






Sacha-Élie Ayoun

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Advanced Research Fellow with Azalea Raad at Imperial College London

Education

Imperial College London

PHD IN COMPUTER SCIENCE - UNDER THE SUPERVISION OF PROF. PHILIPPA GARDNER

Part of the Verified Trustworthy Software Specification Group. Working on Gillian, a parametric symbolic analysis framework, and instantiating it to C and Rust. See Projects section for more details.

London, United Kingdom

Oct. 2018 - present

Marktoberdorf Summer School on Safety and Security of Software Systems

STUDENT

Marktoberdorf, Germany

Aug. 2019

Link to the summer school program : <https://www2.in.tum.de/mod19/lectures.html>

Imperial College London

MSC IN ADVANCED COMPUTING - WITH DISTINCTIONS

London, United Kingdom

Oct. 2017 - Sept. 2018

- Reasoning about programs: Complexity (A*), Separation logic (A*), Probabilistic model checking and program analysis(A**), System Verification(A*)
- Security: Advanced security (A), Privacy Enhancing Techniques (A*), Network and Web security(A)
- Other: Software engineering(A), Deep learning (A), Reinforcement Learning (A*)

CentraleSupélec, Supélec Curriculum

MSC IN ELECTRICAL AND COMPUTER ENGINEERING

Gif-Sur-Yvette, France

Sept. 2015 - Sept. 2018

CentraleSupélec is a top-tier French professional school of science and engineering, with partner programs with prestigious universities around the world, such as MIT, Columbia, Oxford, and Imperial College.

- Broad curriculum with over 30 different subjects, ranging from Corporate Law to Electrical Engineering, Networks, and Operating systems. Average 3.7/4.
- Excellent computer science results: Algorithms and Data Structures (4/4), Numerical Methods of Optimisation (4/4), Operating Systems and Networks (4/4), Big Data (4/4), Software Engineering (4/4)
- One of the top engineering school in France, part of highly ranked Paris-Saclay University

Classes Préparatoires Charlemagne

FRENCH CLASSES PRÉPARATOIRES: 2-YEAR ELITE, INTENSIVE PROGRAM IN ADVANCED MATHEMATICS, PHYSICS AND COMPUTER SCIENCE

Paris, France

Sept. 2013 - Sept. 2015

Accepted at both CentraleSupélec and ENS Lyon in Computer Science

Publications

Compositional Bug Detection for Internally Unsafe Libraries

PEDRO CARROTT, SACHA-ÉLIE AYOUN, AZALEA RAAD

ECOOP - Bergen, Norway

2025

A Hybrid Approach to Semi-Automated Rust Verification

SACHA-ÉLIE AYOUN, XAVIER DENIS, PETAR MAKSIMOVIC, PHILIPPA GARDNER

PLDI - Seoul, Korea

2025

Distinguished Artifact Award

Compositional Symbolic Execution for Correctness and Incorrectness Reasoning

ANDREAS LÖÖW, DANIELE NANTES, SACHA-ÉLIE AYOUN, CAROLINE CRONJÄGER, PETAR MAKSIMOVIC, PHILIPPA GARDNER

ECOOP - Vienna, Austria

2024

Distinguished Paper Award

Matching Plans for Frame Inference in Compositional Reasoning

ANDREAS LÖÖW, DANIELE NANTES, SACHA-ÉLIE AYOUN, PETAR MAKSIMOVIC, PHILIPPA GARDNER

ECOOP - Vienna, Austria

2024

Symbolic Debugging with Gillian

NAT KARMIOS, SACHA-ÉLIE AYOUN, PHILIPPA GARDNER

DEBT workshop @ECOOP

2023

Gillian, Part II: Real-World Verification for JavaScript and C

PETAR MAKSIMOVIC, SACHA-ÉLIE AYOUN, JOSÉ FRAGOSO SANTOS, PHILIPPA GARDNER

CAV - Online

2021

Gillian Part I: A Multi-Language Platform for Symbolic Execution

JOSÉ FRAGOSO SANTOS, PETAR MAKSIMOVIC, SACHA-ÉLIE AYOUN, PHILIPPA GARDNER

PLDI - Online

2020

Talks

Big Specification Workshop @ Isaac Newton Institute

HYBRID VERIFICATION FOR RUST

Cambridge, UK

October 2024

Quarkslab Seminar

GILLIAN: UNIFIED PARAMETRIC COMPOSITIONAL SYMBOLIC EXECUTION

Paris, France

March 2024

Rust Formal Methods Interest Group Seminar

GILLIAN-RUST: A HYBRID APPROACH TO END-TO-END VERIFICATION FOR RUST PROGRAMS

Online

February 2024

ETH Zürich - Programming Languages and Systems Institute Seminar

GILLIAN: UNIFIED PARAMETRIC COMPOSITIONAL SYMBOLIC EXECUTION

Zürich, Switzerland

September 2023

Max Plank Institute for Software Systems - Programming Languages and Verification Seminar

GILLIAN: UNIFIED PARAMETRIC COMPOSITIONAL SYMBOLIC EXECUTION

Saarbrücken, Germany

August 2023

KU Leuven, DistriNet Group Seminar

GILLIAN: UNIFIED PARAMETRIC COMPOSITIONAL SYMBOLIC EXECUTION

Leuven, Belgium

July 2023

CEA List, Seminar

GILLIAN: UNIFIED PARAMETRIC COMPOSITIONAL SYMBOLIC EXECUTION

Saclay, France

April 2023

Employment

Imperial College London

RESEARCH ASSISTANT

London, United Kingdom

Jan. 2023 - present

As my role in the Verified Trustworthy Software Specification group has extended beyond that of a PhD student, I have been promoted to Research Assistant while I finish my thesis.

Amazon Web Services - Kani team

APPLIED SCIENTIST INTERN

Boston, Massachusetts, USA

June 2022 - Sept 2022

The Kani Rust verifier is based on the CBMC tool as a backend. I worked on using Gillian, the tool I am developing for my PhD, as an alternative backend. Doing so unlocked exciting opportunities, and allowed, to our knowledge, the first unbounded proof of unsafe Rust code performed directly on the source code. It also showed promising results regarding Gillian performances, and suggested that the Kani team could explore portfolio reasoning, keeping CBMC as its primary backend, but also use other backends.

Amazon Web Services - CodeGuru team

APPLIED SCIENTIST INTERN

Remote - California, USA

July 2021 - Oct 2021

I was an Applied Scientist intern as part of the CodeGuru team at AWS during the summer. As part of that team, I developed a proof of concepts analysis for Java that could help reduce the number of false positives or reduce the search space in other kinds of analyses without compromising soundness. It was a great and fun experience, and I learned a lot about research in industry. I obtained good feedback from my manager and was offered a return internship.

French Alternative Energies and Atomic Energy Commission (CEA)

RESEARCH INTERN ON FRAMA-C, A STATIC ANALYSER FOR THE C PROGRAMMING LANGUAGE

Saclay, France

Jul. 2017 - Sept. 2017

Frama-C is a modular static analysis tool based on abstract interpretation. In particular, its EVA (Evolved Value Analysis) module automatically computes sets of possible values for the variables of an analysed program. My role was to develop a new abstract domain that would keep track of the state of every file descriptor.

Projects

Gillan, Gillian-C and Gillian-Rust

IMPERIAL COLLEGE - VERIFIED TRUSTWORTHY SOFTWARE SPECIFICATION GROUP

London, United Kingdom

Oct. 2018 - Present

Gillian is a language-independent framework for the development of compositional symbolic analysis tools. It supports three flavours of analysis: whole-program symbolic testing, full verification, and bi-abduction. For a given language, Gillian requires as input a compiler from the language to our intermediate language GIL and an implementation of the memory model and basic actions for the model. Gillian then provides a complete toolchain for the symbolic analysis of that language. For now, Gillian has been instantiated to:

- Gillian-JS, an analysis tool for JavaScript whose performance is as good as the previous work on JaVert 2.0
- Gillian-C, an analysis tool for C leveraging CompCert, a Coq-certified C compiler developed at Inria with promising initial results for performance;
- Gillian-Rust, an analysis tool which allows for the verification semantic type safety and functional correctness of unsafe Rust code;
- and Gillian-WISL, an analysis tool for a toy while language which we will use for experimentation into error reporting, concurrency

While Gillian-JS was extracted from previous work, Gillian-C, Gillian-Rust and Gillian-WISL are entirely my contributions. In addition, I have also contributed to strengthening the formalism constituting the meta-theory of Gillian itself, and have become lead developer on its implementation. A paper describing the core symbolic execution engine of Gillian has been published at PLDI 2020 and a paper about verifying code written both in C and JS and already deployed in production by Amazon AWS has been published in CAV 2021.

“LinkCS” Project lead: Development of a web and mobile application for campus life

CENTRALESUPELEC - VIAREZO

Paris-Saclay, France

Sep. 2016 - Sep. 2017

CentraleSupélec was recently created by a merger between the Ecole Centrale Paris and Supélec. This merger, coupled with the very active student and societal life in the school, gave rise to the need for an application that would help the students manage their everyday lives inside the campus societies. As project lead, I supervised the creation and development of this application, with its ambitious micro-services architecture and use of (at the time) cutting-edge web technologies, such as NodeJS, ReactJS, and GraphQL. To this day, LinkCS is still used as one of the core components of student life on the CentraleSupélec campus.

Teaching and Supervision

Teaching Assistant

IMPERIAL COLLEGE LONDON - 6 COURSES FROM 1ST YEAR TO MASTERS LEVEL

London, United Kingdom

Oct. 2018 - Present

- Scalable Software Verification (taught by Prof. Philippa Gardner) : Tutorial helper, Coursework marking, Exam and coursework questions design
- Compilers (taught by Prof. Paul Kelly): Coursework marking
- Models of Computation (taught by Dr. Herbert Wiklicky and Dr. Azalea Raad): Tutorial helper, Coursework and Exam marking.
- Python Programming (taught by Dr. Oana Cocarascu): Tutorial helper, Coursework marking.
- High Level Programming (taught by Dr. Thomas Clarke): Tutorial helper, Coursework and Project marking.
- Computational Techniques (taught by Manon Flageat, Viet Pham Ngoc, Luca Grilloti and Dr. Pancham Shukla): Personalized Mathematics Tutor and Coursework marking.

Masters Thesis Supervision

CO-SUPERVISOR FOR 7 PROJECTS SINCE 2020

Paris-Saclay, France

Sep. 2016 - Sep. 2017

Between 2020 and 2023, I supervised 7 masters projects related to the Gillian project. Among those, 3 were awarded a distinguished grade (including 2 that received a prize), and 2 were awarded the distinction grade. Projects subjects ranged from improving the real-world applicability of Gillian by enabling continuous and multi-file verification, to reasoning about Rust memory layouts, or extending Gillian with basic concurrency reasoning through fractional permissions. I am particularly proud of a stream of 3 projects from 2020 to 2022 which led to the creation of a symbolic debugger for Gillian, with a small paper published at DEBT2023, ongoing work for a more detailed paper, and discussions with industry actors to integrate our debugging technique in their widely-used tools.

Grants

2023 Co-Investigator, 50 000\$ Amazon Research Award

Committees and Panels

Reviewing - TOPLAS

REVIEWER

Online

July - August 2025

Organising committee - POPL 2025

STUDENT VOLUNTEER CO-CHAIR AND LOCAL ORGANISER

Seoul, South Korea

January 2025

Organising committee - POPL 2024

STUDENT VOLUNTEER CO-CHAIR AND LOCAL ORGANISER

London, United Kingdom

January 2024

I am particularly proud to have been a part of the organising committee for POPL 2024, which was held in London. As student volunteer chair, I had the privilege to meet and work with 50 students from all over the world, running up and down to make sure the experience was as smooth as possible for conference attendees. In addition, as local organiser, I helped with several logistical aspects of the conference, including communication with the venue, designers, conference manager etc.

Artifact Evaluation Committee - VMCAI 2022

REVIEWER

Online

Sept 2021

Panel at PLMW - Navigating PhD Studies

PANEL MEMBER

PLMW @POPL21

January 2021

I was a member of the panel addressed to masters students and new PhD students at the Programming Languages Mentoring Workshop co-located with POPL21.