

**UNIVERSITY OF MILAN**

Public selection for recruiting No. 1 research associate(s) under art.24, paragraph 3.a, of Law No.240/2010 for competition sector 01/B1 - Informatics, (scientific-disciplinary sector INF/01 - Informatics) at the Department of Computer Science, (announcement published in Official Gazette No. 11 of 11 June 2021) - Competition code 4759

## Luca Prigioniero

### CURRICULUM VITAE

**PERSONAL DATA**

<b>SURNAME</b>	PRIGIONIERO
<b>NAME</b>	LUCA
<b>DATE OF BIRTH</b>	16/02/1992

**QUALIFICATIONS****DEGREE**

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| <ul style="list-style-type: none"><li>- Undergraduate Degree in Computer Science at Università degli Studi di Milano (2014)</li><li>- Master Degree in Computer Science at Università degli Studi di Milano (2016)</li></ul> |
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**DOCTORAL DEGREE OR EQUIVALENT QUALIFICATION EARNED IN ITALY OR ABROAD / MEDICAL SPECIALISATION DIPLOMA OR EQUIVALENT QUALIFICATION, FOR THE RELEVANT SECTORS, EARNED IN ITALY OR ABROAD**

PhD in Computer Science at Università degli Studi di Milano (2020)
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**RESEARCH CONTRACTS, RESEARCH FELLOWSHIP CONTRACTS, POSTDOCTORAL SCHOLARSHIPS OR SIMILAR CONTRACTS**

Research Fellowship at Justus Liebig University Giessen (October 2019 - February 2020) Postdoctoral Scholarship at Università degli Studi di Milano (March 2020 - February 2022)
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**ATTESTED TRAINING OR RESEARCH ACTIVITIES AT QUALIFIED ITALIAN OR FOREIGN INSTITUTIONS****Short-term scientific missions:**

- Gießen University, December 2017 - Supported by *COST Action IC1405 - Grant n. 38564*
- University of Copenhagen, October 2018 - Supported by *COST Action IC1405 - Grant n. 41983*

**Attendance to summer schools:**

- *International training school on reversible computation*, Toruń, August 2017 - Supported by *COST Action IC1405*
- *LIPA summer school*, Warsaw, June 2018 - Partially supported by the ERC Consolidator grant agreement n. 683080

Internship at University of Saskatchewan from February to July 2019

## TEACHING ACTIVITIES AT ITALIAN OR FOREIGN UNIVERSITIES

Professore a contratto (Università degli Studi di Milano):

- 2019/2020 and 2020/2021 - Teoria dei Linguaggi (Laurea Magistrale in Informatica) - 30h per academic year

Teaching assistant (Università degli studi di Milano):

- 2014/2015, 2015/2016, 2016/2017, and 2017/2018 - Laboratorio di Programmazione (Laurea Triennale in Informatica Musicale and Laurea Triennale in Comunicazione Digitale) with Dr. Massimo Santini and Prof. Sebastiano Vigna - 48h per academic year

- 2014/2015 and 2015/2016 - Laboratorio di Algoritmi e Strutture Dati (Laurea Triennale in Informatica) with Dr. Violetta Lonati - 48h per academic year

- 2015/2016 - Laboratorio di Ingegneria del Software (Laurea Triennale in Informatica) with Dr. Massimo Santini - 48h

## RESEARCH PROJECTS

- PSR 2016 - “Reversibilità e parsabilità locale di linguaggi formali e automi: studio di proprietà teoriche e potenzialità applicative” (resp. Dr. Violetta Lonati)

- PSR 2016, 2017, 2018 - “Aspetti algebrici e computazionali nella logica e nelle sue applicazioni” (resp. Prof. Stefano Aguzzoli)

- PSR 2019 - “Logic and formal investigations of new models of computation” (resp. Prof. Stefano Aguzzoli)

## ORGANISATION, SUPERVISION AND COORDINATION OF NATIONAL AND INTERNATIONAL RESEARCH GROUPS, OR PARTICIPATION IN THEM

2019-2021 - Member of INdAM (Istituto Nazionale di Alta Matematica) within the GNCS group (Gruppo Nazionale per il Calcolo Scientifico)

## SPEAKING AT NATIONAL AND INTERNATIONAL CONFERENCES AND CONVENTIONS

Date	Title	Venue
06/2017	Concise Representations of Reversible Automata [C3]	DCFS 2017
08/2017	Non-Self-Embedding Grammars and Descriptive Complexity [C5]	NCMA 2017
09/2017	Weakly and Strongly Irreversible Regular Languages [C6]	AFL 2017
07/2018	Linear-Time Limited Automata [C7]	DCFS 2018
09/2018	Reversible Pushdown Transducers [C9]	DLT 2018
09/2018	Linear-Time Limited Automata [C12]	ICTCS 2018
09/2018	On Some Succinct Representations of Regular Languages [C11]	ICTCS 2018
07/2019	Pushdown Automata and Constant Height: Decidability and Bounds [C13]	DCFS 2019
09/2019	Reversible and Irreversible Languages: An Overview	RPLA 2019
09/2019	Pushdown Automata and Constant Height: An Overview [C14]	ICTCS 2019
07/2021	Invited talk - <i>Regular Languages: To Finite Automata and Beyond</i> [C16]	AUTOMATA 2021
07/2021	Boolean Kernels of Context-Free Languages [C17]	CIAA 2021

## NATIONAL AND INTERNATIONAL AWARDS AND ACCOLADES FOR RESEARCH ACTIVITY

Conference DLT 2018 - Golden Student Travel Award - The University of Electro-Communications - Tokyo
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## OTHER INFORMATION

Member of the Program Committee of the conference DCFS 2019
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Peer reviewing for the following conferences: AFL 2017, DCFS 2017, 2019, and 2020, DLT 2017, 2018, 2020, and 2021, ICALP 2017, NCMA 2018 and 2019, SOFSEM 2019 and 2020, UCNC 2019
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Peer reviewing for the following journals: Acta Informatica, Annals of Mathematics and Artificial Intelligence, International Journal of Foundations of Computer Science, Theoretical Computer Science
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Co-advising (undergraduate thesis):
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Riccardo Bianchi - <i>Unary Automata in Chrobak Normal Form</i>
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Andrea Rovati - <i>Automata 1-Limited: uno studio su linguaggi unari</i>
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Conference attendance: AFL 2017, CIAA 2018, DCFS 2016, 2017 and 2018, DLT 2017 and 2018, NCMA 2017
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Member of the organizing committee of the conferences MFCS 2015 and DCFS 2017
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Invited speaker at the conference AUTOMATA 2021
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## RESEARCH ACTIVITY (Short Description)

The research activity of Luca Prigioniero is devoted to the investigation of computational models and their fundamental aspects. In this area, he is mainly focused on two aspects: reversibility of computational models and concise descriptions of formal systems.

### Reversibility of computational models

He studied reversible formal models and their computations. In particular, the study of reversible deterministic automata have been deepened, and a characterization of regular languages that are accepted by multiple minimal non-isomorphic reversible automata has been obtained [J1]. The investigations about reversible deterministic automata have been extended and succinct representations of such a model have been obtained [J3]. Using those representations it is possible to simulate the computations of reversible automata without explicitly writing down their complete descriptions which could be exponentially larger than the size of the explicit representations of the minimum equivalent automata.

Furthermore, the definition of reversibility has been relaxed, by considering finite automata whose computations can be reversed, at any point, by acceding to the last  $k$  symbols read from the input, for a fixed  $k$ . These devices are said to be “weakly irreversible”. Characterizations of languages accepted by weakly irreversible automata and languages not having any weakly irreversible automaton (“strongly irreversible” languages) have been given [C6].

During two short term scientific missions (supported by COST Action IC1405), he investigated, respectively:

- University of Gießen – Deterministic pushdown transducers with respect to their ability to transform inputs into outputs in a reversible way [C9].
- University of Copenhagen – Connections between reversible formal models (e.g., finite automata, counter machines) and reversible programming languages.

### Concise descriptions of formal systems

His research activity is also focused on computational models characterizing the class of regular languages and having succinct descriptions. In particular, generative models (non-self-embedding grammars) and recognizing devices (restrictions of Turing machines and pushdown automata) have been considered, and their relationships with finite automata in terms of computational and descriptonal power have been proved.

Non-self-embedding grammars are a restriction of context-free grammars which does not allow to describe recursive structures. A double exponential gap in size from non-self-embedding grammars to deterministic finite automata has been proven [J6]. Furthermore, non-self-embedding grammars are polynomially related in size to pushdown automata with a fixed pushdown size, and a polynomial simulation of these two models by Turing machines with restricted rewriting capabilities (“limited automata”) has been given [J8].

An exponential gap between the size of limited automata accepting regular languages and the size of equivalent finite automata was known. It has been shown that the same gap holds even in the unary case [J2].

In [J4] the time complexity of limited automata is investigated from a descriptive complexity point of view. It has been shown that, with a polynomial increase in size and preserving determinism, each limited automaton recognizing a regular language can be transformed into an halting equivalent one that works in linear time. Also polynomial transformations into related models, including nondeterministic Turing machines working in linear time, and exponential gaps for converse transformations in the deterministic case have been studied and the costs, in terms of description sizes, of the conversion of nondeterministic finite automata into equivalent linear-time deterministic machines have been deepened [C10]. This study contributes to the investigation about the famous question posed by Sakoda and Sipser in 1978, concerning the size blowups from nondeterministic finite automata to two-way deterministic finite automata.

Moreover, he studied pushdown automata that accept their inputs by using a constant amount of the pushdown store, with respect to the input length, and the relationships between the size of these models and the amount of memory they use. It has also been proved that, in the general case, it cannot be decided whether or not a pushdown automaton accepts using constant pushdown height, while this problem turns to be decidable in the unary case [C13].

From February to July 2019 he has been at University of Saskatchewan as a Visiting Research Student. There, his research has been focused on the investigation of time and space complexity of Turing Machines operating under some restrictions [C15], and from October 2019 he joined the University of Gießen as Research Fellow, where he studied sub-families of context-free languages closed under Boolean operations [C17].

## **SCIENTIFIC PRODUCTION**

Journal papers

**Published:**

- [J1] Giovanna J. Lavado, Giovanni Pighizzini, and Luca Prigioniero:  
*Minimal and Reduced Reversible Automata*  
Journal of Automata, Languages and Combinatorics 22(1-3), pp. 145-168, 2017.  
DOI: 10.25596/jalc-2017-145
- [J2] Giovanni Pighizzini and Luca Prigioniero:  
*Limited Automata and Unary Languages*  
Information and Computation 266, pp. 60-74, 2019.  
DOI: 10.1016/j.ic.2019.01.002
- [J3] Giovanna J. Lavado and Luca Prigioniero:  
*Concise Representations of Reversible Automata*  
International Journal of Foundations of Computer Science 30, pp. 1157-1175, 2019.  
DOI: 10.1142/S0129054119400331
- [J4] Bruno Guillon and Luca Prigioniero:  
*Linear-Time Limited Automata*  
Theoretical Computer Science 798, pp. 95-108, 2019.  
DOI: 10.1016/j.tcs.2019.03.037
- [J5] Bruno Guillon, Giovanni Pighizzini, and Luca Prigioniero:  
*Non-Self-Embedding Grammars, Constant-Height Pushdown Automata, and Limited Automata*  
International Journal of Foundations of Computer Science 31(8), pp. 1133-1157, 2020.  
DOI: 10.1142/S0129054120420071
- [J6] Giovanni Pighizzini and Luca Prigioniero:  
*Non-self-embedding Grammars and Descriptive Complexity*  
Fundamenta Informaticae 180(1-2), pp. 103-122, 2021  
DOI: 10.3233/FI-2021-2036

**Submitted:**

- [J7] Bruno Guillon, Giovanna J. Lavado, Giovanni Pighizzini, and Luca Prigioniero:  
*Weakly and Strongly Irreversible Regular Languages*
- [J8] Bruno Guillon, Giovanni Pighizzini, Luca Prigioniero, and Daniel Průša:  
*Converting Nondeterministic Two-Way Automata into Small Deterministic Linear-Time Machines*
- [J9] Bruno Guillon, Giovanni Pighizzini, Luca Prigioniero, and Daniel Průša:  
*Weight-Reducing Turing Machines*
- [J10] Bruno Guillon, Martin Kutrib, Andreas Malcher, and Luca Prigioniero:  
*Reversible Pushdown Transducers*
- [J11] Oscar H. Ibarra, Jozef Jirásek Jr., Ian McQuillan, Luca Prigioniero:  
*Space Complexity of Stack Automata Models*

Conference papers

**Published:**

- [C1] Giovanna J. Lavado, Giovanni Pighizzini, and Luca Prigioniero:  
*Minimal and Reduced Reversible Automata*  
In Proceedings of Descriptive Complexity of Formal Systems (DCFS) 2016  
July 6-8, Bucharest  
Lecture Notes in Computer Science 9777, pp. 168-179, 2016.  
DOI: 10.1007/978-3-319-41114-9\_13
  
- [C2] Giovanna J. Lavado, Giovanni Pighizzini, and Luca Prigioniero:  
*Minimal and Reduced Reversible Automata - Extended Abstract*  
In Proceedings of Italian Conference on Theoretical Computer Science (ICTCS) 2016  
September 7-9, Lecce  
CEUR Workshop Proceedings 1720, pp. 234-239, 2016.
  
- [C3] Giovanna J. Lavado and Luca Prigioniero:  
*Concise Representations of Reversible Automata*  
In Proceedings of Descriptive Complexity of Formal Systems (DCFS) 2017  
July 3-5, Milan  
Lecture Notes in Computer Science 10316, pp. 238-249, 2017.  
DOI: 10.1007/978-3-319-60252-3\_19
  
- [C4] Giovanni Pighizzini and Luca Prigioniero:  
*Limited Automata and Unary Languages*  
In Proceedings of Developments in Language Theory (DLT) 2017  
August 7-11, Liège  
Lecture Notes in Computer Science 10396, pp. 308-319, 2017.  
DOI: 10.1007/978-3-319-62809-7\_23
  
- [C5] Giovanni Pighizzini and Luca Prigioniero:  
*Non-Self-Embedding Grammars and Descriptive Complexity*  
In Proceedings of Non-Classical Models of Automata and Applications (NCMA) 2017, pp. 197-209.  
August 17-18, Prague
  
- [C6] Giovanna J. Lavado, Giovanni Pighizzini, and Luca Prigioniero:  
*Weakly and Strongly Irreversible Regular Languages*  
In Proceedings of Automata and Formal Languages (AFL) 2017  
September 4-6, Debrecen  
Electronic Proceedings in Theoretical Computer Science 252, pp. 143-156, 2017.  
DOI: 10.4204/EPTCS.252.15
  
- [C7] Bruno Guillon and Luca Prigioniero:  
*Linear-Time Limited Automata*  
In Proceedings of Descriptive Complexity of Formal Systems (DCFS) 2018  
July 23-25, Halifax (NS)  
Lecture Notes in Computer Science 10952, pp. 126-138, 2018.  
DOI: 10.1007/978-3-319-94631-3\_11
  
- [C8] Bruno Guillon, Giovanni Pighizzini, and Luca Prigioniero:  
*Non-Self-Embedding Grammars, Constant-Height Pushdown Automata, and Limited Automata*  
In Proceedings of Conference on Implementation and Applications of Automata (CIAA) 2018  
July 30-August 2, Charlottetown (PEI)  
Lecture Notes in Computer Science 11088, pp. 366-378, 2018.  
DOI: 10.1007/978-3-319-94812-6\_16
  
- [C9] Bruno Guillon, Martin Kutrib, Andreas Malcher, and Luca Prigioniero:  
*Reversible Pushdown Transducers*  
In Proceedings of Developments in Language Theory (DLT) 2018  
September 10-14, Tokyo  
Lecture Notes in Computer Science 11088, pp. 354-365, 2018.  
DOI: 10.1007/978-3-319-98654-8\_29

- [C10] Bruno Guillon, Giovanni Pighizzini, Luca Prigioniero, and Daniel Průša:  
*Two-way Automata and One-Tape Machines: Read Only versus Linear Time*  
 In Proceedings of Developments in Language Theory (DLT) 2018  
 September 10-14, Tokyo  
 Lecture Notes in Computer Science 11088, pp. 366-378, 2018.  
 DOI: 10.1007/978-3-319-98654-8\_30
- [C11] Bruno Guillon, Giovanni Pighizzini, and Luca Prigioniero:  
*On Some Succinct Representation of Regular Languages - Extended Abstract*  
 In Proceedings of Italian Conference on Theoretical Computer Science (ICTCS) 2018  
 September 18-20, Urbino  
 CEUR Workshop Proceedings 2243, pp. 203-207, 2018.
- [C12] Bruno Guillon and Luca Prigioniero:  
*Linear-Time Limited Automata - Extended Abstract*  
 In Proceedings of Italian Conference on Theoretical Computer Science (ICTCS) 2018  
 September 18-20, Urbino  
 CEUR Workshop Proceedings 2243, pp. 208-212, 2018.
- [C13] Giovanni Pighizzini and Luca Prigioniero:  
*Pushdown Automata and Constant Height: Decidability and Bounds*  
 In Proceedings of Descriptive Complexity of Formal Systems (DCFS) 2019  
 July 17-19, Košice  
 Lecture Notes in Computer Science 11612, pp. 260-271, 2019.  
 DOI: 10.1007/978-3-030-23247-4\_20
- [C14] Giovanni Pighizzini and Luca Prigioniero:  
*Pushdown Automata and Constant Height: Decidability and Bounds - Extended Abstract*  
 In Proceedings of Italian Conference on Theoretical Computer Science (ICTCS) 2019  
 September 9-11, Como  
 CEUR Workshop Proceedings 2504, pp. 72-77, 2019.
- [C15] Oscar H. Ibarra, Jozef Jirásek Jr., Ian McQuillan, and Luca Prigioniero:  
*Space Complexity of Stack Automata Models*  
 In Proceedings of Developments in Language Theory (DLT) 2020  
 May 11-15, Tampa (FL)  
 Lecture Notes in Computer Science 12086, pp. 137-149, 2020.  
 DOI: 10.1007/978-3-030-48516-0\_11
- [C16] Luca Prigioniero  
*Regular Languages: To Finite Automata and Beyond (Invited Talk)*  
 In Proceedings of AUTOMATA 2021  
 July 12-14, Marseille  
 OASlcs 90, pp. 2:1-2:16, 2021.  
 DOI: 10.4230/OASlcs.AUTOMATA.2021.2
- [C17] Martin Kutrib and Luca Prigioniero  
*Boolean Kernels of Context-Free Languages*  
 In Proceedings of Conference on Implementation and Applications of Automata (CIAA) 2021  
 July 19-22, Bremen (Virtual Event)  
 Lecture Notes in Computer Science 12803, pp. 152-164, 2021.  
 DOI: 10.1007/978-3-030-79121-6\_13

Date

09/07/2021

Place

Milan