

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 4844.

## ALBERTO DENNUNZIO CURRICULUM VITAE

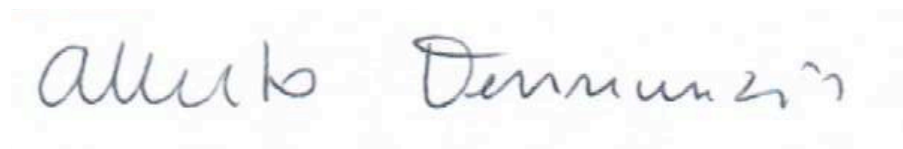
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Il sottoscritto DENNUNZIO ALBERTO, Codice Fiscale DNNLRT74C28E648L, nato a Lodi (LO) il 28-03-1974, residente in Cassina De' Pecchi in via Volta n. 30, consapevole della responsabilità penale cui può andare incontro in caso di dichiarazione mendace, 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.

Cassina de' Pecchi, 20 Ottobre 2021

A handwritten signature in dark ink, reading "Alberto Dennunzio". The signature is written in a cursive, slightly slanted style. The first name "Alberto" is written in a more compact, rounded script, while the last name "Dennunzio" is more elongated and features a prominent, sweeping flourish at the end.

# Indice

<b>1</b>	<b>Personal Data and Contact Information</b>	<b>4</b>
<b>2</b>	<b>Education</b>	<b>4</b>
<b>3</b>	<b>Academic Positions</b>	<b>4</b>
<b>4</b>	<b>Qualifications</b>	<b>4</b>
<b>5</b>	<b>International and National Teaching Activities</b>	<b>5</b>
5.1	Abroad Teaching Activities . . . . .	5
5.1.1	[2010–2011] as Associate Professor at UNIVERSITÉ NICE SOPHIA ANTIPOLIS, FRANCE . . . . .	5
5.1.2	past teaching modules as Contract Professor at Université Nice Sophia Antipolis, France . . . . .	5
5.1.3	past teaching minicourses as Erasmus Teacher Université Nice Sophia Antipolis, France . . . . .	5
5.2	[2004–today] Teaching Activities at Università degli Studi di Milano-Bicocca . . . . .	5
5.3	Past Teaching Activities . . . . .	8
<b>6</b>	<b>Ph.D./Post-doc Supervision and Tutoring Activities</b>	<b>9</b>
6.1	Bachelor and Master Thesis . . . . .	9
6.2	International Ph.D. Co-tutorship Agreement . . . . .	9
6.3	International and Italian Ph.D./Post-doc Supervision and Collaborations . . . . .	9
6.4	Seminars . . . . .	9
<b>7</b>	<b>Publications</b>	<b>10</b>
7.1	International Journal Articles . . . . .	10
7.2	International Journal Prefaces of Special Issues . . . . .	11
7.3	International Book Chapters . . . . .	12
7.4	Editing of International Conference Proceedings . . . . .	12
7.5	Articles in Proceedings of (peer-reviewed) International Conferences . . . . .	12
7.6	Italian Publications . . . . .	14
<b>8</b>	<b>National and International Research Centre/Group Membership/Direction</b>	<b>15</b>
<b>9</b>	<b>Editorial Activity</b>	<b>16</b>
9.1	Editor of International Journals . . . . .	16
9.2	Guest Editor of International Journals . . . . .	16
9.3	Editor of LNCS Volumes . . . . .	16
<b>10</b>	<b>Research Projects</b>	<b>17</b>
10.1	International Projects . . . . .	17
10.2	National Projects . . . . .	17
10.3	Projects funded by private Companies . . . . .	18
10.4	Submitted Projects . . . . .	18
<b>11</b>	<b>International Awards and Honors</b>	<b>19</b>
<b>12</b>	<b>International Conference Participations</b>	<b>20</b>
<b>13</b>	<b>Conference Organization and Participation to Committees</b>	<b>21</b>
<b>14</b>	<b>International Collaborations/Initiatives with other Universities</b>	<b>22</b>

<b>15 (Mainly International) Scientific Collaborations and Invitations</b>	<b>23</b>
15.1 Most Relevant International Collaborations . . . . .	23
15.2 Visiting and invitations abroad . . . . .	23
15.3 Invited Seminars . . . . .	23
<b>16 Evaluation Activities</b>	<b>24</b>
<b>17 Research Description</b>	<b>25</b>
<b>18 Service Activities</b>	<b>26</b>
18.1 University . . . . .	26
18.2 Faculty . . . . .	26
18.3 Department . . . . .	26
<b>19 University Third Mission</b>	<b>28</b>

## 1 Personal Data and Contact Information

Dennunzio Alberto

Born in Lodi, Italy, on March 28, 1974

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]

**(Research) Chair** of Computer Science, i.e., special research position at CNRS, 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 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

### 5.1 Abroad Teaching Activities

#### 5.1.1 [2010–2011] as Associate Professor at UNIVERSITÉ NICE SOPHIA ANTIPOLIS, FRANCE

##### 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

the total teaching schedule is limited to one-third of the standard total amount (180 h) as award due to the Chair position at CNRS, see Section 11

#### 5.1.2 past teaching modules as Contract Professor at Université Nice Sophia Antipolis, France

teaching modules on Cellular Automata, years 2006-2007, 2007-2008, and 2009-2010

course Complex Artificial Systems, M, 2h (L) + 2h (EL)

#### 5.1.3 past teaching minicourses as Erasmus Teacher Université Nice Sophia Antipolis, France

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.

### 5.2 [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. 2021-2022

- in progress: Algorithms and Data Structures (Advanced), B, 6 ECTS (E+EL)
- planned for spring 2022: Algorithms and Data Structures (Introduction), B, 4 ECTS (L) **Responsible**
- planned for spring 2022: Complex and Uncertain Systems, M, 3 ECTS (L+E), **Responsible**

### A.A. 2020-2021

- Algorithms and Data Structures (Introduction), B, 4 ECTS (L) **Responsible**
- Algorithms and Data Structures (Advanced), B, 6 ECTS (E+EL)
- Complex and Uncertain Systems, M, 3 ECTS (L+E), **Responsible**

### A.A. 2019-2020

- Algorithms and Data Structures (Introduction), B, 4 ECTS (L)
- Algorithms and Data Structures (Advanced), B, 6 ECTS (E+EL)
- Complex and Uncertain Systems, M, 4 ECTS (L), **Responsible**

### A.A. 2018-2019

- 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**

### 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**

### 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**

### A.A. 2015-2016

- Algorithms and Data Structures (Advanced), B, 2 ECTS (E)
- Complex and Uncertain Systems, M, 4 ECTS (L), **Responsible**

### 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 5.1).

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)
- 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)
- 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)

### **5.3 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).



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

### 6.1 Bachelor and Master Thesis

He was **supervisor of many Bachelor and Master thesis**.

He also supervised one master thesis inside the Double Master Degree Program with Université Nice Sophia Antipolis (2018/2019).

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

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

**Ph.D Thesis Co-supervisor**

### 6.3 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**

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

**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**

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

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

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

**Supervisor**

### 6.4 Seminars

See Section 15.3.

## 7 Publications

The list includes publications in very selective journals, as *Journal of Computer and System Sciences* and *Information and Computation*, and very selective International Conferences, as *ICALP* and *MFCS*.

### 7.1 International Journal Articles

- [1] 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.
- [2] 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.
- [3] 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.
- [4] 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.
- [5] L. Mariot, L. Manzoni, and A. Dennunzio. Search space reduction of asynchrony immune cellular automata. *Natural Computing*, 19: 287–293, 2020.
- [6] A. Dennunzio, E. Formenti, L. Manzoni, L. Margara, and A. E. Porreca. On the dynamical behaviour of linear higher-order cellular automata and its decidability. *Information Sciences*, 486: 73–87, 2019.
- [7] A. Dennunzio, E. Formenti, L. Manzoni, and A. E. Porreca. Complexity of the dynamics of reaction systems. *Information and Computation*, 267: 96–109, 2019.
- [8] A. Dennunzio, E. Formenti, L. Manzoni, G. Mauri, and A. E. Porreca. Computational complexity of finite asynchronous cellular automata. *Theoretical Computer Science*, 664: 131–143, 2017.
- [9] L. Mariot, A. Leporati, A. Dennunzio, and E. Formenti. Computing the periods of preimages in surjective cellular automata. *Natural Computing*, 16: 367–381, 2017.
- [10] A. Dennunzio, E. Formenti, and L. Manzoni. Reaction systems and extremal combinatorics properties. *Theoretical Computer Science*, 598: 138–149, 2015.
- [11] A. Dennunzio, E. Formenti, L. Manzoni, and A. E. Porreca. Ancestors, descendants, and gardens of Eden in reaction systems. *Theoretical Computer Science*, 608: 16–26, 2015.
- [12] A. Dennunzio, E. Formenti, and M. Weiss. Multidimensional cellular automata: closing property, quasi-expansivity, and (un)decidability issues. *Theoretical Computer Science*, 516: 40–59, 2014.
- [13] A. Dennunzio, E. Formenti, and J. Provillard. Three research directions in non-uniform cellular automata. *Theoretical Computer Science*, 559: 73–90, 2014.
- [14] A. Dennunzio, E. Formenti, and L. Manzoni. Limit properties of doubly quiescent m-asynchronous elementary cellular automata. *Journal of Cellular Automata*, 9: 341–355, 2014.
- [15] A. Dennunzio, E. Formenti, and J. Provillard. Local rule distributions, language complexity and non-uniform cellular automata. *Theoretical Computer Science*, 504: 38–51, 2013.
- [16] A. Dennunzio, P. Di Lena, E. Formenti, and L. Margara. Periodic Orbits and Dynamical Complexity in Cellular Automata. *Fundamenta Informaticae*, 126: 183–199, 2013.

- [17] L. Acerbi, A. Dennunzio, and E. Formenti. Surjective multidimensional cellular automata are non-wandering: A combinatorial proof. *Information Processing Letters*, 113: 156–159, 2013.
- [18] A. Dennunzio, E. Formenti, L. Manzoni, and G. Mauri. m-Asynchronous cellular automata: from fairness to quasi-fairness. *Natural Computing*, 12: 561–572, 2013.
- [19] A. Dennunzio, E. Formenti, and J. Provillard. Non-uniform cellular automata: Classes, dynamics, and decidability. *Information and Computation*, 215: 32–46, 2012.
- [20] A. Dennunzio. From One-dimensional to Two-dimensional Cellular Automata. *Fundamenta Informaticae*, 115: 87–105, 2012.
- [21] A. Dennunzio, E. Formenti, and L. Manzoni. Computing Issues of Asynchronous CA. *Fundamenta Informaticae*, 120: 165–180, 2012.
- [22] L. Acerbi, A. Dennunzio, and E. Formenti. Conservation of Some Dynamical Properties for Operations on Cellular Automata. *Theoretical Computer Science*, 410: 3685–3693, 2009.
- [23] A. Dennunzio, P. Di Lena, E. Formenti, and L. Margara. On the Directional Dynamics of Additive Cellular Automata. *Theoretical Computer Science*, 410: 4823–4833, 2009.
- [24] A. Dennunzio, P. Guillon, and B. Masson. Sand Automata as Cellular Automata. *Theoretical Computer Science*, 410: 3962–3974, 2009.
- [25] F. Farina and A. Dennunzio. A Predator-Prey Cellular Automaton with Parasitic Interactions and Environmental Effects. *Fundamenta Informaticae*, 83: 337–353, 2008.
- [26] G. Cattaneo, A. Dennunzio, and F. Farina. A survey on transitivity in discrete time dynamical systems. Applications to symbolic systems and related languages. *Theoretical Informatics and Applications*, 40: 333–352, 2006.
- [27] G. Cattaneo, A. Dennunzio, and L. Margara. Solution of Some Conjectures about Topological Properties of Linear Cellular Automata. *Theoretical Computer Science*, 325: 249–271, 2004.
- [28] G. Cattaneo, A. Dennunzio, and L. Margara. Chaotic Subshifts and Related Languages Applications to One-Dimensional Cellular Automata. *Fundamenta Informaticae*, 52 : 39–80, 2002.

## 7.2 International Journal Prefaces of Special Issues

- [29] A. Dennunzio and E. Formenti. Preface. *Information and Computation*, 274: 104530, 2020.
- [30] 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.
- [31] A. Dennunzio and E. Formenti. Preface. *Natural Computing*, 19: 271, 2020.
- [32] A. Dennunzio, E. Formenti, G. Mauri, and T. Worsch. Foreword: asynchronous behavior of cellular automata and discrete models. *Natural Computing*, 14: 505–506, 2015.
- [33] A. Dennunzio, L. Manzoni, G. Mauri, and A. E. Porreca. Special Issue Unconventional Computation and Natural Computation 2013. *International Journal of Foundations of Computer Science*, 25: 369–372, 2014.
- [34] J. Cervelle, A. Dennunzio, E. Formenti, and A. Skowron. Cellular Automata and Models of Computation. *Fundamenta Informaticae*, 126: i–ii, 2013.
- [35] A. Dennunzio and E. Formenti. Foreword: cellular automata and applications. *Natural Computing*, 12: 305, 2013.

- [36] A. Dennunzio, N. Fatès, and E. Formenti. Foreword: asynchronous cellular automata and applications. *Natural Computing*, 12: 537–538, 2013.
- [37] A. Dennunzio, E. Formenti, F. Peper and H. Umeo. Foreword: asynchronous cellular automata and nature-inspired computation. *Natural Computing*, 11: 267–268, 2012.
- [38] D. Ciucci, A. Dennunzio, and R. Leporini. From Physics to Computer Science: to Gianpiero Cattaneo for his 70th birthday. *Fundamenta Informaticae*, 115: i–ii, 2012.

### 7.3 International Book Chapters

- [39] A. Dennunzio, E. Formenti, and P. Kůrka. Cellular Automata Dynamical Systems. In G. Rozenberg, T. Back, and J.N. Kok editors, *Handbook of Natural Computing: Theory, Experiments, and Applications*: 25–75, Springer, 2012.
- [40] J. Cervelle, A. Dennunzio, and E. Formenti. Chaotic Behavior of Cellular Automata. In R. Meyer, editor, *Encyclopedia of Complexity and Systems Science*: 978–989. Springer, 2009.

### 7.4 Editing of International Conference Proceedings

- [41] G. Mauri, S. El Yacoubi, A. Dennunzio, K. Nishinari, and L. Manzoni (Eds.). Cellular Automata, *13th International Conference on Cellular Automata for Research and Industry (ACRI 2018)*, volume 11115 of *Lecture Notes in Computer Science*. Springer, 2018.
- [42] A. Dennunzio, E. Formenti, L. Manzoni, and E. Porreca (Eds.). Cellular Automata and Discrete Complex Systems, *23rd IFIP WG 1.5 International Working Conference (AUTOMATA 2017)*, volume 10248 of *Lecture Notes in Computer Science*. Springer, 2017.
- [43] G. Mauri, A. Dennunzio, L. Manzoni, and E. Porreca (Eds.). Unconventional Computation and Natural Computation, *12th International Conference on Unconventional Computation and Natural Computation (UCNC 2013)*, volume 7956 of *Lecture Notes in Computer Science*. Springer, 2013.

### 7.5 Articles in Proceedings of (peer-reviewed) International Conferences

- [44] A. Dennunzio, E. Formenti, D. Grinberg, and L. Margara. From Linear to Additive Cellular Automata. In *47th International Colloquium on Automata, Languages, and Programming (ICALP 2020)*, volume 168 of *LIPIcs*, pages 125:1–125:13. Schloss Dagstuhl - Leibniz-Zentrum für Informatik, 2020.
- [45] A. Dennunzio, E. Formenti, L. Margara, V. Montmirail, and S. Riva. In *16th International Conference on Computational Intelligence for Bioinformatics and Biostatistics (CIBB 2019)*, volume 12313 of *Lecture Notes in Computer Science*, pages 119–132. Springer, 2020.
- [46] A. Dennunzio, E. Formenti, D. Grinberg, and L. Margara. Additive Cellular Automata Over Finite Abelian Groups: Topological and Measure Theoretic Properties. In *44th International Symposium on Mathematical Foundations of Computer Science (MFCS 2019)*, volume 138 of *LIPIcs*, pages 68:1–68:15. Schloss Dagstuhl - Leibniz-Zentrum für Informatik, 2019.
- [47] A. Dennunzio, E. Formenti, L. Manzoni, L. Margara and A. E. Porreca. Decidability of Sensitivity and Equicontinuity for Linear Higher-Order Cellular Automata. In *13th International Conference on Language and Automata Theory and Applications (LATA 2019)*, volume 11417 of *Lecture Notes in Computer Science*, pages 95–107. Springer, 2019.
- [48] A. Dennunzio, V. Dorigatti, E. Formenti, L. Manzoni, and A. E. Porreca. Polynomial Equations over Finite, Discrete-Time Dynamical Systems. In *13th International Conference on Cellular Automata for Research and Industry (ACRI 2018)*, volume 11115 of *Lecture Notes in Computer Science*, pages 298–306. Springer, 2018.

- [49] A. Dennunzio, E. Formenti, L. Manzoni, and A. E. Porreca. Reachability in Resource-Bounded Reaction Systems. In *10th International Conference on Language and Automata Theory and Applications (LATA 2016)*, volume 9618 of *Lecture Notes in Computer Science*. Springer, 2016.
- [50] A. Dennunzio, E. Formenti, L. Manzoni, and A. E. Porreca. Preimage Problems for Reaction Systems. In *9th International Conference on Language and Automata Theory and Applications (LATA 2015)*, volume 8977 of *Lecture Notes in Computer Science*, pages 537–548. Springer, 2015.
- [51] A. Dennunzio, E. Formenti, and L. Manzoni. Extremal Combinatorics of Reaction Systems. In *8th International Conference on Language and Automata Theory and Applications (LATA 2014)*, volume 8370 of *Lecture Notes in Computer Science*, pages 297–307. Springer, 2014.
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## 7.6 Italian Publications

- [71] 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.

## 8 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).

## 9 Editorial Activity

### 9.1 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>

### 9.2 Guest Editor of International Journals

**Guest Editor** of the following international journals for special issues (see Section 7.2 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)

### 9.3 Editor of LNCS Volumes

**Editor of 3** Volumes of the series *Lecture Notes in Computer Science (LNCS)* publishing **Conference Proceedings** (see Section 7.4 for details).



## 10 Research Projects

### 10.1 International Projects

- (58 months) I played the role of **Italian Coordinator** of **International Project** Interlink/MIUR 2006-2008 (extended to 2010), type C, 70K euro, *“Cellular Automata: Topological Properties, Chaos and Associated Formal Languages; use of massively parallel architectures for implementative aspects”*.  
  
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.

### 10.2 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”.

### 10.3 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).

### 10.4 Submitted Projects

I recently applied for the PRIN 2020 call as PI of the project “Simulating Complex Systems by Cellular Automata” in collaboration with Università di Bologna and Università di Trieste.

## 11 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.** For every year since 1975, one paper has been selected.

2010/11 **CNRS (Research) Chair**<sup>1</sup>, i.e., special research 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 each year).

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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.

## **12 International Conference Participations**

I attended many international conferences where the accepted conference papers were been presented, see Section 7.5.

## 13 Conference Organization and Participation to Committees

**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 2019

ACRI 2018 (Int. Conference on Cellular Automata for Research and Industry)

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 2018

CiE 2013 (Int. Conference on Computability in Europe)

## 14 International Collaborations/Initiatives with other Universities

[2006–today] He played a **main role in creating and keeping alive a solid Italian-French Network** for scientific collaborations on Complex Systems and Cellular Automata. The Network is still active today and includes now:

- Aix-Marseille Université, France;
- Université Cote d’Azur, France;
- Université Paris-Est, France;
- CNRS, CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE (FRENCH NATIONAL CENTRE FOR SCIENTIFIC RESEARCH), France;
- Università di Trieste;
- Università di Bologna;
- Università degli Studi di Milano-Bicocca;

[2014–2017] **Promoter, 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 the agreement signature (08/01/2016) until 02/2017

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

[2019/2020–today] **Promoter of an International Ph.D. Co-tutorship Agreement** for S. Riva, incoming Ph.D student from Université Cote d’Azur, France, on the subject “Factorization of Discrete Dynamical Systems”.

**He is the Ph.D Thesis Co-supervisor**

## 15 (Mainly International) Scientific Collaborations and Invitations

### 15.1 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).

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

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

[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.

[2000–today] Scientific collaborations with Luciano Margara and Pietro Di Lena, University of Bologna.

### 15.2 Visiting and invitations abroad

**2006-2010** (*≈ 6 months*) Several periods spent in France for 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

**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.).

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

### 15.3 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.

## 16 Evaluation Activities

- Referee for the Chilean “National Fund for Scientific & Technological Development” (FONDECYT), Ministerio de Educacion, Chile (2011 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)



## 17 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 [25,67], for instance);
- dynamic load balancing in networks (see [66], for instance);
- fluidynamical systems (see [69], for instance).

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

- data encryption methods (see [1,3,6], 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.

## 18 Service Activities

### 18.1 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**

### 18.2 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).

### 18.3 Department

11/2018–today

**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.)

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–today

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

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)

**2019/2020–today Promoter of an International Ph.D. Co-tutorship Agreement** for S. Riva, incoming Ph.D student from Université Cote d’Azur, France, on the subject “Factorization of Discrete Dynamical Systems”.

**He is the Ph.D Thesis Co-supervisor**

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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

**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–today**

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

**2015/16–2017/18**

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

## 19 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 (7 pages):**

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

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