

Matteo Neri

PhD student

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Github: <https://github.com/Mattehub/>

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Summary

I am a mathematician (BCs) and complex systems physicist (Ms) pursuing a PhD at the hyperedge between complex systems physics, computational neuroscience, and AI. I am interested in understanding the emergence of consciousness and intelligence in complex systems. I develop open-source tools for information- and graph-theoretic analysis of neural systems and have co-authored 13 papers, including publications in *Nature Communications*, *Physical Review Letters*, and the *European Journal of Neuroscience*.

Education

- PhD student (visiting), **Imperial College London**, London, UK
Aug 2025 - Present; Nov 2024 - Dec 2024

Machine Intelligence and Neural Dynamics (MIND) lab
Supervisor: Prof. Pedro Mediano
- PhD student, **Institut de Neurosciences de la Timone**, Marseille, France,
Oct 2023 - Present

BRAINETS lab,
Supervisor: Prof. Andrea Brovelli
- MSc. in **Physics of Complex Systems Physics (with honors)**, University of Turin,
Jan 2021 - Apr 2023
- BSc. in **Mathematics**, University of Bologna (UNIBO), Italy,
Nov 2017 - Oct 2020
- **Erasmus Programs**, Aix-Marseille University (AMU), France, *Sep 2021 - July 2022*;
Universitat de Barcelona (UB), Spain, *Sep 2019 - July 2020*.

Research Experience

- Research Assistant, **Institut de Neurosciences de la Timone**, Marseille, France
Apr 2023 - Nov 2023

- Intern Student, **Institut de Neurosciences de la Timone**, Marseille, France
Nov 2022 - Apr 2023
- Intern Student, **CENTAI**, Turin, Italy
Oct 2022 - Apr 2023
- Intern Student, **Institut de Neurosciences des Systèmes**, Marseille, France
Mar 2022 - Sep 2022

Teaching and Scientific Communication

- Teaching Assistant, **Aix-Marseille University**, Marseille (France),
Sep 2023 - Jun 2024
 - L3S5 - HPS5U07 - Méthodes et statistiques (36h)
 - L3S5 - HPS5U07 - Initiation à la psychologie Mathématique (30h)
- **Math Tutor**, Associazione diamo i numeri (~120 hours in total), Bergamo (Italy), 2021 - Present
- **The AI for the people podcast-online**,
Sep 2021 - Sep 2022
I participated in the organization of a podcast. The main topics discussed relate to **AI safety** and the value of AI for the future of humanity.

Grants and Awards

- *Interdisciplinary College IK* (2023), Scholarship, ~ **€200**
- *BIFONDS travel grant* (2025), Funding for three months exchange, ~ **€3000**
- *Neuroschool PhD funding* (2023), PhD scholarship, ~ **€100K**
- *Interdisciplinary College IK* (2023), Full stipend recipient, ~ **€400**
- *Poster award at NeuroDays* (2023), prize of **€150**

List of peer-reviewed publications

ORCID: 0009-0007-0998-552X

Matteo Neri, Dishie Vinchhi, Christian Ferreyra, Thomas Robiglio, Onur Ates, Marlís Ontivero-Ortega, Andrea Brovelli, Daniele Marinazzo, and Etienne Combrisson (2024) *HOI: A Python toolbox for high-performance estimation of Higher-Order Interactions from multivariate data*. **Journal of Open Source Software (JOSS)**

Article DOI: <https://doi.org/10.21105/joss.07360> Github: [brainets/hoi: Higher-Order Interactions](https://github.com/brainets/hoi)

Carlos Coronel-Oliveros*, Marilyn Gatica*, Rubén Herzog*, **Matteo Neri*** (2025) *An integrated computational framework for diversity-sensitive personalized medicine* **IBRO Neuroscience**

Preprint DOI: <https://doi.org/10.1016/j.neuroscience.2025.08.019>

Matteo Neri, Andrea Brovelli, Samy Castro, Fausto Fraioli, Marilyn Gatica, Ruben Herzog, Pedro A.M. Mediano, Ivan Mindlin, Giovanni Petri, Daniel Bor, Fernando E. Rosas, Antonella Tramacere, and Mar Estarellas (2024) *A taxonomy of neuroscientific strategies based on interaction orders*. **European Journal of Neuroscience**

Article DOI: <https://doi.org/10.1111/ejn.16676>

Maxime Lucas, A Townsend-Teague, **Matteo Neri**, Simone Poetto, A Morris, B Habermann (2023) *Phasik: a Python package to identify system states in partially temporal networks*. **Journal of Open Source Software**

Article DOI: <https://doi.org/10.21105/joss.05872> Gitlab: [habermann_lab / phasik · GitLab](https://gitlab.com/habermann_lab/phasik)

Thomas Robiglio, **Matteo Neri**, Davide Coppes, Cosimo Agostinelli, Federico Battiston, Maxime Lucas, Giovanni Petri (2024) *Synergistic signatures of group mechanisms in higher-order systems* **Physical Review Letters**

Article DOI: <https://doi.org/10.1103/PhysRevLett.134.137401>

Etienne Combrisson, Ruggero Basanisi, **Matteo Neri**, Guillaume Auzias, Giovanni Petri, Daniele Marinazzo, Stefano Panzeri, Andrea Brovelli (2024) *Higher-order and distributed synergistic functional interactions encode information gain in goal-directed learning*. **Nature Communications**

Preprint DOI: <https://doi.org/10.1101/2024.09.23.614484>

Claudio Runfola, **Matteo Neri**, Daniele Schön, Benjamin Morillon, Agnès Trébuchon, Giovanni Rabuffo, Pierpaolo Sorrentino, Viktor Jirsa (2024) *Complexity in speech and music listening via neural manifold flows* **Network Neuroscience**

Article DOI: https://doi.org/10.1162/netn_a_00422

Hasnae Agouram, **Matteo Neri**, Marianna Angiolelli, Damien Depannemaecker, Jyotika Bahuguna, Antoine Schwey, Jean Régis, Romain Carron, Alexandre Eusebio, Nicole Malfait, Emmanuel Daucé, and Pierpaolo Sorrentino (2024) *L-Dopa induced changes in aperiodic bursts dynamics relate to individual clinical improvement in Parkinson's disease* **npj Parkinson's Disease**

Preprint DOI: <https://doi.org/10.1101/2024.06.14.24308683>

Review & Resubmit (R&R) major or minor revision in process

Matteo Neri, Marianna Angiolelli, Elsa Bourges, Camille Mazzara, Emahnuel Troisi Lopez, Matteo Demuru, Mario De Luca, Enrica Gallo, Mario Quarantelli, Andrea Brovelli, Pierpaolo Sorrentino (2025) *The role of structural connectivity in shaping whole brain dynamics across scales*

Preprint DOI: <https://doi.org/10.64898/2025.12.29.696703>

Andrea Santoro*, **Matteo Neri***, Simone Poetto, Davide Orsenigo, Matteo Diano, Marilyn Gatica, Giovanni Petri (2025) *Beyond Pairwise Interactions: Charting Higher-Order Models of Brain Function* **Nature Communications** (minor revision)

Preprint DOI: <https://doi.org/10.1101/2025.06.24.661306>

Matteo Neri, Claudio Runfola, Noemie AG te Rietmolen, Pierpaolo Sorrentino, Daniele Schon, Benjamin Morillon, Giovanni Rabuffo (2023) *Neuronal Avalanches in Naturalistic Speech and Music Listening* **R&R Imaging Neuroscience**

Preprint DOI: <https://doi.org/10.1101/2023.12.15.571888>

Yuri Gardinazzi*, Roger González March*, Suprabhath Kalahasti*, Andrea Montaña Ramirez*, **Matteo Neri***, Cicely Nguyen*, Giovanni Palermo*, Erik Weis*, Katharina Ledebur, Elma Dervić (2025) *Characterization of diseases in temporal comorbidity networks*

Preprint DOI: <https://arxiv.org/html/2506.22136v1>

Camille Mazzara, Giuditta Gambino, Gian Marco Duma, **Matteo Neri**, Giuseppe Giglia, Tommaso Piccoli, Fabrizio Guajana, Albert Comelli, Antonino Tuttolomondo, Michele Migliore, Pierpaolo Sorrentino (2025) *Brain Fluidity as a Functional Marker of Tau-Related Neurodegeneration in Alzheimer's Disease*

Preprint DOI: <https://doi.org/10.1101/2025.07.04.25330744>

*co-first authors

Talks and presentations

- **Tutorial for Beyond the Edge Workshop**
Marseille, France (October 2025)

I presented a tutorial (30min) about our toolbox HOI (<https://brainets.github.io/hoi/>).

- **Conference on Complex Systems**
Siena, Italy (September 2025)

My contribution: **Regular talk and satellite talk**

- **Complexity72h**
Madrid, Spain (June 2025)

I presented a tutorial (30min) about our recently published Python toolbox (<https://brainets.github.io/hoi/>).

- **HOI-BrainMod**
Institute for Advanced Studies (IAS), Amsterdam, Netherlands (May 2025)

Workshop on Brain Modeling and Higher-Order Interactions
(<https://ias.uva.nl/content/events/2025/05/hoi-brainmod-workshop-on-brain-modeling-and-high-order-interactions.html>)

My contribution: *Organizer, talk, and a tutorial.*

- **Interdisciplinary College (IK) 2024**

My contribution: *Talk and tutorial* (~1.5 hours)

- **International School and Conference on Network Science (NetSciX 2024)**

My contribution: *Regular talk*

- **International School and Conference on Network Science (NetSci 2023)**

My contribution: *Regular talk.*

Poster Presentations

- **Statistical Physics of Cognition**

Institute of Physics, London (November 2024)

My contribution: poster presentation.

- **BrainModes 2024**

Bilbao, Spain (November 2024)

My contribution: poster presentation.

- **Association for the Scientific Study of Consciousness (ASSC27, 2024)**

Tokyo, Japan (2024)

My contribution: a poster, presented on-site by co-authors.

- **Organization for Human Brain Mapping (OHBM 2024)**

Seoul, South Korea (2024)

My contribution: a poster that was presented on-site by co-authors. [Abstract link](#)

- **Computational and Systems Neuroscience (Cosyne 2024)**

Lisbon, Portugal (February 2024)

My contribution: Poster presentation

- **NeuroDays 2023**

Marseille, France (November 2023)

My contribution: poster presentation, awarded **2nd best poster**.

- **Interdisciplinary College (IK) 2023**

Marseille, France (November 2023)

My contribution: Poster presentation

Extracurricular

- **CAM**, Alba (CN), Italy - Sep 2015 - Jun 2017.

I conducted didactic activities as a **volunteer**.

- **Bassist and rapper**, 2012 - present

I started to play classical guitar in 2008. A few years later, I created with some friends a jazz band, in which I play the **bass** and **sing**. Recently, I also started writing and publishing **rap** songs, following the vibes of indie and jazz.