, and Pablo Ponzio.
26th International Conference on Fundamental Approaches to Software Engineering,
FASE 2023, Paris, France, April 22 - 27, 2023.

NOVEMBER 2022   **Learning to Prune Infeasible Paths in Generalized Symbolic Execution**
Facundo Molina, Pablo Ponzio, Nazareno Aguirre and Marcelo F. Frias.
IEEE 33rd International Symposium on Software Reliability Engineering,
ISSRE 2022, Charlotte, NC, USA, October 31 - Nov. 3, 2022.

MAY 2022   **Fuzzing Class Specifications**
Facundo Molina, Marcelo d'Amorim and Nazareno Aguirre.
Proceedings of the 44th ACM/IEEE International Conference
on Software Engineering, ICSE 2022, Pittsburgh, USA, May 22-27, 2022.

MAY 2021   **EvoSpex: An Evolutionary Algorithm for Learning Postconditions**
Facundo Molina, Pablo Ponzio, Nazareno Aguirre and Marcelo Frias.
Proceedings of the 43rd ACM/IEEE International Conference
on Software Engineering, ICSE 2021, Madrid, Spain, May 23-29, 2021.

SEPTEMBER 2020   **Applying Learning Techniques to Oracle Synthesis**
Facundo Molina
Doctoral Symposium, Proceedings of the 35th IEEE/ACM International Conference
on Automated Software Engineering, ASE 2020, Australia, September 21-25, 2020.

JULY 2019   **An Evolutionary Approach to Translating Operational Specifications**
into Declarative Specifications - Facundo Molina, César Cornejo, Renzo
Degiovanni, Germán Regis, Pablo Castro, Nazareno Aguirre and Marcelo Frias
Science of Computer Programming, Volume 181, Pages 47-63, 2019.

MAY 2019   **Training Binary Classifiers as Data Structure Invariants**
Facundo Molina, Pablo Ponzio, Renzo Degiovanni, Germán Regis,
Nazareno Aguirre and Marcelo Frias
Proceedings of the 41th International Conference on Software Engineering,
ICSE 2019, Montreal, Canada, May 25-31, 2019.

SEPTEMBER 2018   **A Genetic Algorithm for Goal-Conflict Identification**
Renzo Degiovanni, Facundo Molina, Germán Regis and Nazareno Aguirre
Proceedings of the 33rd ACM/IEEE International Conference on Automated
Software Engineering, ASE 2018, Montpellier, France, September 3-7, 2018.

MAY 2018   **From Operational to Declarative Specifications using a Genetic**
Algorithm - Facundo Molina, Renzo Degiovanni, Germán Regis, Pablo Castro,
Nazareno Aguirre and Marcelo Frias
Proceedings of the 11th International Workshop on Search-Based Software Testing,
SBST@ICSE 2018, Gothenburg, Sweden, May 28-29, 2018.

NOVEMBER 2016   **An Evolutionary Approach to Translate Operational Specifications**

into Declarative Specifications - Facundo Molina, César Cornejo, Renzo Degiovanni, Germán Regis, Pablo Castro, Nazareno Aguirre and Marcelo Frias
Proceedings of the 19th Brazilian Symposium on Formal Methods
SBMF 2016, Natal, Brazil, November 22-25, 2016.

Public Talks

October 2023	**Automated Generation of Test Oracles** Invited speaker at the *Jornadas de Ciencias de la Computación*, JCC 2023, Rosario, Argentina.
September 2023	**SpecFuzzer: A Tool for Inferring Class Specifications via Grammar-based Fuzzing** - Tool Demonstrations track, ASE conference, Luxembourg.
July 2023	**EvoSpex: A Search-based Tool for Postcondition Inference** Tool Demonstrations track, ISSTA conference, Seattle, USA.
November 2022	**Learning to Prune Infeasible Paths in Generalized Symbolic Execution** Research track, ISSRE conference, Charlotte, USA.
October 2022	**Fuzzing Class Specifications** - Oral communication, Simposio Argentino de Ingeniería de Software ASSE 2022 (virtual), Argentina.
May 2022	**Fuzzing Class Specifications** - Research track, ICSE conference, Pittsburgh, USA.
March 2022	**EvoSpex: An Evolutionary Algorithm for Learning Postconditions** Invited talk, Argentine Workshop on Fundamentals for the Automatic Analysis and Construction of Software FACAS 2022, La Falda, Argentina.
October 2021	**EvoSpex: An Evolutionary Algorithm for Learning Postconditions** Oral communication, Simposio Argentino de Ingeniería de Software ASSE 2021 (virtual), Argentina.
May 2021	**EvoSpex: An Evolutionary Algorithm for Learning Postconditions** Research track, ICSE conference (virtual), Madrid, Spain.
September 2020	**Applying Learning Techniques to Oracle Synthesis** Doctoral symposium, ASE conference (virtual), Melbourne, Australia.
May 2019	**Training Binary Classifiers as Data Structure Invariants** Research track, ICSE conference, Montréal, Canada.
March 2019	**Learning Hybrid Invariants to Improve Symbolic Execution on Structurally Complex Inputs** - Invited talk, Argentine Workshop on Fundamentals for the Automatic Analysis and Construction of Software FACAS 2021, La Falda, Argentina.
September 2018	**A Genetic Algorithm for Goal-Conflict Identification** Research track, ASE conference, Montpellier, France.
November 2016	**An Evolutionary Approach to Translate Operational Specifications into Declarative Specifications** - Research track, Brazilian Symposium on Formal Methods SBMF 2016, Natal, Brazil.

Research Prototypes

SpecFuzzer   SpecFuzzer is a tool that automatically infers test oracles in the form of class specifications (postconditions, invariants), and works for Java classes. SpecFuzzer uses a fuzzer as a generator of candidate assertions derived from a grammar that is automatically obtained from the class definition; a dynamic invariant detector –Daikon– to filter out assertions invalidated by a test suite; and a mutation-based mechanism to cluster and rank assertions, so that similar constraints are grouped and then the stronger prioritized. SpecFuzzer is available at: https://github.com/facumolina/specfuzzer

EvoSpex   EvoSpex is a tool that, given a Java method, uses an evolutionary algorithm to produce a specification of the method's current behavior, in the form of postcondition assertions. EvoSpex is available at: https://github.com/facumolina/evospex

PLI   PLI is an efficient symbolic execution approach for programs that manipulate complex heap-allocated data structures with rich structural constraints. PLI works for Java, and allows preconditions to be specified as standard operational predicates for concrete structures, eliminating the need for additional specifications tailored to symbolic heaps. PLI is available at: https://github.com/JuanmaCopia/spf-pli

Teaching Background

March 2018 - June 2022   **Teaching Assistant**
Courses: Computability and Complexity, Distributed and Outsourced Software Engineering, Introduction to Programming.
Department of Computer Science - FCEFQyN
University of Río Cuarto - Argentina

August 2014 - June 2017   **Student Teaching Assistant**
Courses: Data Structures and Algorithms, Algorithms Design Techniques, Programming Paradigms, and System Design and Analysis.
Department of Computer Science - FCEFQyN
University of Río Cuarto - Argentina

Supervised Students

2023 - Present   **Agustin Nolasco** - *Bachelor student* - University of Río Cuarto, Argentina. Agustin's thesis presents a new technique for the inference of metamorphic oracles, based on runtime analysis, grammar-based fuzzing and SAT solving.

2023 - Present   **Claudio Dosantos** - *Bachelor student* - University of Río Cuarto, Argentina. Claudio's thesis aims to analyze the effectiveness of regression testing when using different kind of oracles, such as unit assertions and contracts.

2023 - Present   **Ignacio Gonzalez** - *Bachelor student* - University of Río Cuarto, Argentina. Automated test generation tools play a crucial role on dynamic specification inference techniques. Ignacio's work aims at studying how different test generation approaches affects the effectiveness of specification inference techniques.

Academic Service

Since 2021	**Program Committee** *International Conference on AI Foundation Models and Software Engineering, FORGE 2024.* *International Working Conference on Source Code Analysis and Manipulation, SCAM 2023.* *International Workshop on Test Oracles, TORACLE 2021 (at ESEC/FSE 2021).*
Since 2023	**Artifact Evaluation Committee** *International Conference on Software Engineering, ICSE 2024.* *International Symposium on Software Testing and Analysis, ISSTA 2023.* *Static Analysis Symposium, SAS 2023.*
2017 - 2022	**Student Volunteer** *International Conference on Software Engineering, ICSE 2022.* *International Conference on Software Engineering, ICSE 2021.* *International Conference on Software Engineering, ICSE 2019.* *International Conference on Automated Software Engineering, ASE 2018.* *International Conference on Software Engineering, ICSE 2017.*

Awards & Distinctions

2020	**Latin America PhD Award** *A research award for PhD students in computing related fields in their 3rd year* *or beyond at universities in Latin America, and granted by Microsoft Research.*
2018	**Best Paper Award** *From Operational to Declarative Specifications using a Genetic Algorithm* *11th International Workshop on Search-Based Software Testing, SBST 2018.*
2016	**Best Paper Award** *An Evolutionary Approach to Translate Operational Specifications into* *Declarative Specifications, 19th Brazilian Symposium on Formal Methods, SBMF 2016.*
2016	**University of Rio Cuarto flag bearer for a 1-year period** *Traditional honour in educational institutions in Argentina to the three top students* *in the institution.*

Grants & Scholarships

2017	**Doctoral Scholarship** *5-year Scholarship granted by Argentina's National Scientific and Technical Research* *Council (CONICET) to fund doctoral students.*
2016	**EVC-CIN Scholarship** *1-year Scolarship granted by the argentinian National Inter University Council (CIN)* *to encourage undergraduate students to pursue scientific vocations.*

Extracurricular Courses Taken

OCTOBER 2019	**Neural Networks and Deep Learning** - Adjunct Professor Andrew Ng *Foundations of Deep Learning* *An online non-credit course authorized by deeplearning.ai* *Coursera*
MARCH 2019	**Introduction to Data Science in Python** - Christopher Brooks *Introduction to data manipulation and cleaning techniques using pandas* *An online non-credit course authorized by University of Michigan* *Coursera*
AUGUST 2018 NOVEMBER 2018	**Neural Networks** - Dr. Francisco Tamarit *Mathematical Foundations of Artificial Neural Networks* *Postgraduate courses* *University of Córdoba - Argentina*
AUGUST 2017 NOVEMBER 2017	**Text Mining** - Dr. Laura Alonso Alemany *Text Mining techniques applied to Natural Language Processing problems (Word similarity, Document clustering, Sense discrimination, Machine translation)* *Postgraduate courses* *University of Córdoba - Argentina*
AUGUST 2017 NOVEMBER 2017	**Information and its Demons** - Dr. Javier Blanco *Information Philosophy* *Postgraduate courses* *University of Río Cuarto - Argentina*
FEBRUARY 2017	**Human Dynamics: Data, Networks and Modelling** - Dr. Márton Karsai *Summer School of Computer Science RIO 2017* *University of Río Cuarto - Argentina*
MARCH 2016 JUNE 2016	**Software Testing** - Dr. Renzo Degiovanni *Main software testing techniques using state-of-the-art tools* *Postgraduate courses* *University of Río Cuarto - Argentina*
FEBRUARY 2016	**Systematic Test Case Generation** - Prof. Sarfraz Khurshid *Summer School of Computer Science RIO 2016* *University of Río Cuarto - Argentina*
FEBRUARY 2016	**Symbolic Program Analysis** - Prof. Willem Visser *Summer School of Computer Science RIO 2016* *University of Río Cuarto - Argentina*
FEBRUARY 2015	**Description Logic Reasoning** - Dr. Anni-Yasmin Turhan *Summer School of Computer Science RIO 2015* *University of Río Cuarto - Argentina*
FEBRUARY 2015	**Fundamentals of Quantum Programming Languages** - Dr. Alejandro Díaz-Caro *Summer School of Computer Science RIO 2015* *University of Río Cuarto - Argentina*

Languages

Spanish: Mother tongue
English: Fluent