CURRICULUM VITÆ

1. Biographical and Personal Information

Alessandro Betti, born June 29, 1992, Florence, Italy.
Address: Via Europa 348, Quarrata (PT), 51039.
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Phone: +39 334 7659280.
Language: Italian (first language), English.

2. Education

Liceo Scientifico "Amedeo di Savoia"; Maturità scientifica (100/100 e lode), 2011.

Università di Pisa, September 2011–October 2014; Bachelor degree in Physics (with 110/110 cum laude), October 2014. Thesis: "Sistemi Simmetrici in Fisica." Supervisor: Sergio Spagnolo.

Università di Pisa, October 2014–October 2106; Master degree in Theoretical Physics (with 110/110), October 2016. Thesis: "Complex Projective Model on a Worldstrip." Supervisor: Kenichi Konishi.

Università degli Studi di Firenze, Università di Pisa, Università degli Studi di Siena, November 2016–October 2019; Ph.D. in Computer Science (Smart Computing), February 2020. Thesis: "A Variational Framework for Laws of Learning." Advisor: Marco Gori.

3. Employment Record

Postdoctoral researcher, Università degli Studi di Siena, 2020–.

4. Programming Languages

Programming in C, CWEB, TEX, METAFONT, METAPOST.
Basic programming skills in *Mathematica*, *Matlab*, *Python* and LATEX.
Rudimental programming skills in LISP and MIX.
Usage of *Adobe Illustrator*.

5. Personal Interests

Analysis of algorithms in the sense introduced by Donald E. Knuth. Such interest is mainly due to the study of the volumes *The Art of Computer Programming*.

Discrete mathematics. I have recently studied some covering problems and their solution with the method of generating functions. I also have interest in tree structures in general.

Formulation of "learning laws" through least action like principles.

Digital Typography.

6. Hobbies

Cuisine.

Modernist Cuisine. The recipes that I attempt are mainly taken (or are direct extrapolation of recipes) from the five volumes set *Modernist Cuisine* by Nathan Myhrvold, Chris Young e Maxime Bilet.

Pasticceria. I'm currently learning the basics on the fundamental books *Non solo zucchero. Tecnica e qualità in pasticceria* by the pastry-chef Iginio Massari.

7. Conferences and Workshops

New Frontiers in Theoretical Physics—XXXV Convegno Nazionale di Fisica Teorica and GGI 10th anniversary, 17-20 May 2016 Galileo Galilei Institute, Firenze.

"Learning of visual invariances in convolutional networks," MLDM.it at AI*IA 2017, November 15, 2017, Bari.

"Motion Invariance in Visual Environments," *28th International Joint Conference on Artificial Intelligence (IJCAI)*, Macao August 13, 2019.

"Least Action Principles and Well-Posed Learning Problems," *49th Annual Conference of the Italian Operations Research Society (ODS)*, Genova September 5, 2019.

8. Publications

P1. (with Marco Gori) The Principle of Least Cognitive Action. *Theoretical Computer Science* **633** (2016), 83–99.

P2. (with Stefano Bolognesi, Sven Bjarke Gudnason, Kenichi Konishi and Keisuke Ohashi) Large-N $\mathbf{CP}^{N-1}$ sigma model on a finite interval and the renormalized string energy. *Journal of High Energy Physics* (2018).

P3. (with Marco Gori and Giuseppe Marra) A Constrained-Based Approach to Machine Learning. *14th International Conference on Signal-Image Technology & Internet-Based Systems (SITIS)* (2018).

P4. (with Marco Gori and Stefano Melacci) Cognitive Action Laws: The Case of Visual Features. *IEEE transactions on neural networks and learning systems* **31** (2020), 938–949.

P5. (with Marco Gori and Stefano Melacci) Motion Invariance in Visual Environments. *28th International Joint Conference on Artificial Intelligence (IJCAI)* (2019).

P6. (with Marco Gori) Least Action Principles and Well-Posed Learning Problems. To appear in the AIRO Springer Series volume associated with the ODS 2019 Conference.

P7. (with Marco Gori) Trees in the Real Field. In: Esposito A., Faundez-Zanuy M., Morabito F., Pasero E. (eds) Neural Approaches to Dynamics of Signal Exchanges. Smart Innovation, Systems and Technologies, vol 151. Springer, Singapore.

P8. (with Marco Gori and Stefano Melacci) Learning Visual Features Under Motion Invariance. *Neural Networks* **126** (2020), 275–299.

P9. (with Giuseppe Marra, Matteo Tiezzi, Stefano Melacci, Marco Maggini and Marco Gori) Local Propagation in Constraint-based Neural Networks. *2020 International Joint Conference on Neural Networks (IJCNN)*

P10. (with Marco Gori, Simone Marullo and Stefano Melacci) Developing Constrained Neural Units Over Time. *2020 International Joint Conference on Neural Networks (IJCNN)*

9. Other Publications (unrefereed contributions)

Q1. (with Marco Gori) Convolutional Networks in Visual Environments. `arxiv:cs.CV/1801.07110` (2018).

Q2. (with Giovanni Bellettini and Marco Gori) Generalization in quasi-periodic environments. `arXiv:cs.LG/1807.05343` (2018)

Q3. (with Giuseppe Marra Dario Zanca and Marco Gori) Learning Neuron Non-Linearities with Kernel-Based Deep Neural Networks. `arXiv:cs.LG/1807.06302` (2018).

Q4. (with Marco Gori and Giuseppe Marra) Backpropagation and Biological Plausibility. `arXiv:cs.AI/1808.06934` (2018).

Q5. (with Marco Gori) On the Role of Time in Learning. `arXiv:cs.LG/1907.06198` (2019).

Q6. (with Marco Gori) Spatiotemporal Local Propagation. `arXiv:cs.LG/1907.05106` (2019).

Q7. (with Marco Gori) Backprop Diffusion is Biologically Plausible. `arXiv:cs.LG/1912.04635` (2019).