

Curriculum Vitae

Short version

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Personal

Born in 1987. Married, three children: Léa (2019), Noé (2021), Éva (2024).

Research Positions and Education

Habilitation

French degree allowing me to supervise PhD students

University of Bordeaux

11 Feb 2022

Current

Junior Researcher

Chargé de recherche

CNRS, LaBRI, Bordeaux

Since Jan 2018

Past

Research Fellow

Logical Foundations of Data Science

Alan Turing Institute of data science, London

Jan. 2017 – Aug. 2022

Research Fellow

Theoretical Foundations for Computer Systems

Simons Institute, University of Berkeley

Jan. 2021 – May. 2021

Research Fellow

Logical Structures in Computation

Simons Institute, University of Berkeley

Aug. 2016 – Dec. 2016

Research Assistant

Dynamical Systems

University of Oxford

Nov. 2015 – July 2016

Education

PhD in Computer Science

Counting and Randomising in Automata Theory

Jointly supervised by Mikołaj Bojańczyk and Thomas Colcombet

Paris 7 & Warsaw

Sept 2012 – Oct 2015

Five most important publications

In the publications below the interpretation on authors order depends on the venue: alphabetical for [4,5], and ordered by contributions for [2,3]. [1] is a special case. None include my PhD advisors.

I initiated a collaborative textbook on the field of games. The book is composed of 13 chapters (490 pages in PDF format) and written in a mathematically rigorous way with uniform notations, definitions, and technical developments, in order to give the only existing comprehensive account on the state of the art for this dynamic field of research. It is published online on Arxiv. I coauthored 5 chapters and acted as project leader, organising the book contents and inviting the 16 other authors.

- [1] Nathanaël Fijalkow, Nathalie Bertrand, Patricia Bouyer, Romain Brenguier, Arnaud Carayol, John Fearnley, Hugo Gimbert, Florian Horn, Rasmus Ibsen-Jensen, Nicolas Markey, Benjamin Monmege, Petr Novotný, Mickael Randour, Ocan Sankur, Sylvain Schmitz, Olivier Serre, Mateusz Skomra. *Games on Graphs*, 2023

Publicly available: <https://arxiv.org/abs/2305.10546>. To be published by Cambridge University Press in 2024.

The following work develops a theoretical framework for search algorithms in program synthesis. The experiments use DeepSynth, a grammar-based program synthesis tool with neural predictions. I was the main developer of DeepSynth and main contributor to the theoretical developments.

- [2] Nathanaël Fijalkow, Guillaume Lagarde, Théo Matricon, Kevin Ellis, Pierre Ohlmann, Akarsh Potta (by contributions). *Scaling Neural Program Synthesis with Distribution-based Search*, AAAI Conference on Artificial Intelligence 2022. Acceptance rate: 15.0%, Core ranking A*

Publicly available: <https://www.aaai.org/AAAI22Papers/AAAI-5100.FijalkowN.pdf>

The following work solves a long-standing open question in reactive synthesis using automata-theoretic developments. My contributions were to define the automata and games models, and identify and prove the correspondence between these models and the original question.

- [3] Nathanaël Fijalkow, Bastien Maubert, Aniello Murano, Moshe Y. Vardi (by contributions). *Assume-Guarantee Synthesis for Prompt Linear Temporal Logic*, International Joint Conference on Artificial Intelligence, IJCAI 2020. Acceptance rate: 12.6%, Core ranking A*

Publicly available: <https://www.ijcai.org/Proceedings/2020/0017.pdf>

The following work studies the classic problem in computational linguistics of learning probabilistic context-free grammars (PCFGs) from word samples. Published in a premiere journal in computational linguistics (Core ranking A* for attached conference, not applicable for journal). Posterior to the journal publication, this work has been invited for presentation in two conferences: the Society for Computation in Linguistics and the Conference on Empirical Methods in Natural Language Processing.

- [4] Alexander Clark, Nathanaël Fijalkow (alphabetical). *Consistent unsupervised estimators for anchored PCFGs*, Transactions of the Association for Computational Linguistics in 2020.

Publicly available: <https://aclanthology.org/2020.tacl-1.27.pdf>

The fifth selected paper was published in the proceedings of a top-tier conference in Algorithms, SODA. Following a breakthrough result two years earlier constructing a quasi-polynomial time algorithm for parity games, a central question for reactive synthesis, it establishes a matching lower bound on the symbolic approaches developed for that algorithm. This important negative result has already been cited 51 times since 2019 (according to Google Scholar), which is remarkable in this community. My contribution is the definition of the main combinatorial object, universal trees, and the quasi-polynomial lower bound on their sizes.

- [5] Wojciech Czerwiński, Laure Daviaud, Nathanaël Fijalkow, Marcin Jurdziński, Ranko Lazić, Paweł Parys (alphabetical). *Universal trees grow inside separating automata: Quasi-polynomial lower bounds for parity games*, ACM-SIAM Symposium on Discrete Algorithms, SODA 2019. Acceptance rate: 31.0%, Core ranking A*

Full version available as preprint: <https://arxiv.org/abs/1807.10546>

Invited talks

International conferences: ▷ **2024** Jewels of Automata Theory ▷ **2019** Symposium on Games, Automata, Logics, and Formal Verification ▷ **2015** ESF AutoMathA conference

International workshops: ▷ **2023** Workshop on Open Problems in Learning and Verification of Neural Networks (Wolverine, CAV satellite event) ▷ **2020** Coalgebraic Methods in Computer Science (CMCS, ETAPS satellite event) ▷ **2019** Games for Logic and Programming Languages (GaLoP, ETAPS satellite event) ▷ **2019** Complexity, Algorithms, Automata and Logic Meet (CAALM, Chennai) ▷ **2017** Logical Structures for Computation at the Simons Institute, Berkeley ▷ **2016** Collective Adaptive Systems Synthesis (Casting, ETAPS satellite event)

Tutorials and research schools: ▷ **2024** Symposium on Principles of Programming Languages (POPL) ▷ **2023** World Symposium on Formal Methods (FM) ▷ **2022** French School for Young Researchers in Computer Science and Mathematics (EJCIM) ▷ **2020** European Conference on Artificial Intelligence (ECAI) ▷ **2019** ForMaL DigiCosme Spring School on Formal Methods and Machine Learning

Specialised workshops by invitation: ▷ **2024** Dagstuhl Seminar: Artificial Intelligence and Formal Methods Join Forces for Reliable Autonomy ▷ **2023** Dagstuhl Seminar: Approaches and Applications of Inductive Programming ▷ **2023** Dagstuhl Seminar: Model Learning for Improved Trustworthiness in Autonomous Systems ▷ **2022** Dagstuhl Seminar: Finite Model Theory ▷ **2021** Dagstuhl Seminar: Unambiguity in Automata Theory ▷ **2021** Lorentz Center: Rigorous Automated Planning ▷ **2020** Barbados Bellairs Centre: Probabilistic Programming ▷ **2019** Dagstuhl Seminar: Logic and Learning ▷ **2019** Barbados Bellairs Centre: Logical Foundations for Data Science

Seminar talks: over 30 research groups across Europe

Professional service

Scientific Leadership.....

Head of GT-DAAL: Data, Automata, Algebra, and Languages

Since 2018

GDR-IM is a French network gathering computer scientists and mathematicians, it is composed of a dozen working groups and organises and supports several national scientific events. As one of the two Heads of GT-DAAL, one of the working group of GDR-IM, I coordinate the national events pertaining to Database Theory, Automata Theory, and Logic.

Managing Editor for TheoretiCS

2021 – 2024

TheoretiCS is a Diamond Open Access Journal covering all areas of Theoretical Computer Science and launched in Oct 2021. It works as an ArXiv overlay journal, implying that access to all papers is free. Authors are not required to pay any publication fees or article processing charges, and retain copyright. TheoretiCS ambitions to attract the very best papers in each field of Theoretical Computer Science. As one of the two Managing Editors I actively participate in materialising this ambition.

Publicity Chair for the Highlights of Logic, Games, and Automata Conference

2017 – 2022

Highlights of Logic, Games and Automata is an annual conference aiming at integrating the community working in these fields. It is modelled after mathematics conferences: all relevant papers, published elsewhere or not, are accepted for a short presentation. A visit to the Highlights conference offers a wide picture of the latest research in the field and a chance to meet everybody in the community. As Publicity Chair I help disseminating the conference and related events, and in this capacity I sit in the Steering Committee.

Principal Investigator of Research Grants.....

PEPR IA <i>SAIF: Safe AI using Formal Methods</i>	4 years, 900k€ Sept. 2023 – Aug. 2027
IRP <i>Le Trójkąt: Collaboration between Bordeaux, Paris, and Warsaw</i>	5 years, 75k€ Jan 2024 – Dec 2028
ANR JCJC <i>G4S: Games for Synthesis</i>	4 years, 140k€ Jan 2022 – Dec 2025
CNRS Momentum <i>DeepSynth: Machine Learning Guided Program Synthesis</i>	3 years, 180k€ + 2 years post-doc Jan 2019 – Dec 2021

Program Committees of International Conferences.....

▷ **2024** International Conference on Artificial Intelligence (AAAI) ▷ **2024** International Conference on Verification, Model Checking, and Abstract Interpretation (VMCAI) ▷ **2023** International Joint Conference on Artificial Intelligence (IJCAI) ▷ **2023** International Conference on Artificial Intelligence (AAAI) ▷ **2023** International Conference on Quantitative Evaluation of SysTems (QEST) ▷ **2022** Computer Science in Russia (CSR) ▷ **2022** Mathematical Foundations of Computer Science (MFCS), ▷ **2019** International Conference on Reachability Problems (RP), ▷ **2019** International Colloquium on Automata, Languages and Programming (ICALP), ▷ **2019** Foundations of Software Systems and Computer Science (FoSSaCS), ▷ **2019** Highlights of Logic, Games and Automata (Highlights), ▷ **2018** Mathematical Foundations of Computer Science (MFCS), ▷ **2018** Highlights of Logic, Games and Automata (Highlights)

PhD Committees.....

▷ **2023** Nathan Thomasset, Strategy complexity for Gale-Stewart games (*LMF*) ▷ **2023** Grégoire Menguy, Black-box analysis of binary code (*CEA List*) ▷ **2022** Cedric Koh, On Linear, Fractional and Submodular Optimization (*London School of Economics*) ▷ **2022** Xavier Badin de Montjoye, Strategy Improvement Method for Solving Simple Stochastic Games (*Université de Versailles Saint-Quentin-en-Yvelines*) ▷ **2019** Hugo Bazille, Detection and Quantification of Events in Stochastic Systems (*ENS Rennes*)

Co-Organisation of Seminars and Working Groups.....

▷ **2025** Theoretical Foundations of Trustworthy AI (*Simons Institute, Berkeley*) ▷ **2024** Dagstuhl Seminar on Stochastic Games ▷ **2023** Dagstuhl Seminar on the Futures of Reactive Synthesis ▷ **2020** Online Worldwide Seminar on Logic and Semantics (OWLS) ▷ **2018** Theory of Machine Learning Reading Group (*LaBRI, Bordeaux*) ▷ **2018** Formal Methods Team Seminar (*LaBRI, Bordeaux*) ▷ **2017** Logic Seminar (*Alan Turing Institute, London*) ▷ **2016** Fellows Logic Open (*Simons Institute, Berkeley*) ▷ **2015** Verification Seminar (*Oxford*) ▷ **2014** Automata Seminar (*LIAFA, Paris*)

Co-Organisation of Scientific Events.....

▷ **2020** Learning and Verification day (*LaBRI, Bordeaux*) ▷ **2019** Learning and Verification day (*UCL, London*) ▷ **2018** Logic and Learning FoPSS School (*Oxford, affiliated to FLOC*) ▷ **2018** Summit on Machine Learning Meets Formal Methods (*Oxford, affiliated to FLOC*) ▷ **2018** Logic and Learning Workshop (*The Alan Turing Institute, London*) ▷ **2015** Annual meeting of the GT ALGA (*IRIF, Paris*)

Supervision

I have supervised **16** interns, **6** PhD students (3 defended), and **2** postdocs.

Teaching

▷ **Starting 2025** Large Language Models, Master Vision Apprentissage, Saclay (24h) ▷ **Since 2024** Theory and Practice of Machine Learning, IA Master in University of Bordeaux (24h) ▷ **Since 2021** Games Techniques in Computer Science, Parisian Master in Computer Science, MPRI (12h) ▷ **Since 2019** Theory and Practice of Reinforcement Learning, PhD Programme in LaBRI, Bordeaux (12h) ▷ **Since 2019** Reinforcement Learning, IA Master at ENSEIRB (18h)