Michele Allegra's Curriculum Vitae

August 2020

Contents

Personal information

Personal data

Gender: Male. *Citizenship*: Italian. *Date of birth*: Nov. 7th, 1985. *Place of birth*: Moncalieri (Italy).

Contact

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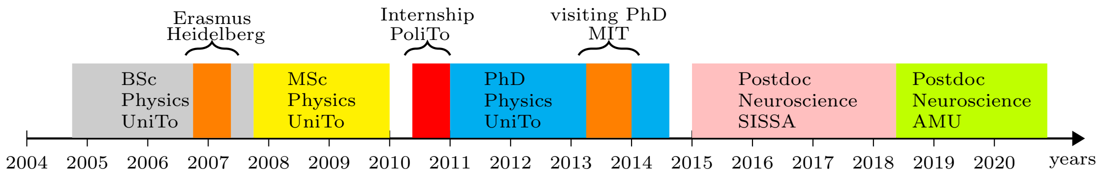
Cursus



Education

Main

09/1999-07/2004	**High school diploma**, Liceo Classico Vincenzo Gioberti, Torino. Final mark: 100/100 with honorable mention.
09/2004-12/2007	**Bachelor Degree in Physics**, University of Torino (Italy). Final mark: 110/110 *summa cum laude*.
09/2007-12/2009	**Master Degree in Physics of Fundamental Interactions**, University of Torino (Italy). Thesis advisors: Dr. Paolo Giorda and Prof. Matteo Paris (tutoring advisors) and Prof. Michele Caselle (official advisor). Thesis title: *Decoherence of non-Gaussian states in noisy channels*. Final mark: 110/110 *summa cum laude*.
01/2011-04/2014	**Ph.D in Physics**, University of Torino (Italy) and ISI Foundation, Torino. Thesis advisors: Dr. Paolo Giorda (tutoring advisor) and Prof. Lorenzo Magnea (official advisor). Thesis title: *Gain and loss of information by decoherence: quantum correlations and decoherent histories in diverse physical systems*

Visiting

09/2006-03/2007	**Visiting student** (Erasmus Program), University of Heidelberg (Germany).
03/2013-12/2013	**Visiting Student**, MIT, Cambridge (USA). Supervisor: Prof. Seth Lloyd.

Research Experience

06/2010-12/2010	**Research Internship** on quantum discord in fermionic systems, Politecnico di Torino (Italy). Supervisor: Prof. Arianna Montorsi.
01/2015-01/2018	**Postdoctoral researcher** on development of clustering analysis for fMRI, International School for Advanced Studies (SISSA), Trieste (Italy). Principal Investigator: Prof. Alessandro Laio.
05/2018-NOW	**Postdoctoral researcher** on analysis of directional interactions in stroke, Institut de Neurosciences de la Timone, CNRS, Marseille (France). Principal Investigator: Dr. Andrea Brovelli.

Academic biography and overview of scientific interests

I am a physicist and data analyst with a passion for neuroscience.

Since childhood I have been fascinated by all kinds of science. Until the last minute before starting university I was undecided between biology and physics. I finally opted for physics, and my university training was entirely within the boundaries of this discipline. I have got a bachelor in physics, a master in physics of fundamental interactions, and a PhD in physics (all from the University of Torino). My research activity began in the realm of theoretical physics, in particular, quantum information science: my doctoral work was centered on information-theoretical measures to characterize the effects of noise on quantum systems and the quantum-classical transition (published articles 1,2,3,9).

As I went through my PhD, I progressively realized that a career in quantum physics was not suited for me. On one side, what excites me most about science are unexplained phenomena. Quantum physics is a mature field, where most phenomena are well understood within an established framework (even though much room is still left for more detailed formalization and for the exploration of possible applications). On the other side, I had completely set aside my original curiosity for living beings. Consequently, I decided to re-orient my career. While I initially thought about combining my interests for quantum physics and biology, for instance by working on quantum effects in biomolecules (published article 9), I soon realized that such a combination would probably not be a good compromise, satisfying neither my wish to shift towards a more developing field, nor my interest in biology. The best option would be instead to try enter an interdisciplinary field where I would use my skills a physicist (e.g., programming, being able to formalize a problem quantitatively, a good knowledge of statistics) to address new questions. Neuroscience was a natural candidate, since it attracts people with diverse backgrounds and competences.

When looking for a Postdoc position in neuroscience, my eventual choice was shaped not only by the skills I already had, but also by the skills I was lacking. As a theoretical physicist, I had no expertise in data analysis, and no acquaintance with real (messy, noisy) data. These were key gaps, and I realized would need to work on a data-intensive project to fill them. I was lucky enough to find a good opportunity. At SISSA, Trieste, Alessandro Laio was leading a group of physicists devoted to devising new data analysis methods, and he was interested in applying a recently developed clustering algorithm to neural data, in particular to fMRI analysis. This was exactly the type of project I was looking for.

Since the start of my first Postdoc, my main research interest has been exploring novel analysis techniques by which one can broaden the scope of what we can learn from fMRI experiments. In particular, the core idea inspiring my research is that there is rich information hidden in the complex (e.g., transient, multivariate, time-shifted) patterns of correlation between the BOLD time series of different areas. This information can be detected with proper unsupervised methods (which can be thought of as advanced ways of doing "functional connectivity"), and harnessed to target new research questions.

In Trieste we developed CDPC (published article 12), an algorithm and pipeline to detect transient multi-voxel clusters of coherent activity in fMRI. Our goal was to link the functional response in a task with specific transient clusters of coherent activity. Such a link would allow investigating variations of the response across different subjects or trials. While CDPC is based on a previously existing clustering algorithm, adapting the latter to fMRI was challenging. We had to explicitly consider many characteristics of the BOLD signal (chiefly, its contamination by many sources of noise) that need not always be considered in full detail when doing standard analyses. A further difficulty was that, contrary to what happens with established methodologies, we did not know in advance under which conditions the method would optimally work; rather, considerable exploration and testing was required to clearly identify the scope of applicability and the limitations of CDPC. For instance, we realized that CDPC is very effective in detecting slow variations of the functional response occurring during learning. In published article 13 we analyzed a task with two alternative strategies, and we could identify several slow changes in the clusters accompanying the optimization of a given strategy and the discovery of a new strategy.

During my Postdoc at SISSA, I gained experience in data analysis, acquired technical expertise with specific analysis methods such as clustering (published articles 12,13,14) and dimensionality reduction (published article 15), and got acquainted with the many subtleties and pitfalls of fMRI analysis. Yet, apart from such skills, the most important acquisition was learning the basics of neuroscience, and in particular human neuroscience. As I slowly got familiar with the literature, I was more and more fascinated by the large-scale organization of cortical activity, and the relation between structure and function in the brain. At the same time, I got the impression that the highest potential of unsupervised analyses of BOLD time series would be fulfilled when looking at intrinsic activity, which provides a window not only into the basic functioning of the brain (physiology), but also into its alterations bu disease (pathology). Accordingly, for my second Postdoc I looked for a laboratory where I could focus more directly on the resting state and its pathological malfunctions.

My current research at the Timone Institute for Neuroscience in Marseille focuses on the analysis of directional interactions between brain areas, as emerging through fMRI and Granger causality analysis, and their anomalies in stroke. In Marseille, I developed a pipeline for the computation of pairwise measures of directed and instantaneous Granger causality from resting-state data. I am currently applying this pipeline to characterize global anomalies in intra- and inter-hemispheric information flows in stroke patients (article 16).

In perspective, my main interest is applying unsupervised learning, statistics and information theory to brain imaging data to to provide new insights into major brain disorders. In particular, I am interested in combining different advanced analysis techniques such as CDPC (published article 12), intrinsic dimension analysis (published article 15), and covariance-based Granger Causality (article 16) to identify connectivity states in fMRI, and characterize their alteration by brain disorders.

Research

Areas of expertise

- fMRI data analysis, method development
- Information theory
- Bayesian statistics
- Network theory, dynamical processes on complex networks
- Unsupervised learning
- Signal processing
- Programming (C, Python)

Research achievements

Quantum physics

- **Robustness of entanglement in quantum optics.** In quantum optics it is important to create entangled states that are robust to noise and decoherence. While continuous-variable quantum optics usually focuses on Gaussian states, in published articles 1,2,3 we considered for the first time a large class of non-Gaussian states, analysing the behavior of their entanglement under Markovian noise and comparing results with the case of entagled Gaussian states. Our evidence suggested that Gaussian entangled states may be generally more robust to noise then non-Gaussian ones. This result gave the spur to a debate with contributions from several Authors in the field.

- **Quantum discord in fermionic systems.** Cross-fertilisation between quantum information theory and condensed matter physics has highlighted strong ties between entanglement and physical properties of many-body ground states, especially at quantum critical points. It is then interesting to look for similar relations involving other types of quantum correlations like quantum discord. In published article 4 we analysed the role of quantum discord in an integrable quantum many-body model (the extended Hubbard model). We discovered a tie between long range correlations (off-diagonal long-range order) and quantum discord in parameter regions where entanglement is vanishing, pinpointing a general relation between discord and macroscopic quantum phenomena like superfluidity and supeconductivity. Moreover, the separation between discord and classical correlations at the critical points allowed us to discriminate between phase transitions that are physically different depending on the appearance/disappearance of off-diagonal long-range order.

- **Quantum discord for non-Gaussian states.** The computation of quantum discord is in general very difficult, since an optimisation over all local measurements is required. In published article 6 we addressed this optimisation problem for an important class of continuous-variable states, that of Gaussian states. We found strong evidence that Gaussian measurements like homodyne detection (as opposed to non-Gaussian ones like photon counting) are optimal.

- **Quantum time-optimal control.** In quantum technology, time-optimal control is crucial for the sake of escaping decoherence effects. Finding time-optimal solutions is a very challenging mathematical problem even for relatively simple cases. In published article 7 we analyzed time-optimal unitary gate generation for the case where the control Hamiltonian is restricted to a subspace of the full algebra. Under a general bound on the total energy of the system, we could elucidate a general asymptotic connection between geodesics of right-invariant metrics on the unitary group and time-optimal curves, paving the way for more efficient numerical solutions to the time-optimality problem. In published article 8 we focused on time-optimal unitary control in two-level systems (qubits) where only a pair of non-orthogonal controls is allowed. We presented analytical results concerning the type and duration time-optimal control sequences. Our results can be applied to the control of several quantum systems including NV-centers in diamond.

- **Coherence in quantum transport.** While interference is a key feature of quantum dynamics, measures allowing to precisely quantify the amount of interference developed by a given dynamics are lacking. In published article 9, we used the decoherent histories framework to define measures the amount of interference in dissipative (Markovian) quantum evolutions. We applied our measures to discuss the role of interference in exciton transport in photosynthetic complexes. Our analysis illustrates how the high efficiency of environmentally assisted transport depends on the capability of thermal noise to selectively kill the negative interference between different exciton pathways, while retaining the initial positive one.

- **Coherence in quantum estimation.** When a parameter is encoded in a family of quantum states, it can be estimated with greater-than-classical precision ("quantum estimation"). In the last years, there has been extensive discussion on what is the quantum property allowing for enhanced estimation precision in the quantum setting. In published article 10 we showed a relation between the statistical distance between infinitesimally close quantum states and the second order variation of the coherence of the optimal measurement basis with respect to the state of the probe, which led us to propose coherence as the relevant resource in quantum estimation protocols.

- **Classical correlations between quantum observables.** Correlations used in quantum communication protocols ultimately reduce to correlations between classical observables. In published article 11 we introduced a general measure of correlations for two-qubit states, based on the classical mutual information between local observables. By focusing on a simple yet paradigmatic example, the remote state preparation protocol, we introduced a method to systematically identify the correlations between observables that are useful for a given protocol.

Other physics

- **Exciton transport on complex networks.** In light-harvesting systems, excitons created by light absorption must converge to reaction centers where they are in turn absorbed, triggering a chemical reaction. Maximising the efficiency of excitonic trapping by reaction centers is essential for artificial light-harvesting devices. In published article 5 we addressed this problem by taking inspiration from biological light-harvesting membranes of purple bacteria and modelling the motion of excitons as dissipative and absorbing random walks over networks with a complex topology. We considered a wide range of possible artificial topologies, including both regular structures such as Cayley trees and random structures. As a result, we showed how network-theoretical centrality measures allow to identify efficient dispositions of the absorbing traps (reaction centers).

- **Clustering of force-extension curves in single-molecule force spectroscopy.** Recent experimental advances allow applying single-molecule force spectroscopy (SMFS) in previously inaccessible conditions, such as native cell membranes. While common SMFS analysis pipelines assume a homogeneous molecular sample, such new experiments pose the challenge of analyzing protein unfolding curves ("traces") coming from preparations with heterogeneous composition (e.g. where different proteins are present in the sample). In published article 14 we developed an automated data analysis pipeline able to identify recurring unfolding patterns in large sets of unfolding curves, most of which are noise (i.e., do not correspond to successful protein unfolding events). Our pipeline combines traditional trace filtering steps, trace quality assessment based on adherence of each curve to the standard WLC model, and density peak clustering to identify recurrent unfolding traces. We applied our pipeline to two challenging data sets: $\sim 50,000$ traces from a sample containing a globular protein (tandem GB1) and $\sim 400,000$ traces from a native rod membrane. In both cases we were able to identify several unfolding clusters, despite a daunting signal-to-noise ratio in the data. A C++ implementation of the method was was made available as free software at https://github.com/ninailieva/SMFS_clustering

Neuroscience

- **Identification of coherent activity clusters ion fMRI.** Task-based fMRI is aimed at characterizing the neural response to a given set of task stimuli. Usually, identifying the response requires averaging across several subjects and several repetitions of the same stimuli. A limitation of such an approach is that it is not suitable to characterize variability of the response across several trials of the task, or across different subjects. Another limitation is that it cannot be used to uncover the neural response to isolated cognitive events, which commonly occur in problem-solving, learning and decision-making. In published article 12, we assumed that a task can evoke short-term multi-voxel clusters of coherent activity, and that identifying such clusters may help overcoming some of these limitations. Exploiting a recently developed, powerful clustering algorithm (density peak clustering), we designed a method to detect clusters of coherent activity by grouping together voxels with similar time-series within a short time window (e.g., 20 s). The method, which we called Coherence Density Peak Clustering (CDPC), was tested on simulated data and compared with a standard unsupervised approach for fMRI analysis, independent component analysis (ICA), proving more reliable in the identification of short-term activity clusters. The reliability of the method was further demonstrated on real fMRI data from a simple motor task, containing brief iterations of the same movement. CDPC can be applied to fMRI task data to: i) identify variations in the response, as characterized by the clusters, across different subjects and different trials/phases of a task; ii) identify a neural response to non-repeatable cognitive events. A Matlab GUI implementation of CDPC was made available as free software at https://github.com/micheleallegra/CDPC.

- **Identification of coherence activity clusters ion fMRI.** When performing a task, humans can improve their performance by either optimizing a known strategy or discovering a novel, potentially more effective strategy. Neural mechanisms underlying strategy optimization and strategy discovery are not fully known. In published article 13, we addressed this issue by applying fMRI in a task with two possible alternative strategies. For analysis we combined multivariate pattern classification and CDPC (published article 12). Multivariate pattern classification allowed identifying areas encoding for relevant stimuli in the task. CDPC allowed revealing variations of the neural response in the course of the task. As subjects progressively improved the initial strategy or discovered a new strategy, we observed changes in the frequency with which neighboring and distant regions form transient clusters of coherent activity. Combining evidence from both methods, we showed that the precuneus and the angular gyrus have a central role in strategy optimization, while medial prefrontal cortex and the rostral portion of the fronto-parietal network are associated with strategy discovery. Overall, our findings shed light on the dynamic interactions between regions related to attention and cognitive control, underlying the balance between strategy exploration and exploitation.

- **Directional interactions in stroke.** Neuroimaging studies have suggested that stroke, beyond causing local structural damage, perturbs the functional organization of the brain at large. However, a complete understanding of how whole-brain dynamics is altered post-stroke is missing. In article 16 we used resting-state fMRI and Granger causality analysis to quantify information transfer between brain areas, and its alteration in stroke. We developed a pipeline to compute covariance-based Granger causality from fMRI time series, which we made publicly available at https://github.com/micheleallegra/CovGC. Applying it to the Washington stroke database, we observed two main large-scale dynamic anomalies in stroke. Overall our results provide key constraints for whole-brain models aimed at further characterizing brain dynamics in stroke and suggest that the lesioned hemisphere should be a privileged target for stimulation therapy.

Data analysis

- **The intrinsic dimension of data and its variability.** Commonly, a small number of variables is sufficient to describe high-dimensional data. The minimum number of variables required is called the intrinsic dimension (ID) of the data. Contrary to common intuition, there are cases where the ID varies within the same data set: different "portions" of the data require a different number of variables to be properly described. In published article 15 we developed a robust approach to discriminate regions with different local IDs and segment the data accordingly. Our approach rests on inversion of a Bayesian model that extends the TWO-NN ID estimator to the case of a variable ID. Our method, termed Hidalgo (heterogeneous intrinsic dimension algorithm) reveals that many real-world data sets contain regions with widely heterogeneous dimensions. These regions host points differing in core properties: folded vs unfolded configurations in a protein molecular dynamics trajectory, active vs non-active regions in brain imaging data, and firms with different financial risk in company balance sheets. Matlab and Python implementations of Hidalgo were made available as free software at https://github.com/micheleallegra/Hidalgo.

Publications

Published articles

1. M. Allegra, P. Giorda, and M.G.A. Paris, *Role of Initial Entanglement and Non-Gaussianity in the Decoherence of Photon-Number Entangled States Evolving in a Noisy Channel*, Phys. Rev. Lett. **105**, 100503 (2010).

2. M. Allegra, M.G.A. Paris, and P. Giorda, *Robustness of Gaussian and non-Gaussian Entanglement in a Noisy Environment*, Int. J. Quant. Inf. **9**, 27 (2010).

3. M. Allegra, M.G.A. Paris, and P. Giorda, *Allegra, Giorda, and Paris Reply*, Phys. Rev. Lett. **107**, 238902 (2011).

4. M. Allegra, P. Giorda, and A. Montorsi, *Quantum discord and classical correlations in the bond-charge Hubbard model: Quantum phase transitions, off-diagonal long-range order, and violation of the monogamy property for discord*, Phys. Rev. B **84**, 245133 (2011).

5. M. Allegra and P. Giorda, *Topology and energy transport in networks of interacting photosynthetic complexes*, Phys. Rev. E **85**, 051917 (2012).

6. P. Giorda, M. Allegra and M.G.A. Paris, *Quantum discord for Gaussian states with non-Gaussian measurements*, Phys. Rev. A **86**, 052328 (2012).

7. X. Wang, M. Allegra, K. Jacobs, S. Lloyd, C. Lupo, M. Mohseni, *Quantum Brachistochrone Curves as Geodesics: Obtaining Accurate Minimum-Time Protocols for the Control of Quantum Systems*, Phys. Rev. Lett. **114**, 170501 (2015).

8. C. D. Aiello, M. Allegra, B. Hemmerling, X. Wang, P. Cappellaro, *Algebraic synthesis of time-optimal unitaries in SU (2) with alternating controls*, Quant. Inf. Proc. **14**, 3233 (2015)

9. M. Allegra, P. Giorda, S. Lloyd, *Global coherence of quantum evolutions based on decoherent histories: theory and application to photosynthetic quantum energy transport*, Phys. Rev. A **93**, 042312 (2016).

10. P. Giorda, M. Allegra, *Coherence in quantum estimation*, J. Phys. A **51(2)**, 025302 (2017).

11. P. Giorda, M. Allegra, *Two-qubit correlations revisited: average mutual information, relevant (and useful) observables and an application to remote state preparation*, J. Phys. A **50(29)**, 295302 (2017).

12. M. Allegra, S. Seyed-Allaei, F. Pizzagalli, F. Baftizadeh, M. Maieron, C. Reverberi, A. Laio, and D. Amati, *fMRI single trial discovery of spatio-temporal brain activity patterns*, Hum. Brain Mapp. **38**, 1421 (2017).

13. M. Allegra, S. Seyed-Allaei, N. W. Shuck, D. Amati, A. Laio, and C. Reverberi, *Brain network dynamics during spontaneous strategy shifts and incremental task optimization*, NeuroImage, 116854 (2020).

14. N. I. Ilieva, N. Galvanetto, M. Allegra, M. Brucale, and A. Laio, *Automatic classification of single-molecule force spectroscopy traces from heterogeneous samples*, Bioinformatics, btaa626 (2020).

15. M. Allegra, E. Facco, F. Denti, A. Laio, and A. Mira, *Data segmentation based on the local intrinsic dimension*, Scientific Reports, accepted, in press (2020).

Articles in preparation

16. M. Allegra, C. Favaretto, N. Metcalf, M. Corbetta, and A. Brovelli, *Post-stroke changes in whole-brain information transfer via Granger causality analysis*, in preparation (2020).

PhD thesis

Michele Allegra, *Gain and loss of information by decoherence*, PhD thesis, Universitá di Torino (2014).

Conference articles

- X. Wang, M. Allegra, K. Jacobs, S. Lloyd, C. Lupo, M. Mohseni, *Time-Optimal Quantum Control via Differential Geometry*, Proceedings Volume 10118, Advances in Photonics of Quantum Computing, Memory, and Communication X (2017)

- M. Allegra, M. d'Errico, E. Facco, A. Laio, A. Rodriguez, *Reconstructing the topography of multidimensional probability landscapes*, 49th Scientific meeting of the Italian Statistical Society (2018)

Presentations

Invited Talks

- 07/1/2013: invited talk at the Aspuru-Guzik group meeting, Chemistry Department, Harvard University, Cambridge, Massachusetts (USA)

- 01/25/2018: invited talk at the Monthly Neuroimaging Meeting, Aix-Marseille Université, Marseille (France)

- 04/17/2018: invited talk at the Institute for Computational Science, Università della Svizzera Italiana, Lugano (Switzerland)

- 06/08/2018: invited talk at the CECAM Workshop on Machine Learning at Interfaces, CECAM-HQ-EPFL, Lausanne (Switzerland)

- 6/22/2018: invited talk at the 49. Meeting of the Italian Statistical Society, Palermo (Italy)

- 04/09/2019: invited talk at TNG group meeting, Institut de Neurosciences des Systémes, Aix-Marseille Université, Marseille (France)
- 05/09/2019: invited talk at the Young Researcher's Workshop on Machine Learning for Materials Science 2019, Helsinki (Finland)
- 11/05/2019: invited talk at the TSN group meeting, Centre Interdisciplinaire de Nanosciences de Marseille, Aix-Marseille Université, Marseille (France)
- 05/20/2020: invited talk at the Physics Department, Università di Padova (Italy)

Other

- 05/25/2010: poster presentation at Quantum 2010, INRIM, Torino (Italy)
- 06/17/2011: talk at Quantum Information 2011, Centro de ciencias Benasque (Spain)
- 05/24/2012: talk at Quantum 2012, INRIM, Torino (Italy)
- 11/7/2012: talk at the Workshop on tensor network states, ISI, Torino (Italy)
- 11/14/2013: poster presentation at the MURI Review Meeting, M.I.T., Cambridge, Massachusetts (USA)
- 06/27/2016: poster presentation at the 22nd Annual Meeting of the Organization for Human Brain Mapping, Geneve (Switzerland)
- 09/29/2017: poster presentation at the International Conference Cognitive Neuroscience of Executive Functions, Padova (Italy)
- 10/17/2018: poster presentation at the 2018 HBP Summit in Maastricht (Netherlands)
- 05/22/2019: poster presentation at Neurofrance 2019, Marseille (France)
- 02/05/2020: poster presentation at the 2020 HBP Summit in Athens (Greece)

Grants and awards

- 05/2006: I was awarded an Erasmus scholarship at the University of Heidelberg (Heidelberg, Germany)
- 06/2010: I was awarded an internship scholarship at the Politecnico di Torino (Torino, Italy)
- 11/2010: I was awarded a PhD scholarship at the Università di Torino (Torino, Italy), ranking 1^{st} among all applicants
- 11/2015: I won the public competition for a PostDoc position at the Molecular and Biophysical Physics Sector at SISSA, Trieste (Italy)
- 03/2018: I won the public competition for a PostDoc position at the Institut de Neurosciences de la Timone, Aix-Marseille Université, Marseille (France)

Reviewer activity

I am reviewer for Physical Review A, Physical Review Letters, Journal of Physics A, Scientific Reports.

Public code

- Matlab implementation of Coherence Density Peak Clustering (published article 12): https://github.com/micheleallegra/CDPC.
- Matlab and Python implementations of Heterogeneous Intrinsic Dimension Algorithm (published article 15): https://github.com/micheleallegra/Hidalgo.
- Python implementation of covariance-based Granger causality (article 16): https://github.com/micheleallegra/CovGC.
- C++ implementation of clustering for force-extension curves in single-molecule force spectroscopy (published article 14): https://github.com/ninailieva/SMFS_clustering

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Skills

Language skills

Italian (mother tongue), English (fluent, FCE 2002), German (fluent, KDS 2008), French (fluent), Spanish (basic).

Computational skills

Programming languages: Python, Matlab, R, C/C++, Mathematica, Bash, Fortran.

Referees

- Alessandro Laio, SISSA, Trieste, Italy (laio@sissa.it)
- Daniele Amati, SISSA, Trieste, Italy (amati@sissa.it)
- Andrea Brovelli, CNRS, Marseille, france (andrea.brovelli@univ-amu.fr)
- Seth Lloyd, MIT, Cambridge, USA (slloyd@mit.edu)
- Carlo Reverberi, Università di Milano Bicocca, Milan, Italy (carloreve@gmail.com)
- Antonietta Mira, USI, Lugano, Switzerland (antonietta.mira@usi.ch)
- Arianna Montorsi, Politecnico di Torino, Turin, Italy (arianna.montorsi@polito.it)
- Ciro Cattuto, ISI, Torino, Italy (ciro.cattuto@isi.it)
- Paola Cappellaro, MIT, Cambridge, USA (pcappell@mit.edu)
- Matteo Paris, Università di Milano, Milan, Italy (matteo.paris@fisica.unimi.it)
- Paolo Giorda, CNISM, Italy (magpaolo16@gmail.com)