Emanuela Merelli

CURRICULUM VITAE

GENERAL INFORMATION
Name: Emanuela Merelli
Born: San Ginesio, Italy, 9 August 1960
Citizen: Italian
Education: Italian Doctoral Degree (Laurea) in Computer Science (Pisa, 1985) and PhD in Artificial Intelligent Systems (Ancona, 2000)
Two children: Costanza (25), Giovanni (23)

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POSITION
Full Professor of Computer Science (since 2015) at Università di Camerino

Courses (* indicates the 2015-2016 academic year):
- Distributed Calculus and Coordination*
- Algorithms and Data Structures*
- Information Systems and Database
- Methods and Programming Languages
- Algorithms and Complexity
- Operational Research
- Non-linear Optimization

Appointments:
- Coordinator of PhD in Computer Science, School of Advanced Studies (since 2010)
- Head of Computer Science Division, School of Science and Technology (from 2006 to 2012)
- Delegate of the Rector to coordinate the European International Mobility (2011 and 2012)
- Vice-chair of the Scientific Advisory Board, Master in IT Technologies for BioMedical Image Processing, (from 2001 to 2006).

External appointments:
- Fulbright Scholar at University of Oregon, Computer Science Dep., Eugene, US (from 2005 to 2006)
- Visiting Researcher at University of East Anglia, School of Information System, Norwich, UK (1998)
- Italian delegate to ISO/WG6, editor of OSI/WG6-Presentaion Layer (1986 and 1987)
- Research Fellow at National Research Institute (CNR), Pisa (1987)
- Scientist Fellow at European Networking Center, IBM, Heidelberg, Germany (1985-1986)
- Honorary Scholar at Ing. C. Olivetti S.p.A., Ivrea, Italy (from 1984 to 1985)

MEMBERSHIPS
- Member of Bioinformatics Italian Society (BITS) , (since 2006)
- Member of Gruppo GNCS (Gruppo Nazionale per il Calcolo Scientifico), (from 2009)
- Member of the Consorzio Interunivesritario Nazionale per la Fisica della Atmosfere e Idrosfere (CINFAI) (since 2011)

PROFESSIONAL CONTRIBUTIONS
- Coordinator of the EC FP7, FET Proactive, "TOPDRIM: Topology Driven Methods for Modelling Complex Systems" project, GA N. 318121 (2012-2015)
- Principal Investigator of the COST Action on "Reversible Computation: extending horizon of computing" IC1405 (2015-2017)
- Principal Investigator of the IT Flagship, RITMARE, "Agent-oriented modelling for spacial and temporal multiscale analysis, simulation and prediction of a dynamics population in the marine ecosystem" project SP2-WP2-AZ2-UO05, (2012-2016)
- Principal Investigator of the POR MARCHE FESR 2007-2013 , "AALISABETH: "Ambient-Aware LIfeStyle tutoring, Aiming at a BETter Health" project, (2013-2015)
- Principal Investigator of the IT MIUR, FIRB, "LITBIO: Interdisciplinary Laboratory of Bioinformatics Technologies", project (2005-2009)
- Scientific delegate at FP6, NoE, Virtual Physiological Human- Network of Excellence, (2209-2011)
- Principal Investigator of the IT MIUR, Strategic Research Project, "O2I: Oncology over Internet Methodologies, models, Techniques and tools, per information extraction and retrieval", project (2002-2005)
- Principal Investigator of the CIPE MARCHE, "SICOM: SIstemi COoperativi e Multiagente" project (2003-2004)

Expert and evaluator for:
- European Commission DG CONNECT (ex-INFSO), (since 2011) Future and Emerging Technologies (FET) Unit (since 2011)
- Italian Ministry for Research and Education, MIUR, (since 2012)
- Fulbright Program US-Italy (since 2007)
- Quatar National Research Fund, QNRF, (since 2006)
- Region Marche - Research, Development, Innovation and Technology Transfer (since 2011)

Referee for:
- ACM Transaction on Computational Biology and Bioinformatics
- Acta Informatics, Springer
- Applied Mathematics and Computation, Elsevier
- Bioinformatics, Oxford Journal
- BioSystems, Elsevier Journal
- BMC Bioinformatics
- Briefings in Bioinformatics, Oxford Journal
- Computer and Industrial Engineering, Elsevier

- Data and Knowledge Engineering, Elsevier
- IEEE Transaction on Parallel and Distributed Computing
- International Journal of Computer Mathematics
- International Journal for Production Research
- International Journal of Modelling, Identification and Control
- International Journal on Software Tools for Technology Transfer, Springer
- Journal of Theoretical Biology, Elsevier
- Neural Computing and Applications, Springer Journal
- PLOS, Computational Biology
- PLOS ONE
- Robotics and Computer-Integrated Manufacturing, Elsevier
- Simulation, Modelling Practice and Theory, Elsevier
- Theoretical Computer Science, Elsevier
- Transactions on Computational Systems Biology, Springer

Guest Editor for :
Journal of Theoretical Computer Science - Theory of Natural Computing, Elsevier.
- From Computer Science to Biology and back, vol. 608 (2015)
- Interaction between Computer Science, Complex Systems and Biology, vol. 587 (2015)
- Hybrid Automata and Oscillatory Behaviour in Biological Systems, vol. 411, issue 20 (2010)
- Concurrent Systems Biology: To Nadia Busi (1968-2007), vol. 410, issue 33-34: P.3037-3038, (2009)

Journal of Electronic Proceedings of Theoretical computer Science
- Proceedings of 5th Workshop Interaction between Computer Science and Biology vol. 306, (2014)
- Proceeding of 4th Workshop Interaction between Computer Science and Biology. vol. 299, (2013)
- Proceedings of 2nd Workshop From Biology To Concurrency and back. vol. 229, issue 1, (2009)
- Proceedings of 1st Workshop From Biology To Concurrency and back. vol. 194, issue 3, (2008)

Transaction on Computational Systems Biology, Springer
- Model and Metaphors from Biology to Bioinformatics and Back, vol. 3737, (2005)

Awards:
FET11: The European Future Technologies Conference and Exhibition. The 3rd Price for the Best Poster: Methodological Bridges for Complex Systems. co-authors: Pietro Lio and Nicola Paoletti. http://www.fet11.eu/awards

Founding Member of Spin-Off:
- eLios: eLinking on line services S.r.l., Universit di Camerino (2007) http://www.e-lios.eu
- NGB: New Generation Bioinformatics dellUniversit di Camerino (2010) http://www.engeebee.com

Other activities:
- Chair and co-chair for many workshops of interdisciplinary character
- Member of many program committees of events with interdisciplinary character, last of which the Joint European Association for Theoretical Computer Science and TOPDRIM Young Researcher School on Concurrency and Complexity through Topology (2015)
- Advisor and Tutor of several PhD Candidates with brilliant carriers

MAIN FIELD OF RESEARCH
Bio-inspired formal methods, concurrency theory, multi-level & agent-oriented modelling of complex systems, topological field theory of data and new models of computation. Computational biology of RNA Folding and Immune System.

PROFESSIONAL ACTIVITIES

Author or co-author of about one hundred papers on scientific journals. Invited lecturer at several international events.

Most cited paper: "A tabu search method guided by shifting bottleneck for the job shop scheduling problem", E. Merelli, F. Pezzella, European Journal of Operational Research 120 (2), 297-310 (2000) $\sim$ 248 citations.

MOST RELEVANT CONTRIBUTIONS

The most relevant contributions in the various areas are:

i) new bio-inspired formal languages such as BioAgent, SHAPE Calculus, BIOSHAPE and BOSL, for modelling, simulating and analysing autonomous agents represented as geometric shapes whose internal behavior allows them to interact, bind and move in an Euclidian space.

ii) new model of computation, the S[B] machine, characterized by two entangled levels of computation, global and local. The global one represents the environment, i.e. the semantic context, for a pool of locally interacting agents.

iii) topological field theory of data, a research program towards a new strategy for mining data through a data language that turns out to be a shape language.

iv) a new data model, Resourceome, that allows to manage declarative and procedural knowledge by a model that relates by a certain action the concept of resource to its domain.

v) a new heuristic method combines Tabu Search and Shifting Bottleneck and solves the optimization problem of job shop scheduling in a better time; a new constraint logic programming technique based on cooperative logic agents for concurrency control and deadlock avoidance dynamic scheduling of distributed transaction management.

vi) the definition of persistent entropy measure, whose value is basically calculated using the persistent Betti barcodes. By definition, the value of the persistent entropy is strongly related to the topological structures derived from the data.

vii) the design and development of jHoles, an algorithm based on persistent homology and clique weigh rank homology whole implementation allows us to study the connectivity features of complex networks. Applications of jHoles to epidermal tumor diagnosis was successful.

viii) the design and development of DISPAS, Demersal fIsh Stock Probabilistic Agent-based Simulator, suitable to investigate and understand sustainability in the exploitation of fishery resources, by focusing on common sole (Solea solea) stock in the North-ern Adriatic Sea.

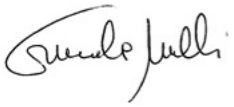
ix) a wide study on bone remodelling as a multiscale, multilevel system - through Spatial P Systems, complex automata-based model running in BioShape, by combining process algebraic and stochastic approach and by modelling some pathologies such as osteomyelitis and osteoporosis.

x) a model of cell cycle based on the use of hybrid systems, a model reduction which allows to define the crucial features of the dynamical system. The new methodology allows to describe the cellular system by combining continuous behavior with discrete events by using the hybrid automata technology.

xi) the immune system, the idiotypic network has been widely studied both as a biological inspiration for design new methods such as S[B] and as a complex adaptive system to be faithfully modelled with PEA: persistent entropy automaton.

xii) a methodology for deriving a model of a complex system by exploiting the information extracted from topological data analysis to construct a persistent entropy automaton.

Camerino, 20th March 2016 Prof. Emanuela Merelli



List of Selected Publications

1. M. Rasetti, E. Merelli: The Topological Field Theory of Data: mining data beyond complex networks Cambridge University Press - In press
   The Topological Field Theory of Data: a program towards a novel strategy for mining data through data language. J. Physics: Conf. Series, 626, (2015)

2. A.L. Mamuye, E. Merelli, L. Tesei: Graph Grammar for Modeling RNA Folding Evolution as a Self-Adaptive System. Accepted to the Graphs as Models 2016.

3. D. Cacciagrano. F. Corradini, E. Merelli, L. Tesei: Uniformity in Multiscale Models: From Complex Automata to BioShape. Journal of Cellular Automata - In press

4. E. Merelli, N. Paoletti, L. Tesei: Adaptability checking in complex systems. Science of Computing Programming, vol. 115-116, (2016)

5. E. Merelli, M. Rucco, P. Sloot and L. Tesei: Topological Characterization of Complex Systems: Using Persistent Entropy. Entropy, 17(10), (2015)

6. E. Merelli, I. Petre: From Computer Science to Biology and Back. Theor. Comput. Sci. 608: 2-3 (2015)

7. E. Merelli, M. Pettini, M. Rasetti: Topology driven modeling: the IS metaphor, *Natural Computing Journal, NACO*, 14(3), Springer (2015)

8. P. Giannini, E. Merelli, A. Troina: Interactions between Computer Science and Biology. Theor. Comput. Sci. 587: 1-2 (2015)

9. J. Binchi, E. Merelli, M. Rucco, G. Petri, F. Vaccarino: jHoles: A Tool for Understanding Biological Complex Networks via Clique Weight Rank Persistent Homology. Electr. Notes Theor. Comput. Sci. 306: 5-18 (2014)

10. E. Merelli, M. Rasetti: *Non locality, topology, formal languages: new global tools to handle large data sets, Procedia Computer Science*, vol. 18 (2013)

11. N.Paoletti, P. Lio', E. Merelli, M. Viceconti: Multilevel Computational Modeling and Quantitative Analysis of Bone Remodeling. *IEEE/ACM Trans. Comput. Biology Bioinformatics* Vol. 9, Num. 5, 2012.

12. E. Merelli, M. Rasetti: The Immune System as a Metaphor for Topology Driven Patterns Formation in Complex Systems. *Int. Conference on Artificial Immune Systems.* Taormina, Aug. 2012

13. P. Liò, E. Merelli, N. Paoletti: Disease processes as hybrid dynamical systems. *Int. Workshop on Hybrid Systems.* Newcastle, Sept. 2012

14. F. Buti, F. Corradini, E. Merelli, L. Tesei: A Geometrical Refinement of Shape Calculus Enabling Direct Simulation. *Conference on Simulation, Meth. And Techn. And Appl.* Rome, July 2012

15. E. Bartocci, P. Li, E. Merelli, N. Paoletti: Multiple Verification in Complex Biological Systems: The Bone Remodelling Case Study. Trans. Computational Systems Biology 14: 53-76 (2012)

16. R. Alfieri, E. Bartocci, E. Merelli, L. Milanesi: Modeling the cell cycle: From deterministic models to hybrid systems. *Journal of Biosystems* 105(1), 2011

17. F. Buti, D. Cacciagrano, F. Corradini, E. Merelli, L. Tesei: A Uniform Multiscale Metamodel of BioShape. Electr. Notes Theor. Comput. Sci. 277: 15-27 (2011)

18. P. Li, E. Merelli, N. Paoletti, M. Viceconti: A Combined Process Algebraic and Stochastic Approach to Bone Remodeling. Electr. Notes Theor. Comput. Sci. 277: 41-52 (2011)

19. E. Bartocci, F. Corradini, E. Merelli, L. Tesei: Detecting Synchronisation of Biological Oscillators by by Model Checking. *Theoretical Computer Science* 411(20), 2010

20. E. Bartocci, M.R. Di Berardini, D. Cacciagrano, E. Merelli, L. Tesei: Timed Operational Semantics and Well-Formedness of Shape Calculus. *Scientific Annals of Computer Science*, vol.20, pages 33-52, 2010.

21. E. Bartocci, M.R. Di Berardini, F. Corradini, E. Merelli, L. Tesei: Shape Calculus. A Spatial Mobile Calculus for 3D Shapes. Scientific Annals of Computer Science vol. 20, pages 1-31, 2010.

22. E. Bartocci, D. Cacciagrano,F. Corradini, E. Merelli, and L. Vito. A Resourceome for the automation of in-silico biological experiments. Appearing in proceedings of *International Conference on Computational and Systems Biology and Microbiology (BioSysCom)*, Cancum, Messico, March 7-13, 2010.

23. F. Buti, D. Cacciagrano,F. Corradini, E. Merelli, L.Tesei. BioShape: a spatial shape-based scale-independent simulation environment for biological systems. Appearing in proceedings of *International Conference on Computational Science (ICCS)*, Amsterdam, May 31-June 2, 2010.

24. F. Buti, D. Cacciagrano, F. Corradini, E. Merelli, M. Pani, L. Tesei: Bone remodelling in BioShape. In *CS2BIO 2010: Interactions between Computer Science and Biology*, 1st International Workshop, 2010.

25. D. Cacciagrano, F. Corradini, E. Merelli. Bone Remodelling: a Complex Automata-based model running in Bioshape *ACRI 2010: The Ninth International Conference on Cellular Automata for Research and Industry*, Ascoli Piceno (Italy), September 21-24, 2010.

26. E. Bartocci, F. Corradini, E. Merelli, L. Tesei: Detecting synchronisation of biological oscillators by model checking. Theor. Comput. Sci. 411(20): 1999-2018 (2010). *Theor. Comput. Science* 411(20): 1999-2018 (2010)

27. F. Buti, F. Corradini, E. Merelli, E. Paschini, P. Penna, L. Tesei: An Individual-based Probabilistic Model for Fish Stock Simulation. *AMCA-POP* 2010: 37-55

28. E. Bartocci, F. Corradini, E. Merelli, L. Tesei. Model Checking Biological Oscillators. *Electronic Notes in Theoretical Computer Science* vol. 229 no. 1. 2009.

29. N. Cannata, F. Corradini, E. Merelli, F. Piersigilli, L. Vito Towards Bioinformatics Resourceomes. *Biomedical Data and Applications* 13-36, 2009

30. N. Cannata, F. Corradini, E. Merelli. Multiagent modelling and simulation of carbohydrate oxidation *International Journal of Modelling, Identification and Control* (IJMIC), vol.1 n.3, ISSN: 1746-6172, 2008

31. E. Bartocci, F. Corradini, R. Grosu, E. Merelli, O. Riganelli, S. A. Smolka. StonyCam: A Formal Framework for Modeling, Analyzing and Regulating Cardiac Myocytes. *Concurrency, Graphs and Models*, LNCS Vol. 5065, 493-502, 2008

32. E. Merelli et al. Agents in Bioinformatics, Computational and Systems Biology. *Briefing in Bioinformatics*, Vol.8 Num. 1, 45-59, 2007

33. E. Merelli, M. Young. Validating MAS with mutation. *International Journal of Multiagent and Grid Systems* Vol.3 Num. 2, ISSN 1574-1702, 2007

34. N. Cannata, F. Corradini, E. Merelli. A Resourceomic Grid for Bioinformatics. *International Journal of Grid Computing: Theory, Methods and Applications: Future Generation Computer Systems Journal,* Vol.23, n.3, ISSN: 0167-739X, 2007

35. E. Bartocci, F. Corradini, E. Merelli, Lorenzo Scortichini. BioWMS: a web-based Workflow Management System for Bioinformatics. *BMC Bioinformatics Int. Journal,* vol.8 suppl.1 ISSN: 1471-2105, 2007

36. F. Corradini, E. Merelli: Hermes: Agent-Based Middleware for Mobile Computing. *SFM 2005* LNCS Vol. 3465. 234-270.

37. N. Cannata, F. Corradini, E. Merelli, A. Omicini, A. Ricci. An agent-oriented conceptual framework for Systems Biology. *Transaction on Computational Systems Biology*, LNBI Vol. 3737, 105-122, Springer, ISBN: 3-540-30883-0, 2005

38. N. Cannata, E. Merelli, R.B. Altman. Time to organize the Bioinformatics Resourceome. *PloS Computational Biology*, Vol. 1, Num. 7, ISSN: 1553-734X, 2005

39. M. Luck and E. Merelli. Agents in Bioinformatics. *The Knowledge Engineering Review*, Vol. 20, Num. 2 117-125, Cambridge University Press, ISSN: 0269-8889, 2005

40. F. Corradini, L. Mariani, and E. Merelli. An agent-based approach to tool integration. *Software Tools for Technology Transfer*, Vol. 6 Num. 3, 231-244, Springer Journal, ISNN: 1433-2779,November 2004

41. E. Merelli, F. Pezzella. A tabu search method guided by a shifting bottleneck for a job shop scheduling. *European Journal of Operational Research*, volume 120, pagine 297-310, ISSN: 0377-2217, 2000

42. R. De Leone, R. Capparuccia, E. Merelli. A successive overrelaxation back propagation algorithm for neural network training. *IEEE Transaction on Neural Networks*, volume 9, numero 3, pagine 381–389, ISSN: 045-9227, Maggio 1998.

43. R. De Leone, R. Capparuccia, E. Merelli. A successive overrelaxation back propagation algorithm for neural network training. *IEEE Transaction on Neural Networks*, volume 9, numero 3, pagine 381–389, ISSN: 045-9227, Maggio 1998.

44. F. Caneschi, E. Merelli. An architecture for an asn.1 encoder/decoder. *Computer Networks, North Holland*, volume 14, pagine 297–303, ISSN: 1389-1286, 1987.