UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

DOTTORATO DI RICERCA / PhD PROGRAM IN
INFORMATION TECHNOLOGY AND ELECTRICAL ENGINEERING

Activities and Publications Report

PhD Student: Francesco Altiero

Student DR number: DR995043

PhD Cycle: XXXVI
PhD Cycle Chairman: Prof. Stefano Russo

PhD program student's start date: 01/11/2020
PhD program student's end date: 31/01/2024

Supervisor: Prof. Adriano Peron

e-mail: adriano.peron@units.it

Co-supervisor: Prof. Anna Corazza

e-mail: anna.corazza@unina.it

PhD scholarship funding entity: Università Federico II

General information

Francesco Altiero received in year 2020 the Master Science degree in Computer Science from the University of Napoli Federico II. He attended a curriculum in Software Engineering within the PhD program in Information Technology and Electrical Engineering. He received a grant from Università Federico II.

Study activities

Attended Courses

Year	Course Title	Type	Credits	Lecturer	Organization
1st	Digital Forensics	Ad hoc course	3	Dr. Giovanni Cozzolino	ITEE
1st	Statistical Data Analysis for Science and Engineering Research	Ad hoc course	4	Prof. Roberto Pietrantuono	ITEE
1st	Data Science for Patient Record Analysis	Ad hoc course	2.5	Prof. Marcello Cinque	ITEE
1st	Scientific Programming and Data Visualization with Python	Ad hoc course	2	Prof. Marcello Botta	ITEE
1st	Combinatorial Optimization	MSc course	6	Prof. Paola Festa, DMA UNINA	Computer Science, DIETI
1st	Data Analytics	MSc course	6	Prof. Anna Maria Tulino	Computer Science, DIETI
2nd	Imprenditorialità Accademica	Ad hoc course	4	Prof. Pierluigi Rippa	ITEE
2nd	Neural Networks and Deep Learning	Ad hoc course	10	Prof. Giorgio Carlo Buttazzo	Scuola Superiore Sant'Anna, Pisa
3rd	Muscle-Based Human - Machine Interfaces	Ad hoc course	2.6	Dr. Daniele Esposito	ITCH, University of Naples Federico II

Attended PhD Schools

None.

Attended Seminars

Year	Seminar Title	Credits	Lecturer	Lecturer affiliation	Organization
1st	Robot Manipulation and Control	0.5	Prof. Bruno Siciliano	DIETI, UNINA	Scuola Superiore Sant'Anna, Pisa
1st	ITEE Webinar: Patent Searching Best Practices with IEEE Xplore	0.2	Dr. Eszter Lukacs	IEEE	University of Naples Federico II
1st	ITEE Webinar: How to get Published by IEEE	0.3	Dr. Paul Henriques	IEEE	University of Naples Federico II

1st	Picariello Lectures IV: #andratuttobene - Image, Texts, Emojis, & Geodata in a Sentiment Analysis Pipeline	0.3	Dr. Serena Pelosi	Università degli Studi di Salerno	University of Naples Federico II
1st	Network Systems, Kuramoto Oscillators, and Synchronous Power Flow	0.3	Prof. Francesco Bullo	University of California	Dipartimento di Fisica "E. Pancini", UNINA
1st	Picariello Lectures VI: Exploiting Deep Learning and Probabilistic Modeling for Behavioural Analytics	0.3	Prof. Giuseppe Manco	CNR	DIETI
1st	Picariello Lectures VII: Data Driven Transformation in WINDTRE through Manager's Voice	0.3	Marcello Savarese, Erica Bertone, Amida Kudasheva	WINDTRE	DIETI
1st	GDPR Basics for Computer Scientists	0.3	Dr. Rigo Wenning	European Research Consortium for Informatics and Mathematics	ITEE
1st	Picariello Lectures VIII: From Photometric Redshifts to Improved Weather Forecasts - an Interdisciplinary view on Machine Learning	0.2	Dr. Kai Polsterer	Heidelberg Institute for Theoretical Studies	DIETI
1st	Picariello Lectures X: AI LEGAL: Artificial Intelligence for notary's sector - A case study	0.2	Dr. Salvatore Palange	FUEL Company	DIETI
1st	Picariello Lectures XII: Machine Learning: causality lost in translation	0.3	Prof. Edwin A. Valentijn	Kapteyn Astronomical Institute	DIETI
1st	Robo Ludens: A game design taxonomy for human-robot interaction	0.2	Prof. John M. Cardonas	University of Waterloo	PRISCA Lab
1st	Dai Mainframe all'IoT: una retrospettiva sull'evoluzione delle architetture di calcolo	0.4	Prof. Antonino Mazzeo	DIETI, UNINA	DIETI
1st	Picariello Lectures XVII: The coming Revolution of Data driven Discovery	0.3	Prof. Giuseppe Longo	DIETI, UNINA	DIETI
1st	Introduction to Underwater Robotics	0.4	Prof. Gianluca Antonelli	Università di Cassino e del Lazio Meridionale	DIETI
1st	5G: l'architettura, le applicazioni e la rete di accesso	0.4	Ing. Francesco Mollica	Vodafone Italia S.p.A.	ITEE

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1st	L'esposizione ai campi elettromagnetici generati dal sistema 5G – Metodologie scalari e vettoriali di misura dell'esposizione e tecniche di estrapolazione	0.8	Dr. Sara Adda, Dr. Daniele Franci, Ing. Settimio Pavoncello	Agenzia per la Protezione Ambientale	ITEE
1st	Localized least-squares radial basis function methods for PDEs	0.2	Prof. Elizabeth Larsson	Uppsala University	DIETI
1st	Analyzing and supporting the Evolution of Data-Intensive Systems	0.2	Dr. Anthony Cleve	University of Namur	Università della Svizzera Italiana
1st	Visualizing Discord Servers - definitely not a virtual conference video replay	0.2	Dr Marco Raglianti	Università della Svizzera Italiana	Università della Svizzera Italiana
1st	Qiskit: state of the art and tools for Quantum Computers from IBM	0.4	Dr Federico Accetta	IBM Italia	ITEE
1st	SAR Polarimetry: Theory, Machine Learning & Applications	0.4	Prof. Carlos Lopez-Martinez	Universitat Politècnica de Catalunya	ITEE
2nd	Supporting Code-Related Tasks with Deep Learning	0.2	Dr. Antonio Mastropaolo	Università della Svizzera Italiana	Università della Svizzera Italiana
2nd	Possible Quantum Machine Learning Approaches in HEP	0.4	Dr. Michele Grossi	CERN	ITEE
2nd	Connecting the dots: Investigating an APT campaign using Splunk	0.4	Dr. Antonio Forzieri	EMEA Cybersecuriy, SPLUNK Inc.	ITEE
2nd	Threat Hunting Use-Cases	0.4	Dr. Vladimir Kurdin	Group-IB	ITEE
2nd	All roads lead to WebRTC: an introduction to Janus	0.4	Dr. Lorenzo Miniero	Meetecho	ITEE
2nd	Picariello Lectures: Can a Text-to-Speech Engine Generate Human Sentiments?	0.2	Prof. Vijay K. Gubani	Illinois Institute of Technology	DIETI
2nd	IEEE Authorship and Open Access Symposium: Tips and Best Practices to Get Published from IEEE Editors	0.3	Dr. Rachel Berrington	IEEE	IEEE
2nd	Picariello Lectures: Towards a Political Philosophy of AI	0.3	Prof. Mark Coeckelbergh	University of Wien	DIETI
2nd	An Introduction to Deep Learning for Natural	0.2	Dr. Marco Valentino	University of Manchester	ITEE

	Language Processing				
2nd	Explainable Natural Language Inference	0.3	Dr. Marco Valentino	University of Manchester	ITEE
2nd	5G Network in Action – The Private Mobile Era	0.3	Ing. Marco Centenaro, Ing. Nicola di Pietro, Ing. Daniele Munaretto	5G Academy	DIETI
2nd	Fixed Wireless Access: Site Engineering, Implementation and Legal Regulations	1	Ing. Luca Mazza, Dr. Angela Delugan, Ing. Marco Fazzari	Fastweb S.p.A.	DIETI
2nd	Vine Robots: design challenges and unique opportunities	0.2	Dr. Nicholas Naclerio	University of California	ITEE
2nd	Quantum computing with superconducting qubits, an overview on the current state and future directions at Rigetti computing	0.2	Dr. Stefano Poletto	Rigetti Computing	Dipartimento di Fisica "E. Pancini", UNINA
2nd	Privacy-Preserving Machine Learning	0.4	Dr. Vittorio Prodomo	DIETI, Universidad Carlos III de Madrid	DIETI
3rd	Picariello Lectures: Crash-course on Data Excellence	0.2	Dr. Roberto Maranca	Schneider Electric SE	DIETI

Research activities

Francesco Altiero participated in research on Regression Test Prioritization, an active field in the domain of Software Testing. Prioritization is applied when there are limited resources allocated in the validation phase of a software during its evolution, and it consists in re-ordering the test suite to execute test cases which are more likely to fail before the others, trying to expose as many faults as possible even if the validation phase is abruptly interrupted.

Francesco Altiero analyzed the impact of changes in the source code when re-ordering the test cases, motivated by the rationale that the changes in a codebase might introduce faults in the software.

Francesco Altiero contributed to the field by designing two novel change-based prioritization approaches driven by the code churn, i.e., the modification in the source code: a genetic prioritization approach which includes information on code modification in the search, and a churn-based prioritization technique, employing a refined evaluation of structural changes through Tree Kernel functions. Another contribution concerned the collection a novel dataset with real faults to provide a solid support to Regression Test Prioritization studies.

His research has been also oriented to Regression Test Prioritization in Microservice environments, and to the challenges that this developmental methodology poses in the field.

Tutoring and supplementary teaching activities

Tutoring for the course "Algorithms and Data Structures", B.Sc. in Computer Science (20 hours).

Credits summary

PhD Year	Courses	Seminars	Research	Tutoring / Supplementary Teaching
1st	23.5	7.1	33	
2nd	14	5.4	44	
3rd	2.6	0.2	63	0.9

Research periods in institutions abroad and/or in companies

PhD Year	Institution / Company	Hosting tutor	Period	Activities
3	Technische Universität Wien (TUW), Wien, Austria	Prof. Jürgen Cito, Assistant Professor in Software Engineering	28/03/2023 - 05/07/2023	Research on Regression Test Prioritization approaches in Microservice Environments. Collection of benchmark microservice-based software projects and design of a change-aware technique to re-arrange the order of execution of e2e-tests.

PhD Thesis

In the PhD Thesis, Francesco Altiero presented two novel techniques for Regression Test Prioritization which leverage on code-churn, i.e. the modification in the source code in a software evolutionary step, motivated by the scarce presence in literature of prioritization approaches considering the changes in the source code to drive the construction of a permutation of test cases.

The first technique is designed in the Genetic Algorithm framework and aims to search for a permutation which provide higher priority at test cases covering any changed source element. The second technique employ a finer-grained quantification of the structural changes in the code by the means of Tree Kernel, using this information to prioritize test cases covering a high amount of such structural changes. The performances of the techniques have been empirically evaluated on a benchmark dataset of real-world software projects, in which injected faults have been automatically injected through software mutation.

Furthermore, since datasets with real faults are seldom employed in the Regression Test Prioritization literature, or the amount of information they provide is limited, the PhD thesis

presents a novel dataset of real-world projects with real faults. The dataset has been collected through mining online public code repository and Continuous Integration/Continuous Delivery pipelines, and includes various information, such as full source code and test coverage reports, to support Regression Test Prioritization research. Several techniques have been executed on the dataset and their fault-detection performances have been discussed.

Research products

Research results appear in 1 paper published in international journals, 0 papers published in national journals, *5* contributions to international conferences, 0 contributions to national conferences, 0 patents.

List of scientific publications

International Journal papers

F. Altiero, A. Corazza, S. Di Martino, A. Peron, L. L. L. Starace,
Regression Test Prioritization Leveraging Source Code Similarity with Tree Kernels,
International Journal of Software: Evolution and Process,
DOI: 10.1002/smr.2653. In production.

International Conference papers

F. Altiero, A. Corazza, S. Di Martino, A. Peron, L. L. L. Starace,
Inspecting Code Churns to Prioritize Test Cases,
Proceedings of Testing Software and Systems: 32nd IFIP WG 6.1 International Conference (ICTSS 2020),
Naples, Italy, Dec. 2020, pp. 272-285, Springer, DOI: 10.1007/978-3-030-64881-7_17.

F. Altiero, A. Corazza, S. Di Martino, A. Peron, L. L. L. Starace,
ReCover: a Curated Dataset for Regression Testing Research,
2022 IEEE/ACM 19th International Conference on Mining Software Repositories (MSR),
Pittsburgh, PA, USA, May 2022, pp. 196-200, IEEE, DOI: 10.1145/3524842.3528490. I attended the conference and presented the paper.

F. Altiero, G. Colella, A. Corazza, S. Di Martino, A. Peron, L. L. L. Starace,
Change-Aware Regression Test Prioritization using Genetic Algorithms,
Proceeding of the 48th Euromicro Conference on Software Engineering and Advanced Applications (SEAA),
Gran Canaria, Spain, Sep. 2022, pp. 125-132, IEEE, DOI: 10.1109/SEAA56994.2022.00028. I attended the conference and presented the paper.

F. Altiero, A. Corazza, S. Di Martino, A. Peron, L. L. L. Starace,
AI-based Fault-proneness Metrics for Source Code Changes,
Joint Proceedings of the 32nd International Workshop on Software Measurement (IWSM) and the 17th International Conference on Software Process and Product Measurement (MENSURA),
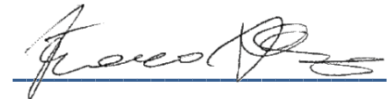Rome, Italy, Sep. 2023. To appear in the proceedings.

F. Altiero, A. Corazza, S. Di Martino, A. Peron, L. L. L. Starace,
Tree Kernels to Support Formal Methods-based Testing of Evolving Specifications,
Proceedings of the 4th Workshop on Artificial Intelligence and Formal Verification, Logic, Automata, and Synthesis (OVERLAY) hosted by the 21st International Conference of the Italian Association for Artificial Intelligence (AIxIA 2023),
Rome, Italy, Nov. 2023. To appear in the proceedings. I attended the conference and presented the paper.

Awards and Prizes

Best Paper Award for the conference paper "AI-based Fault-proneness Metrics for Source Code Changes", presented at the International Conference on Software Process and Product Measurement (MENSURA) in Sep. 2023.

Date 19/01/2024_____

PhD student signature _____

Supervisor signature _____