

UNIVERSITÀ DEGLI STUDI DI MILANO

Procedura di selezione per la chiamata a professore di I fascia da ricoprire ai sensi dell'art. 18, comma 1, della Legge n. 240/2010 per il settore concorsuale 01/B1 - Informatica (settore scientifico-disciplinare INF/01 - Informatica) presso il Dipartimento di INFORMATICA "GIOVANNI DEGLI ANTONI", codice concorso 5282.

## ALBERTO DENNUNZIO CURRICULUM VITAE

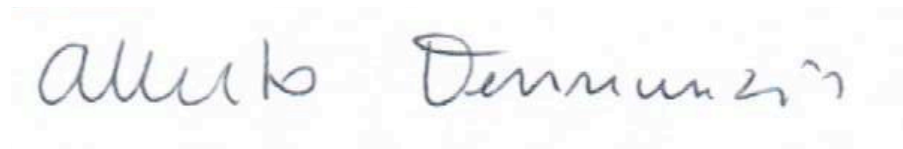
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Il sottoscritto DENNUNZIO ALBERTO, Codice Fiscale DNNLRT74C28E648L, nato a Lodi (LO) il 28-03-1974, residente in Cassina De' Pecchi in via Volta n. 30, consapevole della responsabilità penale cui può andare incontro in caso di dichiarazione mendace, ai sensi degli art. 76, 46 e 47 del D.P.R. n. 445 del 28/12/2000,

DICHIARA

di aver svolto le attività e di possedere i titoli riportati nel seguente Curriculum Vitae comprendente l'Attività Scientifica, Didattica e Organizzativa.

Milano, 3 Maggio 2023

A handwritten signature in dark ink, reading "Alberto Dennunzio". The signature is written in a cursive, flowing style. The first name "Alberto" is on the left, and the last name "Dennunzio" is on the right, connected by a fluid stroke. The background is a light, textured surface.

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# 1 Personal Data and Contact Information

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Office Address: Università degli Studi di Milano – Bicocca  
Dipartimento di Informatica, Sistemistica e Comunicazione  
viale Sarca 336, Milano, Italy

E-mail: alberto.dennunzio@unimib.it

# 2 Education

1999: Laurea in Scienze dell'Informazione (Master in Computer Science), summa cum laude,  
Università degli Studi di Milano, Italy.

2004: PhD degree in Computer Science, Università degli Studi di Milano, Italy. Mention: excellent.

# 3 Academic Positions

[01/10/2016–today]

**Associate Professor** of Computer Science, UNIVERSITÀ DEGLI STUDI DI MILANO-BICOCCA, ITALY.

[01/09/2011-30/09/2016]

**Assistant Professor** (Ricercatore) of Computer Science, UNIVERSITÀ DEGLI STUDI DI MILANO-BICOCCA, ITALY.

[01/09/2010-31/08/2011]

**Associate Professor** of Computer Science, UNIVERSITÉ NICE SOPHIA ANTIPOLIS, FRANCE.

[01/09/2010-31/08/2011]

**Chair** of Computer Science, i.e., special research position at CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE (FRENCH NATIONAL CENTRE FOR SCIENTIFIC RESEARCH), FRANCE.

[01/01/2004-31/08/2010]

**Assistant Professor** (Ricercatore) of Computer Science, UNIVERSITÀ DEGLI STUDI DI MILANO-BICOCCA, ITALY.

# 4 Qualifications

11/09/2019: Italian National Scientific Qualification for the Academic Recruitment Field 01/B1 (Computer Science) as Full Professor.

26/07/2018: Italian National Scientific Qualification for the Academic Recruitment Field 09/H1 (Information Processing Systems) as Full Professor.

2010: French National Scientific Qualification for the Academic Recruitment Field 27 (Computer Science) as Associate Professor.

## 5 ATTIVITÀ DIDATTICA, DI DIDATTICA INTEGRATIVA E DI SERVIZIO AGLI STUDENTI

### 6 International and National Teaching Activities

#### Legend

B=Bachelor in Computer Science, M=Master in Computer Science, BS Bachelor in Materials/Environmental Science

L= Lecture, E=practice Exercise, EL=Laboratory Exercise

#### 6.1 Abroad Teaching Activities

**6.1.1 [2010–2011] as Associate Professor at UNIVERSITÉ NICE SOPHIA ANTIPOLIS, FRANCE (due to the research chair position at CNRS, as honor, the teaching schedule has been limited to one-third)**

##### Undergraduate and Graduate Courses in Computer Science

A.A. 2010-2011

- Formal Tools for Computer Science , B, 36h (E)
- Simulation of Discrete Models, B, 9h (L) + 9h (EL), **Responsible**
- Complex Artificial Systems, M, 4h (L) + 4h (EL)

each hour (h) of Lecture is weighted with coefficient 1.5

**6.1.2 past teaching modules as Contract Professor at Université Nice Sophia Antipolis, France**

in each of the years 2006-2007, 2007-2008, and 2009-2010 teaching modules on Cellular Automata, course Complex Artificial Systems, M, 2h (L) + 2h (EL)

**6.1.3 past teaching minicourses as Erasmus Teacher Université Nice Sophia Antipolis, France**

in each of the years 2007-08, 2008-09, 2009-10, 2011-12, 2012-13, 2013-14, 2014-2015, and 2015-16 minicourse or **seminar cycle** on Discrete Dynamical Systems/Cellular Automata for both Master and PhD students.

#### 6.2 [2004–today] Teaching Activities at Università degli Studi di Milano-Bicocca

**Undergraduate courses** on the following topics:

- Computer Programming – Bachelor in Computer Science, 1st year
- Algorithms and Data Structures (Introduction and Advanced) – Bachelor in Computer Science, 1st and 3rd year
- Systems Theory – Bachelor in Computer Science, 3rd year
- Computer Science – Bachelor in Materials Science/Environmental Science, 1st year

**Graduate courses** on the following topics:

- complex systems, discrete dynamical systems and cellular automata

## Details

B=Bachelor in Computer Science, M=Master in Computer Science, BS Bachelor in Materials/Environmental Science

L= Lecture, E=practice Exercise, EL=Laboratory Exercise

### A.A. 2022-2023

- Algorithms and Data Structures (Advanced), B, 10 ECTS (L+E+EL), **Responsible**
- Complex and Uncertain Systems, M, 3 ECTS (L+E), **Responsible**,

### A.A. 2021-2022

- Algorithms and Data Structures (Introduction), B, 4 ECTS (L) **Responsible**,  
Evaluation by students: Efficacia Didattica 8.7, Soddisfazione Complessiva 8.77
- Algorithms and Data Structures (Advanced), B, 6 ECTS (E+EL)
- Complex and Uncertain Systems, M, 3 ECTS (L+E), **Responsible**,  
Evaluation by students: not available due to a low number of questionnaires

### A.A. 2020-2021

- Algorithms and Data Structures (Introduction), B, 4 ECTS (L) **Responsible**  
Evaluation by students: Efficacia Didattica 8.64, Soddisfazione Complessiva 8.61
- Algorithms and Data Structures (Advanced), B, 6 ECTS (E+EL)  
Evaluation by students: Efficacia Didattica 9.14, Soddisfazione Complessiva 8.87
- Complex and Uncertain Systems, M, 3 ECTS (L+E), **Responsible**  
Evaluation by students: not available due to a low number of questionnaires

### A.A. 2019-2020

- Algorithms and Data Structures (Introduction), B, 4 ECTS (L)  
Evaluation by students: Efficacia Didattica 8.5, Soddisfazione Complessiva 9.17
- Algorithms and Data Structures (Advanced), B, 6 ECTS (E+EL)
- Complex and Uncertain Systems, M, 4 ECTS (L), **Responsible**  
Evaluation by students: not available due to a low number of questionnaires

### A.A. 2018-2019

- Computer Programming 1, B, 6 ECTS (E+EL)  
Evaluation by students (range [0,3]): Efficacia Didattica 2.66, Soddisfazione Complessiva 2.56
- Algorithms and Data Structures (Advanced), B, 2 ECTS (EL)
- Complex and Uncertain Systems, M, 4 ECTS (L), **Responsible**  
Evaluation by students (range [0,3]): Efficacia Didattica 2.94, Soddisfazione Complessiva 2

### A.A. 2017-2018

- Computer Programming 1, B, 6 ECTS (E+EL)
- Algorithms and Data Structures (Advanced), B, 2 ECTS (EL)
- Complex and Uncertain Systems, M, 4 ECTS (L), **Responsible**  
Evaluation by students: not available due to a low number of questionnaires

### A.A. 2016-2017

- Algorithms and Data Structures (Introduction), B, 2 ECTS (EL)
- Computer Programming 1, B, 4 ECTS (E)
- Algorithms and Data Structures (Advanced), B, 2 ECTS (E)
- Complex and Uncertain Systems, M, 4 ECTS (L), **Responsible**  
Evaluation by students (range [0,3]): Efficacia Didattica 2.42, Soddisfazione Complessiva 2.13

A.A. 2015-2016

- Algorithms and Data Structures (Advanced), B, 2 ECTS (E)
- Complex and Uncertain Systems, M, 4 ECTS (L), **Responsible**  
Evaluation by students: not available due to a low number of questionnaires

A.A. 2014-2015

- Algorithms and Data Structures (Advanced), B, 4 ECTS (E)
- Complex and Uncertain Systems, M, 4 ECTS (L), **Responsible**

A.A. 2013-2014

- Algorithms and Data Structures (Advanced), B, 4 ECTS (E)
- Complex and Uncertain Systems, M, 4 ECTS (L), **Responsible**

A.A. 2012-2013

- Algorithms and Data Structures (Introduction), B, 4 ECTS (EL)
- Systems Theory, B, 4 ECTS: 3 ECTS (L) + 1 ECTS (E), **Responsible**

A.A. 2011-2012

- Algorithms and Data Structures (Advanced), B, 3 ECTS: 2 ECTS (L) + 1 ECTS (E)
- Systems Theory, B, 4 ECTS: 3 ECTS (L) + 1 ECTS (E), **Responsible**

A.A. 2010-2011 year spent at Université Nice Sophia Antipolis (see 6.1).

A.A. 2009-2010

- Algorithms and Data Structures (Advanced), B, 4 ECTS: 2 ECTS (L) + 2 ECTS (E)
- Systems Theory, B, 4 ECTS: 3 ECTS (L) + 1 ECTS (E), **Responsible**

A.A. 2008-2009

- Algorithms and Data Structures (Introduction), B, 2 ECTS (E)
- Algorithms and Data Structures (Advanced), B, 2 ECTS (E)
- Systems Theory, B, 4 ECTS: 3 ECTS (L) + 1 ECTS (E), **Responsible**

A.A. 2007-2008

- Algorithms and Data Structures (Introduction), B, 2 ECTS (E)
- Algorithms and Data Structures (Advanced), B, 2 ECTS (E)
- Systems Theory, B, 5 ECTS: 4 ECTS (L) + 1 ECTS (E)

A.A. 2006-2007

- Algorithms and Data Structures (Introduction), B, 2 ECTS (E)

- Systems Theory, B, 5 ECTS: 4 ECTS (L) + 1 ECTS (E)

A.A. 2005-2006

- Computer Science, BS, 4 ECTS (L), **Responsible**
- Algorithms and Data Structures (Introduction), B, 2 ECTS (E)
- Systems Theory, B, 6 ECTS: 4 ECTS (L) + 2 ECTS (E)

A.A. 2004-2005

- Computer Science, BS, 4 ECTS (L), **Responsible**
- Algorithms and Data Structures (Introduction), B, 2 ECTS (E)
- Systems Theory, B, 5 ECTS: 4 ECTS (L) + 1 ECTS (E)

A.A. 2003-2004

- Systems Theory (Advanced), M, 5 ECTS: 4 ECTS (L) + 1 ECTS (E)
- Systems Theory, B, 6 ECTS: 4 ECTS (L) + 2 ECTS (E)

### 6.3 Past Teaching Activities

A.A. 2001-2002 and 2002-2003: Systems Theory and Advanced System Theory (Advanced), B, Instructor (E), *Università degli Studi di Milano-Bicocca*

A.A. 2001-2002, 2002-2003 and 2003-2004: **Teaching Tutor** at I and V Engineering Faculty, *Politecnico di Milano* (70h E+ 26h E+ 60h E).

## 7 Certificates of participation in specialization courses regarding innovative teaching methods in University

He attended the Workshop “Large Classroom Teaching” in 2018 (organized by Università degli Studi di Milano-Bicocca). A personal **open badge** certifies the acquired knowledge, skills, and abilities.

## 8 Thesis works with a highly qualifying profile

He supervised 2 Master thesis inside the Double Master Degree Program with Université Nice Sophia Antipolis (2018/2019 and 2021/2022).



## 9 Ph.D./Post-doc Supervision and Tutoring Activities

### 9.1 Bachelor and Master Thesis

He supervised 8 Master thesis (5 as “Relatore” and 3 as “Correlatore”) and at least 11 Bachelor Thesis/Bachelor final stage (as “Relatore” or “Correlatore” or University Tutor).

Two among the master theses were inside the Double Master Degree Program with Université Nice Sophia Antipolis (2018/2019 and 2021/2022).

He also co-supervised the research stage of a Master student coming from University of Lyon (Julien Provillard, June 2008). This stage gave rise to next collaborations and scientific results.

### 9.2 International Ph.D. Co-tutorship Agreement

**2019/2020–2021/2022** S. Riva, incoming Ph.D student from Université Cote d’Azur, France, on the subject “Factorization of Discrete Dynamical Systems”. Ph.D. defense in November 2022

Ph.D Thesis Co-supervisor

He was invited to join the Jury of the Ph.D. thesis defense of Sara Riva

### 9.3 International and Italian Ph.D./Post-doc Supervision and Collaborations

Most relevant collaborations where he gave a supervision contribution of the research activities:

**09/2008-08/2009** Michael Weiss (Post-doc at Università degli Studi di Milano-Bicocca), on the subject “Computability of Tiling and Cellular Automata”

Co-supervisor

**02/2007-07/2007** Benoit Masson (Post-doc at Università degli Studi di Milano-Bicocca), on the subject “Topological Properties of Sand Automata”

Supervisor

**09/2010-12/2012** Julien Provillard (Ph.D at Université Nice Sophia Antipolis), on the subject “Non-uniform Cellular Automata”.

He was invited to join the Jury of the PhD thesis defense of Julien Provillard

**03/2014-03/2018** Luca Manzoni (Post-doc at Università degli Studi di Milano-Bicocca), on the subjects “Cellular Automata” and “Reaction Systems”. **Informal Supervision**

**11/2009-02/2013** Luca Manzoni (Ph.D. at Università degli Studi di Milano-Bicocca), on the subject “Asynchronous Cellular Automata”. **Informal Supervision**

**09/2009-08/2010** Michael Weiss (Post-doc all’Université Nice Sophia Antipolis), on the subject “Computability of Tiling and Cellular Automata”. **Informal Supervision**

### 9.4 Seminars and Tutoring for Students (including PhD)

In each of years 2007-08, 2008-09, 2009-10, 2011-12, 2012-13, 2013-14, 2014-2015, and 2015-16:

**minicourse/seminar cycle** on Cellular Automata/Discrete Dynamical Systems, each for both PhD and Master students and of at least 5 hours, *Université Nice Sophia Antipolis*

years 2001-2002, 2002-2003 and 2003-2004:

**Teaching Tutor** at I and V Engineering Faculty for Bachelor students, *Politecnico di Milano* (70h E+ 26h E+ 60h E).

See also 6.1.3 and 6.3.

## 10 ATTIVITÀ DI RICERCA SCIENTIFICA E PUBBLICAZIONI

### 11 Research Projects

#### 11.1 International Projects

- (58 months) I played the role of **Italian Coordinator** of  
**International Project** Interlink/MIUR 2006-2008 (extended to 2010), type C, “Cellular Automata: Topological Properties, Chaos and Associated Formal Languages”. Partners: École Normale Supérieure de Lyon, Université Paris-Est Marne-La Vallée, Université Nice Sophia Antipolis, Université de Provence (Marseille), Università degli Studi di Milano-Bicocca, Università degli Studi di Bologna.  
**Main overall result of the project:**  
a solid Italian-French Network for scientific collaborations which is still active today.
- (12 months) **Member of**  
**International Project** 2008 “Automates Cellulaires, Dynamique Symbolique et Décidabilité” of international scientific cooperation funded by the region Provence-Alpes-Cotes d’Azur (France). Partners: Université Nice Sophia Antipolis and Università degli Studi di Milano-Bicocca.

#### 11.2 National Projects

**Member** of the following projects

- (30 months)  
**Project** PON SmartCal 2017 per il potenziamento dell’offerta turistica italiana sulla base dell’integrazione delle nuove tecnologie e dei principi del turismo “Smart”.
- (36 months)  
**National Italian Project** PRIN/MIUR 2010-2011 “Automata and Formal Languages: Mathematical and Applicative Aspects”.
- (47 mesi)  
**Project** PON Ricerca e Competitività 2007-2013 PON01\_01286 “eJRM (electronic Justice Relationship Management)”
- (47 mesi)  
**Project** “NEDD (Network Enabled Drug Design)” ID14546A Rif SAL-7 funded by Fondo per la Promozione di Accordi Istituzionali Regione Lombardia
- (24 months)  
**National Italian Project** PRIN/MIUR 2007-2009 “Mathematical Aspects and Emerging Applications of Automata and Formal languages”.
- (24 months)  
**National Italian Project** PRIN/MIUR 2005-2007 “Automata and Formal languages: mathematical and application driven studies”
- (24 months)  
**National Italian Project** MIUR/COFIN 2003-2005 “Formal languages and Automata: Methods, Models and Applications”.

- (12 months)  
**Project** “Cellular Automata for simulation of two-phase fluid dynamics systems” (2002) funded by Università degli Studi di Milano-Bicocca (research funding for young researchers).
- (24 mesi)  
**National Italian Project** MIUR/COFIN 2001-2003 “Formal Languages and Automata: Theory and Applications”.

### 11.3 Projects funded by private Companies

Member of the following projects

- (12 months)  
**Project funded by Enitecnologie (Italy)** “Simulations of two-phase flows by Cellular Automata approach” (2001).
- (12 months)  
**Project funded by Elf-Aquitaine (France)** “Potential evaluation of the new representation methods of the dynamics of gas and liquid flow in the distillation or absorption columns” (01/2000–01/2001).

## 12 National and International Research Centre/Group Membership/Direction

### National:

**[11/2009–today] Co-Responsible of the Research Laboratory (unique responsible since 2017) “Complex and Uncertain Systems”** (since 2020 ‘Responsible of the Laboratory “Complex Systems”) at DISCo (Dipartimento di Informatica, Sistemistica e Comunicazione), Università degli Studi di Milano-Bicocca.

**[2019–today] Member of the AIIS “Artificial Intelligence and Intelligent Systems National Laboratory”, CINI** (National Interuniversity Consortium for Informatics).

### International:

**[2019–today] Member of the I3S Laboratory (= Department) of CNRS (CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, FRENCH NATIONAL CENTRE FOR SCIENTIFIC RESEARCH), Sophia Antipolis, France.**

**[2016–today] Member of the IFIP Working Group 1.5 "Cellular Automata and Discrete Complex Systems"** of Technical Committee 1 "Foundations of Computer Science", IFIP (International Federation for Information Processing).

## 13 Editorial Activity

- (Associate) Editor of International Journals

04/2019–today **Theoretical Computer Science**, Elsevier

<https://www.journals.elsevier.com/theoretical-computer-science/editorial-board>

08/2016–today **Natural Computing (NaCo)**, Springer

<https://www.springer.com/journal/11047/editors>

- **Guest Editor** of the following journals for special issues (see Section 17 for details)

- Information and Computation (1 issue)
- Natural Computing NaCo (5 issues)
- Fundamenta Informaticae (3 issues)
- International Journal of Foundations of Computer Science (1 issue)

- **Editor of 4 Volumes** of the series Lecture Notes in Computer Science (LNCS) publishing **Conference Proceedings** (see Section 17.3 for details).

## 14 International Awards and Honors

### 2015 The article

“A. Dennunzio, E. Formenti, M. Weiss. Multidimensional cellular automata: closing property, quasi-expansivity, and (un)decidability issues. *Theoretical Computer Science*, 516: 40–59, 2014”

**already published in 2014 has been selected for publication on the Special Issue of the journal Theoretical Computer Science (TCS) prepared in 2015 on the occasion of the 40th anniversary of its founding** in order to give recognition to the most influential scientific production that has been published by TCS throughout the years 1975–2014. For every year since 1975, one paper has been selected.

2010/11 **CNRS Chair**<sup>1</sup>, i.e., special position at French National Centre for Scientific Research providing

- research funding (10K euro per year)
- teaching schedule limited to one-third of the hours at Université Nice Sophia Antipolis.

2010/11 **“Prime d’Excellence Scientifique” (Scientific Excellence Prize)** at CNRS–Université Nice Sophia Antipolis, France. Remunerated prize (5,5K euro).

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<sup>1</sup>In 2010, 73 Chairs were on the whole assigned in France, 6 out of them in the field of Computer Science/Computer Engineering.

## 15 International Conference Participations

I attended many international conferences where the accepted conference papers were been presented, see Section 17.4.

## 16 Participation to Committees and Conference Organization

**Steering Committee Member** of IFIP Working Conference-International Workshop “Cellular Automata and Discrete Complex Systems” (AUTOMATA), years 2017/18 and 2019/2020.

**General and Program co-Chair** of IFIP Working Conference-International Workshop “Cellular Automata and Discrete Complex Systems 2017” (AUTOMATA 2017), 23rd edition, Milan, June 2017.

**Program co-Chair** of

- ACA 2018 (Int. Workshop on Asynchronous Cellular Automata and Asynchronous Discrete Models)
- ACA 2016
- ACA 2014
- ACA 2012
- ACA 2010

**PC member** of

- AUTOMATA 2023 (End of August 2023)
- ACRI 2022 (Int. Conference on Cellular Automata for Research and Industry)
- AUTOMATA 2022
- AUTOMATA 2021
- ACRI 2020
- AUTOMATA 2019
- ACRI 2018
- AUTOMATA 2018
- ACRI 2016
- NCMA 2016 (Int. Workshop on Non-Classical Models of Automata and Applications)
- UCNC 2014 (Int. Conference on Unconventional Computation and Natural Computation)
- ACRI 2014
- UCNC 2013
- ACRI 2012
- AUTOMATA 2012
- ACRI 2010

**Organization member** of

- ACRI 2022
- ACRI 2018
- CiE 2013 (Int. Conference on Computability in Europe)
- UCNC 2013

## 17 Publications

Besides many papers published in journals ranked by SJR in Q1, the list includes publications in very selective journals, as *Journal of Computer and System Sciences*, and very selective International Conferences, as *ICALP* and *MFCS*.

### 17.1 International Journal Articles

- [1] A. Dennunzio, E. Formenti, L. Margara, and S. Riva. An algorithmic pipeline for solving equations over discrete dynamical systems modelling hypothesis on real phenomena. *Journal of Computational Science*, 66: 101932, 2023.
- [2] A. Dennunzio, E. Formenti, D. Grinberg, and L. Margara. Decidable characterizations of dynamical properties for additive cellular automata over a finite abelian group with applications to data encryption. *Information Sciences*, 563: 183–195, 2021.
- [3] A. Dennunzio, E. Formenti, D. Grinberg, and L. Margara. An efficiently computable characterization of stability and instability for linear cellular automata. *Journal of Computer and System Sciences*, 122: 63–71, 2021.
- [4] A. Dennunzio, E. Formenti, D. Grinberg, and L. Margara. Chaos and ergodicity are decidable for linear cellular automata over  $(\mathbb{Z}/m\mathbb{Z})^n$ . *Information Sciences*, 539: 136–144, 2020.
- [5] A. Dennunzio, E. Formenti, D. Grinberg, and L. Margara. Dynamical behavior of additive cellular automata over finite abelian groups. *Theoretical Computer Science*, 843: 45–56, 2020.
- [6] L. Mariot, L. Manzoni, and A. Dennunzio. Search space reduction of asynchrony immune cellular automata. *Natural Computing*, 19: 287–293, 2020.
- [7] A. Dennunzio and E. Formenti. Preface. *Information and Computation*, 274: 104530, 2020.
- [8] A. Dennunzio, G. Păun, G. Rozenberg, and C. Zandron. Preface. Interdisciplinary Nature of Information Processing Special Issue Dedicated to Giancarlo Mauri on the Occasion of His 70th Birthday. *Fundamenta Informaticae*, 171: v–vi, 2020.
- [9] A. Dennunzio and E. Formenti. Preface. *Natural Computing*, 19: 271, 2020.
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## 17.2 International Book Chapters

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## 17.3 Editing of International Conference Proceedings

- [42] S. Bandini, B. Chopard, A. Dennunzio, M. Arabi Haddad (Eds.). Cellular Automata, *15th International Conference on Cellular Automata for Research and Industry (ACRI 2022)*, volume 13402 of *Lecture Notes in Computer Science*. Springer, 2022.
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## 17.4 Articles in Proceedings of (peer-reviewed) International Conferences

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## 17.5 Italian Publications

- [75] A. Dennunzio. Formal Studies of Complex Systems: Cellular Automata Models. In Emerging Paradigms in Informatics, Systems and Communications, volume 2009-01 of *QD Quaderni*, pages 123–128. Starrylink Ed, 2009.

## **18 (Mainly International) Scientific Collaborations, Visiting, and Seminars**

### **18.1 Most Relevant International Collaborations**

[2021–today] Scientific collaborations with Jarkko Kari (University of Turku, Finland).

[2019–today] Scientific collaborations with Darij Grinberg (Drexel University, Philadelphia, USA).

[2006–today] Scientific collaborations with Université Nice Sophia Antipolis and I3S Laboratory (=Department) of CNRS, Sophia Antipolis.

[2019–today] Scientific collaborations with A. E. Porreca (Aix-Marseille Université, France).

[2011] Scientific collaborations with Petr Kurka (Charles University of Prague, Czech Rep.).

[2006-2010] Scientific collaborations with the French partners of the INTERLINK/MIUR project: Ecole Normale Supérieure de Lyon, Université Paris-Est Marne-La Vallée, Université Nice Sophia Antipolis, Université de Provence (Marseille), Università degli Studi di Bologna.

### **18.2 Visiting and invitations abroad**

**04/2014** 1 week invited at team MC3 (Models of Computation, Complexity, and Combinatorics) of the I3S Laboratory of CNRS, Sophia Antipolis, France

**07/2012-08/2012** 6 weeks invited at team MC3 (Models of Computation, Complexity, and Combinatorics) of the I3S Laboratory of CNRS, Sophia Antipolis, France

**02/2011** 1 week invited at Charles University of Prague (Czech Rep.).

**2006-2010** ( $\approx$  6 months) Several periods spent in France research activity at the University partners of the international Project INTERLINK/MIUR

**summer/fall 2008** 3 months invited at team MC3 (Models of Computation, Complexity, and Combinatorics) of the I3S Laboratory of CNRS, Sophia Antipolis, France

### **18.3 Invited Seminars**

- 16/04/2014: Université Nice Sophia Antipolis, Nice, France.
- 21/02/2012 Université Nice Sophia Antipolis, Nice, France.
- 30/04/2010: I3S Laboratory of CNRS, Sophia Antipolis, France.
- 25/02/2010: LAMA Laboratory of CNRS, Le Bourget-du-Lac, France.
- 19/02/2010: during the meeting Math-Info 2010, CIRM, Marseille, France.
- 12/05/2009: Dipartimento di Scienze dell'Informazione, Università degli Studi di Milano.
- 02/12/2008: during the meeting of the French National Project ANR “Sycomore” on Sistemi Complessi.
- 16/07/2008: I3S Laboratory of CNRS, Sophia Antipolis, France.

## 19 Evaluation Activities

- Invited to be reviewer of project proposals for the Chilean “National Fund for Scientific & Technological Development” (FONDECYT), Ministerio de Educacion, Chile (2011, 2017, and 2021).
- Referee for several International Journals:
  - Information Sciences,
  - Information & Computation,
  - Theory of Computing Systems,
  - Theoretical Computer Science,
  - Fundamenta Informaticae,
  - Natural Computing,
  - Mathematics and Computer in simulation,
  - Journal of Cellular Automata
  - International Journal of Computer Mathematics
- Referee for several (peer-reviewed) International Conferences:
  - Symposium of Theoretical Aspects of Computer Science (STACS)
  - Mathematical Foundations of Computer Science (MFCS)
  - Computability in Europe (CiE)
  - Developments in Language Theory (DLT)
  - Language and Automata Theory and Applications (LATA)
  - Unconventional Computation and Natural Computation (UCNC)
  - Cellular Automata and Discrete Complex Systems (Automata)
  - Cellular Automata for Research and Industry (ACRI)
  - Developments in Computational Models (DCM)
  - European Conference on Artificial Life (ECAL)

## 20 Research Description

**Keywords.** Complex Systems, Discrete Modelling, Simulation, Cellular Automata, Collective Intelligence, Applications, Decidability and Computational Complexity Issues.

The researches conducted by Alberto Dennunzio deal with *Complex Systems*, i.e., multitudes of elementary components which cooperate and produce complex behaviors. In particular, formal models for describing and *simulating* Complex Systems are considered and studied.

A particular attention is focused on *Cellular Automata* (and several variants as asynchronous models, non-uniform models, models with higher-order memory, . . . , as well as affine models as *Automata Networks*). They are models based on simple local rules that are able to exhibit complex emerging behaviors and then describe/simulate phenomena of *Collective Intelligence* and reaction-diffusion processes. For all these reasons, they are used for designing several applications in different domains (image processing, data encryption, pseudo-random number generation, simulations of biological, chemical, physical, social and economical phenomena, etc.).

Other models under consideration for describing, modelling and simulating complex systems are *Reaction Systems* and *Agent Systems*.

**Research Tasks.** His research tasks mainly focus on

- Formal Studies of Complex Systems.

The goal is to understand the long-term behavior of formal models for Complex Systems. He pursues this aim through

- the investigation of properties describing complex behaviors (reachability, reversibility, stability, instability, chaos, periodic behaviors, . . . );
- the study of the decidability of such properties along with the detection of decision algorithms;
- the detection of non trivial subclasses of the model where the properties become decidable when they are not in the general case;
- the study of the computational complexity of the decision algorithms.

- Collective Intelligence: Emergent Behavior from Local Interactions.

He deals with the problem of identifying and possibly characterizing the interactions of the elementary components giving rise to a certain global behavior. The results of this research line have strong applications concerning the modelling and simulation of phenomena from the real world.

- Applications: Simulation of real phenomena/processes.

He performed modelling and simulation of specific real complex phenomena:

- predator-prey systems, including virus-cell interactions (see [35,68], for instance);
- dynamic load balancing in networks (see [67], for instance);
- fluidynamical systems (see [70], for instance).

He is currently dealing with applications of Cellular Automata to cryptosystems for designing and improving

- data encryption methods (see [1,3,9], for instance);
- pseudo random number generators .

He recently started a research line on *Agent Systems* in the field of *Affective Computing*. A particular attention concerns the modelling and simulation of the spatial interactions among human beings during the pandemic caused by the SARS-COV-2 virus.



## 21 ATTIVITÀ GESTIONALI, ORGANIZZATIVE, DI SERVIZIO E DI TERZA MISSIONE

## 22 Service Activities

### 22.1 University

20/21–today + years 15/16 and 16/17 (until 12/04/17)

Member of the Orientation Committee of the University of Milano-Bicocca

### 22.2 Faculty

years 15/16 and 16/17 (until 03/04/17)

President of the Orientation Committee of the Faculty of Science, University of Milano-Bicocca (member since 12/2013).

### 22.3 Department

11/2018–A.A. 2020/2021

**Vice President of the Bachelor and Master Programs in Computer Science** (Vicepresidente del Consiglio di Coordinamento Didattico dei Corsi di Laurea Triennale e Magistrale in Informatica) at DISCo<sup>2</sup>.

As such, in 2019 he attended in the work concerning the periodic accountability and assessment of the Master Program in Computer Science by ANVUR held in March 2019: material preparation, preparatory, meetings, auditions, etc.)

2015/16–2017/18

**Member of the Teaching Committee (“Commissione Didattica”)** of DISCo.

In those years the Teaching Committee was a restricted Committee replacing CCD (Coordination Committee of Bachelor and Master Programs in Computer Science).

2012/13–today

**Responsible of the Orientation Committee of the Bachelor and Master Programs in Computer Science** at DISCo (member since 2009)

**Main overall results:**

- strong increase of the number of the enrolled students at the Master in CS from 2012 (43) to 2020 (134): 43, 79, 62, 92, 108, 102, 117, 123, 134
- strong increase of the number of candidates for the Bachelor in CS from 2013 (346) to 2019 (680)
- high mark (8/10)<sup>3</sup> concerning the evaluation of the Orientation activities by ANVUR during the periodic accountability and assessment of the Master in CS held in March 2019

2015/16–A.A. 2020/2021

**Responsible of the teaching program quality (“Responsabile/Referente AQ”)** of the Bachelor in Computer Science at DISCo

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<sup>2</sup>DISCo=Department of Informatics, Systems, and Communication, University of Milano-Bicocca

<sup>3</sup>the mark of the overall evaluation of the Master was 6.2

**2014-2017 (until 02/2017)**

**Designer and Responsible of an International Double Master Degree Program in Computer Science** between University of Milano-Bicocca and Université Nice Sophia Antipolis (Francia):

Definition of the Program started in 2014

Responsible from 08/01/2016 until 02/2017

(the agreement has been renewed later and it is still active today)

**2013/14–today**

**Member of the Board of the PhD Program** (“Collegio Docenti del Dottorato di Ricerca”) in **Computer Science** at University of Milano-Bicocca

**winter/spring 2021**

**Member of the Final Exam Board** for the PhD Program in Computer Science at University of Milano-Bicocca

**2015/16–A.A. 2020/2021**

**Member of the Committee for the teaching program quality** (“Gruppo di Riesame/Gruppo AQ”) of the Bachelor in Computer Science at DISCo

**summer 2016**

**Member of the Selection Board** for admission to the PhD Program in Computer Science at DISCo

**2012/13–2016/17**

**Member of the Board** for admission to the Master Program in Computer Science at DISCo

Service at I3S Laboratory (= Department) of CNRS, Sophia Antipolis, France:

**2010/11**

**Responsible of Seminars of the team MC3 (Models of Computation, Complexity, and Combinatorics) at the I3S Laboratory of CNRS, Sophia Antipolis, France.**

19 Seminars organized

## 23 University Third Mission

### Public Engagement Activity and Collaboration with Industry

[2014–today]

**Organization of “Lezioni Lincee di Scienze Informatiche” in collaboration with Accademia dei Lincei**

(one edition for every year since 2014/15<sup>4</sup>, about 700/800 participants for each edition)

Each edition consists of a cycle of seminars addressed to students and teachers of high schools with the goal of describing some scientific challenges of Computer Science.

[years 2015 and 2016]

**Organization of “NERD? - Non E' Roba per Donne?” in collaboration with the company IBM**

(about 200 participants for each edition)

Each edition consists of laboratory activities addressed to the girls of high schools for exposing them to Computer Science.

The initiative is still active today.

[2018/2019]

**Collaboration with AIRI (Associazione Italiana Ricerca Industriale) for the production of the Volume**

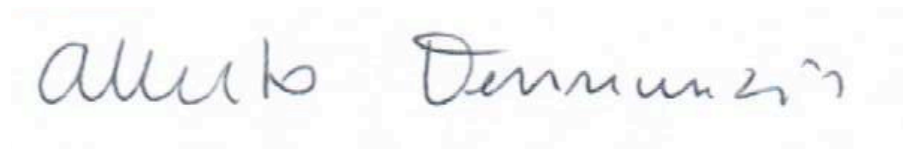
“Le Innovazioni del prossimo futuro, Tecnologie prioritarie per l'industria”, X Edizione – 2020, Volume 2 – Le Tecnologie Prioritarie, Agra Editrice.

See <https://www.airi.it/tecnologie-prioritarie/>

**He is the author of the following contribution for that Report** (single author, 7 pages):

**“Tecnologia Prioritaria n. 4. Intelligenza Artificiale, Maching Learning e Deep Learning”.**

Milano, 03/05/2023

A handwritten signature in dark ink, appearing to read "Alberto Dammunari", is written on a light-colored, slightly textured background.

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<sup>4</sup>except in 2020, 2021, and 2022 because of the pandemic problems