Luca Di Stefano

Curriculum vitae
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Personal information

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Research interests

My research mainly concerns the formal modelling and analysis of agent-based models of complex collective systems. On one hand, this entails the development of formally defined high-level languages to concisely describe the features of individual agents; on the other hand, it requires applying and improving state-of-the-art verification techniques to check the collective behaviour of the resulting system.
Keywords associated with my interests include:
Modelling: Agent-based modelling, Attribute-based communication, Collective adaptive systems, Domain-specific languages, Multi-agent systems, Process algebras, Stigmergic interaction, Structural operational semantics, Temporal logics.

Analysis: Bounded model checking, Explicit-state and symbolic model checking, Software verification, Static analysis.

Education

Gran Sasso Science Institute **L'Aquila, Italy**
PhD in Computer Science *November 2016 – October 2020*
Thesis: *Modelling and Verification of Multi-Agent Systems via Sequential Emulation*
Advisors: Rocco De Nicola, Omar Inverso
URL: hdl.handle.net/20.500.12571/10181
Other activities: Student representative in the academic senate (2018–2020).

University of L'Aquila **L'Aquila, Italy**
MSc in Computer Science and Systems Engineering *March 2014 – October 2016*
Thesis: *Design of a reactive system for autonomous UAV navigation in unknown environments*. Thesis written in Italian. Original title: *Progettazione di un sistema reattivo per la navigazione autonoma di un drone in ambienti sconosciuti*.
Advisors: Eliseo Clementini, Enrico Stagnini
Final grade: 110/110, *cum laude*
Official degree name: *Ingegneria Informatica e Automatica*.

Positions held

University of Gothenburg/Chalmers **Gothenburg, Sweden**
Post-doctoral researcher *May 2022 – Present time*
Member of the d-SynMA ERC Consolidator project (Distributed Synthesis from Single to Multiple Agents). The main aim of the project is to develop the theoretical foundations that will enable reactive synthesis in the context of multiple agents.
Web page of the project: `https://dsynma.bitbucket.io`

CONVECS, Inria/LIG **Grenoble, France**
Post-doctoral researcher *November 2020 – April 2022*
The aim of this post-doc is to enable efficient model checking of temporal properties in the context of collective adaptive systems. Building upon previous work with the CONVECS team, I developed an automated translation of a state-based temporal property language into MCL (an extension of the alternation-free fragment of the modal μ-calculus), and used it to verify a selection of systems. I am also investigating how compositional verification techniques may help with model checking of large systems.

SySMA, IMT Lucca **Lucca, Italy**
Grant holder *December 2019 – October 2020*
The grant topic was "Verification of Emerging Properties in Collective Adaptive Systems". I adapted a structural encoding procedure I had been working upon as part of my PhD to multiple verification tools implementing a variety of techniques, including predicate abstraction, k-induction and property-directed reachability.

CONVECS, Inria/LIG **Grenoble, France**
Visiting PhD student *March – July 2019*
As a visitor at CONVECS, I focussed on topics related to my doctoral thesis, such as defining a structural encoding of multi-agent systems in the LNT specification language and using it to verify these systems through model checking.

Teaching

Chalmers **Gothenburg, Sweden**
BSc course in Principle of Concurrent Programming *January – March 2023*
Teaching assistant (approx. 80 hours). The course covered both shared-memory and message-passing concurrency, using Java and Erlang as reference languages. I provided assistance in lab sessions, grading of assignments and exams, and Erlang coding tutorials.

Polytech Paris-Saclay **Paris, France**
MSc course in Modelling and Verification *March – April 2022*
April – May 2021
36-hour course for Master students in Computer Science Engineering, *filière apprentissage*. Held remotely (2021) and in person (2022) as a supply teacher (*intervenant vacataire*). The course focused on the following topics: modelling of concurrent systems through communicating automata (labelled transition systems); behavioural equivalences; process algebras (CCS, LNT); modal and temporal logics (HML, μ-calculus, MCL); model checking; modelling of real-time systems through timed automata; model-based testing. Tools such as CADP and UPPAAL were showcased in lab sessions.

Supervised students

Master students: Love Lyckaro, Chalmers, 2023 (ongoing).

Other academic activities

Reviewing activity

Conferences: SEFM 2019, TASE 2019, AAMAS 2021, FM 2021, ICSOFT 2021, ISoLA 2021, FORTE 2022, ISoLA 2022, TACAS 2023.

Journals: Logical Methods in Computer Science, Science of Computer Programming.

Participation to PhD schools

1st VMCAI Winter School **Lisbon, Portugal**
January 2019

The school featured lectures on several topics associated with the VMCAI conference series, including: abstract interpretation (Patrick Cousot, New York University); computing with SAT oracles (João Marques-Silva, University of Lisbon); neural network verification (M. Pawan Kumar, University of Oxford); verification of distributed protocols (Ken McMillan, Microsoft Research).

Invited presentations

- *Verifying collective adaptive systems by emulation.* Remote presentation to the Formal Methods unit of the Computer Science and Engineering department (University of Gothenburg and Chalmers). Gothenburg, Sweden, 10 March 2022.
- *Multi-agent (smart) systems with virtual stigmergies.* Kickoff meeting of Italian national research project (PRIN) *IT MATTERS: Methods and Tools for Trustworthy Smart Systems.* Pisa, Italy, 14 October 2019.
- *Multi-agent systems with virtual stigmergies.* Invited presentation at IMT School for Advanced Studies. Lucca, Italy, 3 July 2018.

Skills

Technical skills: My experience in programming spans more than a decade. As of now my languages of choice are mainly F# and Python, but I have worked with a number of popular languages across the years (e.g., C, C++, C#, Erlang, Go, Java, Prolog). I have some knowledge of control theory, computer architectures, assembly languages, and hardware description languages (mainly VHDL). I am also familiar with version control systems such as Git and Subversion.

Language skills: Italian is my first language. I am fluent in English (CEFR level C1–C2) and have some knowledge of French (CEFR level A2–B1).

Soft skills: Having been the main contributor to all my publications so far, I have acquired good academic writing skills, as well as an ability to work in groups, meet deadlines, and present my ideas both to my team mates and to external audiences.

Publications

Journal articles

R. De Nicola, L. Di Stefano, O. Inverso, and A. Uwimbabazi. 2022. "Automated Replication of Tuple Spaces via Static Analysis". In: *Sci. Comput. Program.* 223.

L. Di Stefano, R. De Nicola, and O. Inverso. 2022. "Verification of Distributed Systems via Sequential Emulation". In: *TOSEM* 31.

R. De Nicola, L. Di Stefano, and O. Inverso. 2020. "Multi-Agent Systems with Virtual Stigmergy". In: *Sci. Comput. Program.* 187.

R. De Nicola, L. Di Stefano, and O. Inverso. 2018. "Toward Formal Models and Languages for Verifiable Multi-Robot Systems". In: *Frontiers Robotics AI* 5.

Peer-reviewed conference and workshop papers

L. Di Stefano and F. Lang. 2023. "Compositional Verification of Stigmergic Collective Systems". In: *24th International Conference on Verification, Model Checking, and Abstract Interpretation* (*VMCAI*).

R. De Nicola, L. Di Stefano, O. Inverso, and S. Valiani. 2022. "Modelling Flocks of Birds from the Bottom Up". In: *11th International Symposium on Leveraging Applications of Formal Methods, Verification and Validation* (*ISoLA*).

L. Di Stefano and F. Lang. 2021. "Verifying Temporal Properties of Stigmergic Collective Systems Using CADP". In: *10th International Symposium On Leveraging Applications of Formal Methods, Verification and Validation* (*ISoLA*).

L. Di Stefano, F. Lang, and W. Serwe. 2020. "Combining SLiVER with CADP to Analyze Multi-agent Systems". In: *22nd International Conference on Coordination Models and Languages* (*COORDINATION*).

R. De Nicola, L. Di Stefano, and O. Inverso. 2018. "Multi-Agent Systems with Virtual Stigmergy". In: *STAF Collocated Workshops, Revised Selected Papers*.

Book chapters

R. De Nicola, L. Di Stefano, O. Inverso, and S. Valiani. 2022. "Process Algebras and Flocks of Birds". In: *A Journey from Process Algebra via Timed Automata to Model Learning - Essays Dedicated to Frits Vaandrager on the Occasion of His 60th Birthday*.

Technical reports

L. Di Stefano and F. Lang. *Compositional Verification of Priority Systems using Sharp Bisimulation*. INRIA. URL: `https://hal.inria.fr/hal-03640683`.

Citation indices

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