Debraj Chakraborty

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Areas of Interest

My research focuses on **formal methods**, **verification**, and **model checking**, with an emphasis on controller synthesis for **probabilistic systems** such as Markov decision processes. I am also exploring **machine learning** techniques for developing scalable and explainable controllers.

Research experience

Postdoctoral researcher

Brno, Czechia

Learning in Verification lab, Masaryk University — *Apr. 2023 - present*

Mentor: Jan Křetínský

Visiting researcher

Kolkata, India

Advanced Computing and Microelectronics Unit, Indian Statistical Institute — *Jan. 2023 - Mar. 2023*

Education

PhD in Computer Science

Brussels, Belgium

Université Libre de Bruxelles — *Sep. 2018 - Dec. 2022*

- Advisor: Jean-François Raskin
- PhD thesis: Monte Carlo Tree Search with Advice

MSc in Computer Science

Chennai, India

Chennai Mathematical Institute — *Aug. 2016 - Jul. 2018*

CGPA : 9.56/10

BSc in Mathematics and Computer Science

Chennai, India

Chennai Mathematical Institute — *Aug. 2013 - Jul. 2016*

CGPA : 8.33/10

Publications

1-2-3-Go! Policy Synthesis for Parameterized Markov Decision Processes via Decision-Tree Learning and Generalization

with Muqsit Azeem, Sudeep Kanav, Jan Křetínský, Mohammadsadegh Mohagheghi, Stefanie Mohr and Maximilian Weininger — *To appear, Jan. 2025*

at Verification, Model Checking, and Abstract Interpretation (VMCAI 2025)

Learning Explainable and Better Performing Representations of POMDP Strategies

with Alexander Bork, Kush Grover, Jan Křetínský and Stefanie Mohr — *Apr. 2024*

at Tools and Algorithms for the Construction and Analysis of Systems (TACAS 2024)

Bi-objective Lexicographic Optimization in Markov Decision Processes with Related Objectives

with Damien Busatto-Gaston, Anirban Majumdar, Sayan Mukherjee, Guillermo A. Pérez and Jean-François Raskin — *Oct. 2023*

at Automated Technology for Verification and Analysis (ATVA 2023)

Formally-Sharp DAgger for MCTS: Lower-Latency Monte Carlo Tree Search using Data Aggregation with Formal Methods

with Damien Busatto-Gaston, Guillermo A. Pérez and Jean-François Raskin *May 2023*

at Autonomous Agents and Multiagent Systems (AAMAS 2023)

Safe Learning for Near Optimal Scheduling

with Damien Busatto-Gaston, Shibashis Guha, Guillermo A. Pérez and Jean-François Raskin *Aug. 2021*

at Quantitative Evaluation of Systems (QEST 2021)

Monte Carlo Tree Search guided by Symbolic Advice for MDPs

with Damien Busatto-Gaston and Jean-François Raskin *Sep. 2020*

at Concurrency Theory (CONCUR 2020)

Teaching Experience

Algorithms for Quantitative Verification *Masaryk University*

Instructor: Prof. Jan Křetínský

Sep. 2023 - Jan. 2024

Embedded Systems Design *Université Libre de Bruxelles*

Instructor: Prof. Jean-François Raskin

Feb. 2021 - Jun. 2021

Feb. 2022 - Jun. 2022

Formal Verification of Computer Systems *Université Libre de Bruxelles*

Instructor: Prof. Jean-François Raskin

Feb. 2021 - Jun. 2021

Feb. 2022 - Jun. 2022

Computability and Complexity *Université Libre de Bruxelles*

Instructor: Prof. Jean-François Raskin

Sep. 2019 - Jan. 2020

Concurrency Theory *Chennai Mathematical Institute*

Instructor: Prof. Madhavan Mukund

Jan. 2017 - Apr. 2017

Internships

Distributed Synthesis Problem for Ring-like Architectures *Bordeaux, France*

Supervisor: Prof. Hugo Gimbert *May. 2017 - Jul. 2017*

Laboratoire Bordelais de Recherche en Informatique

Bisimulation Equivalence of First-Order Grammars *Chennai, India*

Supervisor: Prof. Teodor Knapik *May. 2016 - Jul. 2016*

Institute of Mathematical Sciences

Writers Identification by Pattern Recognition in Bengali *Kolkata, India*

Supervisor: Prof. Umapada Pal *May. 2015 - Jul. 2015*

Indian Statistical Institute

Academic Service

PC member AAMAS 2024, AAMAS 2025

Reviewer FSTTCS 2019, AAMAS 2024, ISoLA 2024, AAMAS 2025

Talks

Sep. 2024	**Highlights of Logic, Games and Automata** Learning Explainable and Better Performing Representations of POMDP Strategies	*Bordeaux, France*
Apr. 2024	**Workshop on Learning in Verification (LiVe), ETAPS 2024** Predicate Decision Diagrams for Explainable Policy Representation	*Luxembourg*
Oct. 2023	**International Symposium on Automated Technology for Verification and Analysis (ATVA)** Bi-objective Lexicographic Optimization in MDPs with Related Objectives	*Singapore*
Sep. 2023	**Verifying Learning AI Systems (VeriLearn), ECAI 2023** Formally-Sharp DAgger for MCTS: Lower-Latency MCTS using Data Aggregation with Formal Methods	*Kraków, Poland*
Sep. 2023	**Workshop on rigorous dependability analysis using model checking techniques for stochastic systems (ROCKS)** Bi-objective Lexicographic Optimization in MDPs with Related Objectives	*Saarbrücken, Germany*
Jul. 2023	**Highlights of Logic, Games and Automata** Formally-Sharp DAgger for MCTS: Lower-Latency MCTS using Data Aggregation with Formal Methods	*Kassel, Germany*
Apr. 2022	**Workshop on Learning in Verification (LiVe), ETAPS 2022** Safe Learning for Near Optimal Scheduling	*Munich, Germany*
Dec. 2021	**Workshop on artificial intelligence and Verification (iVerif), FSTTCS 2021** Safe Learning for Near Optimal Scheduling	*Online*
Aug. 2021	**International Conference on Quantitative Evaluation of SysTems (QEST)** Safe Learning for Near Optimal Scheduling	*Online*
Jun. 2021	**Highlights of Logic, Games and Automata** Monte Carlo Tree Search guided by Symbolic Advice for MDPs	*Online*
Sep. 2020	**International Conference on Concurrency Theory (CONCUR)** Monte Carlo Tree Search guided by Symbolic Advice for MDPs	*Online*

Skills

Programming Python, C++, Java, Haskell.

Tools
- **Model checking tools**: Prism, UppAal, Storm, NuSmv
- **Machine learning libraries**: TensorFlow, scikit-learn, dtControl

References

Jean-François Raskin

Professor, Université Libre de Bruxelles

jean-francois.raskin@ulb.be

Jan Křetínský

Professor, Masaryk University, Brno & Technical University of Munich

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