

CONTACT

Maria Grazia Puxeddu, Ph.D,
Department of Computer, Control and Management Engineering, Sapienza University of Rome

RESEARCH INTERESTS

My research focuses on advancing our understanding of the brain by applying cutting-edge network science to the study of anatomical and functional brain connectivity. I develop network models to uncover organizational principles that govern brain function, and their relation to behavior, cognition, and disease. My work integrates tools from graph theory and information theory in the analysis of neuroimaging data—including MRI, fMRI, EEG and sEEG—to push the boundaries of how we map and interpret brain's anatomy and dynamics.

EDUCATION AND TRAINING

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| 03/2024 – present | Postdoctoral researcher at Sapienza University of Rome
Postdoctoral advisor: Dr. Laura Astolfi |
| 03/2024 – present | Affiliated non-paid researcher at Indiana University Bloomington |
| 03/2022 – 02/2024 | Postdoctoral researcher at Indiana University Bloomington
Postdoctoral advisor: Dr. Olaf Sporns |
| 03/2020 – 02/2022 | Postdoctoral researcher at Sapienza University of Rome
Postdoctoral advisor: Dr. Laura Astolfi |
| 10/2016 – 02/2020 | PhD student in Bioengineering at Sapienza University of Rome, Department of Computer, Control and Management Engineering
Dissertation: The structural and functional multilayer modular organization of the human brain
PhD advisor: Dr. Laura Astolfi
PhD co-advisor: Dr. Manuela Petti |
| 10/2016 – 02/2020 | Visiting student at laboratory of Neuroelectrical Imaging and BCI at IRCSS Fondazione Santa Lucia, Rome
Host: Dr., MD, Donatella Mattia |
| 04/2018 – 10/2018 | Visitor scholar at Indiana University, Bloomington, Indiana (USA), in the Department of Psychological and Brain Sciences
Host: Dr. Olaf Sporns |
| 2013 – 2016 | Master degree in Biomedical Engineering at Sapienza University of Rome
grade: 110/110 cum laude |

Thesis: Clustering algorithms for the study of stationary and time-varying networks: simulation study and application to brain connectivity

2009 – 2013

Bachelor degree in Clinical Engineering at Sapienza University of Rome
Thesis: Studio dosimetrico per il posizionamento del microelettrodo intraoperatorio nella stimolazione cerebrale profonda

AWARDS

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| 09/2017 | Best Thesis Award “Vincenzo Tagliasco” received from the Italian National Bioengineering Group in the occasion of the “XXXVIII Scuola Nazionale del Gruppo di Bioingegneria”, Bressanone, Italy, 18 – 22 Sept 2017. |
| 05/2017 | Prize “Excellent graduate” for the academic year 2015/16, received from Fondazione Roma Sapienza and promoted by NoiSapienza Associazione Alumni, in the occasion of the V edition of “Giornata del Laureato”, Rome, Italy, 15 May 2017. |

FUNDED GRANTS

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| 2024 | Grant for the project Avvio alla Ricerca (AR224190749B7D92) “ <i>Multi-dimensional networks as a new tool to analyze and interpret multi-subject data in hyperscanning settings</i> ”, (Principal Investigator) received from Sapienza University of Rome. |
| 2018 | Grant for the project Avvio alla Ricerca (AR1181643680C682) “ <i>A multilayer network based analysis to infer dependencies among frequencies in EEG signals</i> ” (Principal Investigator), received from Sapienza University of Rome. |
| 2017 | Grant for the mobility project “ <i>MoRe-Net, Motor Recovery supported by hybrid Brain-Computer Interface and complex network theory</i> ” (Principal Investigator), received from Sapienza University of Rome. |
| 2017 | Grant for the project Avvio alla Ricerca, (AR11715C821E23FC) “ <i>Multilayer approaches for the detection of stable and dynamic communities in EEG-based brain networks</i> ” (principal investigator), received from Sapienza University of Rome. |

PARTICIPATION IN OTHER FUNDED RESEARCH PROJECTS

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|-------------|---|
| 2024 | Participant in the project PRIN 2020, prot. 20207S3NB8, Italian Ministry for Universities and Research, 2022-2025, “ACT2: Acting together: how motor styles shape action prediction and brain-to-brain connectivity in typical and autistic populations” (Principal investigators: Andrea Cavallo; Associated Investigators: Laura Astolfi, Angela Ciaramidaro) |
| 2022 – 2024 | NIH/NIMH grant R01-MH122957 “The evolution of the mammalian connectome” (Principal Investigator: Olaf Sporns). |
| 2021-2022 | Participant in the project “Network-based data integration for precision medicine in neuroscience applications” (Principal Investigator: Manuela Petti) |
| 2020 | Participant in the project “B2B: Brain-to-Brain Connectivity for the Real-time Monitoring of Social Interactions”, funded by Bitbrain. |

2018	Participant in the project “Sviluppo di algoritmi per l’analisi di potenziali evento-correlati in presenza di jitter” (Principal Investigator: Laura Astolfi), funded by Sapienza University of Rome – Progetto di Ateneo 2018.
2017	Participant in the project “EMBRACING: Estimating Multiple-Brain connectivity in Autism during Cooperative Interaction: anew tool for real-time hyperscanninG” (Principal Investigator: Laura Astolfi), funded by Sapienza University of Rome – Progetto di Ateneo 2017.
2016	Participant in the project “MIME-BCI: Mindfulness Meditation training supported by Brain-Computer Interfaces” (Principal Investigator: Febo Cincotti), funded by Sapienza University of Rome – Progetti di Ateneo 2016.

TEACHING EXPERIENCE

fall 2024	Co-instructor for “Industrial Neuroscience” (Master in Biomedical Engineering)
fall 2023	Guest lecture at Indiana University Bloomington, Department of Psychological and Brain Sciences (topic: Modularity in brain networks).
2016 – 2021	Seminars and tutorials for “Industrial Neuroscience” (Master in Biomedical Engineering).
fall 2018	Guest lecture in the course “Modeling and simulation of biomolecular dynamical systems” (Master in Bioinformatics).
2017 – 2018	Seminars and tutorials in the course of “Models of biological systems” (Master in Biomedical Engineering).
2016 – 2018	Seminars and tutorials in the course “Advanced methods for the analysis of biomedical signals” (Master in Biomedical Engineering).

STUDENT SUPERVISION

2025	Vanessa Palmieri, Master thesis in Biomedical Engineering at Sapienza University of Rome – Caratterizzazione dell’evoluzione normotipica delle reti cerebrali dall’infanzia all’adolescenza in soggetti
2024	Greta Rinaldini, Master thesis in Biomedical Engineering at Sapienza University of Rome – Multidimensional networks for the identification of leader/follower dynamics in two-persons neuroscience
2019	Chiara Parrillo, Master thesis in Biomedical Engineering at Sapienza University of Rome – Sviluppo e validazione di algoritmi basati su grafi multilayer per lo studio in frequenza della connettività cerebrale.
2019	Alessia Tota, Master thesis in Biomedical Engineering at Sapienza University of Rome – Impiego di metodi avanzati di teoria di grafi per lo studio dell’evoluzione dei pattern di connettività cerebrale a seguito di un intervento riabilitativo.
2016	Valentina D’Urso, Master thesis in Biomedical Engineering at Sapienza University of Rome – Analisi di algoritmi di clustering multilayer per lo studio di reti dinamiche cerebrali.

PUBLICATIONS

H-index: 9 ([scholar](#))

Journal papers:

1. M.G. Puxeddu, M. Pope, T.F. Varley, J. Faskowitz, O. Sporns, “Leveraging multivariate information for community detection in functional brain networks”, *Nature Communication Biology*, 2025. (Impact Factor 5.2) [link](#)
2. M. Pope, T.F. Varley, M.G. Puxeddu, J. Faskowitz, O. Sporns, “Time-varying synergy/redundancy dominance in the human cerebral cortex”, *Journal of Physics: Complexity*, 2025. [link](#)
3. R.F. Betzel, M.G. Puxeddu, C. Seguin, “Hierarchical communities in the larval *Drosophila* connectome: Links to cellular annotations and network topology”, *Proceedings of the National Academy of Science (PNAS)*, 2024, (Impact Factor: 9.4). [link](#)
4. M.G. Puxeddu, J. Faskowitz, C. Seguin, Y. Yovel, Y. Assaf, R.F. Betzel, O. Sporns, “Relation of connectome topology to brain volume across 103 mammalian species”, *PLOS Biology*, 2024, (Impact Factor: 9.8). [link](#)
5. T.F. Varley, M. Pope, M.G. Puxeddu, J. Faskowitz, O. Sporns, “Partial entropy decomposition reveals higher-order information structures in human brain activity”, *Proceedings of the National Academy of Science (PNAS)*, 2023, (Impact Factor: 11.1). [link](#)
6. J. Faskowitz, M.G. Puxeddu, M. Van Den Heuvel, B. Misic, Y. Yovel, Y. Assaf, R. Betzel, O. Sporns, “Connectome topology of mammalian brains and its relationship to taxonomy and phylogeny”, *Frontiers in Neuroscience*, 2023 (Impact Factor: 5.12). [link](#)
7. M.G. Puxeddu, J. Faskowitz, O. Sporns, L. Astolfi, R. Betzel, “Multi-modal and multi-subject modular organization of human brain networks”, *NeuroImage*, 2022 (Impact Factor: 7.4). [link](#)
8. M.Z. Esfahlani*, Y. Jo*, M.G. Puxeddu*, H. Merritt, J.C. Tanner, S. Greenwell, R. Patel, J. Faskowitz, R.F. Betzel, “Modularity maximization as a flexible and generic framework for brain network exploratory analysis”, *NeuroImage*, 2021 (Impact Factor: 6.556). [link](#)
9. M.G. Puxeddu, M. Petti, L. Astolfi, “A comprehensive analysis of multilayer community detection algorithms for the application to EEG-based brain networks”, *Frontiers in System Neuroscience*, 2021 (Impact Factor: 3.293). [link](#)
10. M.G. Puxeddu, J. Faskowitz, R. Betzel, M. Petti, L. Astolfi, O. Sporns, “The modular organization of brain cortical connectivity across the human lifespan”, *NeuroImage*, 2020 (Impact Factor: 5.902). [link](#)
11. A. Paffi, F. Apollonio, M.G. Puxeddu, M. Parazzini, G. D’Inzeo, P. Ravazzani and M. Liberti: “A numerical study to compare stimulations by intraoperative microelectrodes and chronic macroelectrodes in the DBS technique”, *BioMed Research International*, Aug. 2013. (Impact Factor: 2.276). [link](#)

Encyclopedia chapters:

12. M.G. Puxeddu, C. Seguin, O. Sporns, “Functional specialization, modularity and communication: Network models linking brain structure and function”, *Reference Module in Neuroscience and Biobehavioral Psychology*, 2024. [link](#)

Preprints:

13. C. Seguin, M.G. Puxeddu, J. Faskowitz, R. Betzel, O. Sporns, “Connectome architecture favours within-module diffusion and between-module routing”, *bioRxiv*, 2025 (under review at PNAS). [link](#)
14. C. Seguin, S. Mansour, R.F. Betzel, E. Chumin, M.G. Puxeddu, J. Lv, L. Parkes, L. Cocchi, P.B. Fitzgerald, R.F. Cash, A. Zalesky, “Neuroanatomical pathways of TMS therapy for depression”, *medRxiv*, 2025 (under review at *Nature Neuroscience*). [link](#)
15. R.F. Betzel, M.G. Puxeddu, C. Seguin, B. Misic, “Parallel and converging multisensory cascades in the *Drosophila* connectome”, *bioRxiv*, 2024 (under review at PNAS). [link](#)

16. R.F. Betzel, M.G. Puxeddu, C. Seguin, V. Bazinet, A. Luppi, A. Podschun, S.P. Singleton, J. Faskowitz, V. Parakkattu, B. Misic, S. Markett, A. Kuceyeski, L. Parkes, “Controlling the human connectome with spatially diffuse input signals”, bioRxiv, 2024 (provisionally accepted by Nature Communication Biology). [link](#)

Papers in International Conferences indexed in ISI Web of Science:

17. G. Rinaldini, M.G. Puxeddu, A. Ciaramidaro, P. Vogel, C.M. Freitag, M. Siniatchkin, J. Toppi, L. Astolfi “Quantification of the spontaneous emergence of leader-follower dynamics in EEG hyperscanning data”, 2025 47th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Copenhagen, Denmark, July 14-17, 2025.
18. M.G. Puxeddu, G. Rinaldini, L. Astolfi, “Multi-dimensional networks as a tool to model, analyze, and interpret multi-subject brain connectivity in hyperscanning settings”, 2024 IEEE International Conference on Bioinformatics and Biomedicine (BIBM). [link](#)
19. M.G. Puxeddu, M. Petti, L. Astolfi, “Multi-layer analysis of multi-frequency brain networks as a new tool to study EEG topological organization”, in 43rd Annual International Conference of the IEEE EMBS, Nov 1-5, 2021. [link](#)
20. M.G. Puxeddu, M. Petti, D. Mattia, L. Astolfi, “The optimal setting for multilayer modularity optimization in multilayer brain networks”, in 41st Annual International Conference of the IEEE EMBS, Berlin, Germany, July 23-27, 2019. [link](#)
21. M.G. Puxeddu, M. Petti, F. Pichiorri, F. Cincotti, D. Mattia, L. Astolfi: “Community detection: comparison between clustering algorithms and application to EEG-based brain networks”, in 39th Annual International Conference of the IEEE EMBS, Jeju Island, Korea, Jul 11-15, 2017. (Selected for oral presentation). [link](#)
22. A. Paffi, F. Apollonio, M.G. Puxeddu, M. Parazzini, G. D’Inzeo, P. Ravazzani, F. Camera, M. Liberti: “A dosimetric study comparing intra-operatory microelectrode and chronic macroelectrode in the DBS technique”, in 6th International IEEE EMBS Conference on Neural Engineering, San Diego, CA, Nov 6-8, 2013, pp. 1206 – 1209. [link](#)

In preparation

23. M.G. Puxeddu*, S. Boesso*, J. Faskowitz, L. Astolfi, M. Petti, “Attentional network based age classification and its relation to the human connectome topology”

INVITED AND SELECTED TALKS

1. “Redundancy-dominated modular structure of the human brain and its relationship with aging”, at Network Neuroscience 2025 (NetSci 2025 satellite). June 2nd, 2025, Maastricht, Netherlands.
2. “Multi-dimensional networks as a tool to model, analyze, and interpret multi-subject brain connectivity in hyperscanning settings”, at IEEE International Conference on Bioinformatics and Biomedicine (workshop on Network Science and Artificial Intelligence for Biomedicine & Health Informatics), December 3rd, 2024, Lisbon, Portugal.
3. “Modular Brain Networks”, at 2022 Course on Advances in Bioengineering for PhD students in Automatic, Bioengineering and Operational Research. October 3rd, 2022 (virtual).
4. “Multi-layer models for brain networks”, for IUNI Lunch Colloquium: Network Neuroscience. September 23rd, 2022, @ IUNI (Indiana University Network Science Institute).
5. “Multi-modal and multi-subject modular organization of human #brain networks” at the Brain and More Lab (PI Alessandro Crimi) for the series Sano Neurospritz. June 17, 2022 (virtual).
6. “Multilayer analysis for community detection in evolving brain networks”, Mediterranean School of Complex Networks, Salina, Italy, Sep 4 – 8, 2017.

POSTERS AND CONFERENCE PROCEEDING

1. M.G. Puxeddu, T. Varley, M. Pope, O. Sporns, “A characterization of brain modular structure based on higher-order functional interactions”, in Neuroscience 2023, Society for Neuroscience, Washington, DC, USA, November 2023.
2. C. Seguin, M.G. Puxeddu, R. Betzel, O. Sporns, “Connectome architecture favours communication via within-module diffusion and between-module routing”, in Neuroscience 2023, Society for Neuroscience, Washington, DC, USA, November 2023.
3. M.G. Puxeddu, J. Faskowitz, C. Seguin, Y. Yovel, Y. Assaf, R. Betzel, O. Sporns “Relation of connectome topology and brain volume across mammalian brains”, in OHBM 2023, Montreal, Canada, July 2023.
4. M.G. Puxeddu, J. Faskowitz, Y. Yovel, Y. Assaf, O. Sporns, “Scaling laws in connectome topology across mammalian brains”, in Neuroscience 2022, Society for Neuroscience, San Diego, CA, USA, November 2022.
5. M.G. Puxeddu, J. Toppi, D. Mattia, L. Astolfi, “Reduction of latency jitter in ERP through visibility graphs and community detection”, in 41st Annual International Conference of the IEEE EMBS, Berlin, Germany, July 23-27, 2019.
6. M.G. Puxeddu, J. Faskowitz, M. Petti, L. Astolfi, O. Sporns, “Modular structure of anatomical brain networks across the human lifespan”, Organization for Human Brain Mapping, Rome, June 9-13, 2019
7. M.G. Puxeddu, M. Petti, F. Pichiorri, F. Cincotti, D. Mattia, L. Astolfi, “Analysis of multilayer clustering algorithms for the application to brain functional connectivity”, VI Congresso Nazionale del GNB, Milano, June 25-27, 2018.
8. M.G. Puxeddu, M. Petti, L. Astolfi, “Multilayer analysis for community detection in evolving brain networks”, Mediterranean School of Complex Networks, Salina, Italy, Sep 4 – 8, 2017. (Selected for oral presentation).
9. A. Paffi, M.G. Puxeddu, F. Apollonio, M. Parazzini, G. D’Inzeo, P. Ravazzani, M. Liberti: “A numerical dosimetric study to clarify different stimulations by intra-operative microelectrodes and chronic macroelectrodes in the DBS technique”, BioEM2013, Thessaloniki, Greece, Jun 10-14, 2013.

AD HOC REVIEWER

Nature Communication; Nature Communication Biology; Network Neuroscience; Journal of Physics: Complexity; Biomedical Signal Processing and Control, Elsevier; Computer Methods and Programs in Biomedicine, Elsevier; Frontiers; NeuroImage; Brain Topography; Scientific Reports; Human Brain Mapping; Brain Connectivity; Aperture Neuro

Reviewer for contributions to the Annual International Conferences: OHBM, IEEE EMBS, IEEE BIBM

PERSONAL SKILLS AND COMPETENCES

Languages	<ul style="list-style-type: none">• ENGLISH (near-native)• ITALIAN (first language)• FRENCH (scholar level)• SPANISH (scholar level)
Computer skills	<ul style="list-style-type: none">• MATLAB• PYTHON• MICROSOFT OFFICE SUITE

Technical skills	Competent with EEG acquisition devices such as BrainAmp, gTech. Good knowledge of software for the analysis of brain signals, such as EEGLAB and BRAINVISION ANALYZER.
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I hereby authorize you to use my personal details contained in this document (D. lgs. n.196/2003).

Rome, 25/08/2025