Filipi Nascimento Silva

Research Assistant Professor | Network Science, AI, Science of Science & Visual Computing

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Professional Summary

Researcher, data scientist, and developer with expertise in dynamic complex networks, machine learning, science of science, computational social science, and applied network science. Creator of Helios Web, a browser-based network visualization system for graphs with more than one million nodes. Author of 60+ publications, with 2,600+ citations and an h-index of 23 on Google Scholar. Ph.D. in Computational Physics with a strong interdisciplinary focus bridging physics, computer science, biology, and the social sciences.

Scholarly Metrics

60+ publications | **2,600+ citations** | **h-index 23** | Google Scholar

Research Leadership and Current Directions

- Research on how science-of-science methods can work with structured extraction pipelines, network analysis, embedding-based search, and domain knowledge to identify promising scientific and engineering opportunities. Early-stage technical directions are intentionally summarized at a high level.
- Integrated maps of science funding, research publications, technological capabilities, and institutional participation.
- Reliable measurement of scientific novelty, research trajectories, collaboration, and the movement of ideas across fields.
- Scalable, interpretable network and embedding visualization using browser-native GPU computing and WebAssembly.
- Computational social systems, information integrity, coordination, and behavior across emerging platforms.

Academic Appointments

Research Assistant Professor | Center for Science of Science & Innovation, Kellogg School of Management, Northwestern University | 2025-Present

- Develop science-of-science and AI methods that connect scholarly evidence, technical structures, and expert reasoning to support scientific and engineering discovery.
- Build integrated data systems linking research funding, publications, institutions, people, topics, and downstream technological capabilities.
- Lead research-software and visualization development for complex networks, embeddings, and large heterogeneous knowledge systems.
- Contribute to interdisciplinary research strategy, proposal development, and evaluation across academic and applied projects.

Associate Research Scientist (Faculty) | Observatory on Social Media, Indiana University Bloomington | 2023-2025

- Developed methods for tracking entities through scholarly networks and embedding spaces using Web of Science and OpenAlex data.
- Led Helios Web development for interactive visualization of large networks and embedding spaces in modern browsers.
- Applied network science and transformer models to social media, narratives, literature, song lyrics, historical events, biological data, and scientific documents.
- Developed methods for coordination detection, behavioral analysis, community robustness, LLM-assisted network interaction, and community summarization.
- Designed browser-based and scientific-workflow tools for single-cell gene-expression and neuroscience network analysis.

Assistant Research Scientist (Faculty) | Indiana University Network Science Institute | 2019-2023

- Modeled knowledge acquisition through random walks and studied the robustness of community structure in static and dynamic networks.
- Represented scientific activity using citation, coauthorship, and semantic embedding systems.
- Developed and validated network approaches for detecting climate teleconnections.
- Contributed to open research infrastructure, large-scale funded projects, mentoring, and interdisciplinary proposal development.

Postdoctoral Fellow | São Carlos Institute of Physics, University of São Paulo | 2015-2019

- Developed methods for measuring dimension, symmetry, similarity, and organization in complex networks.
- Applied network science to scholarly communication, natural language, urban systems, biology, and science-of-science problems.
- Served as a visiting research scholar at Indiana University Bloomington during 2017-2018.

Education

Ph.D. in Physics, Computational Physics | University of São Paulo, São Carlos Institute of Physics | 2011-2015

University of São Paulo: #1 in Latin America, Times Higher Education Latin America University Rankings 2026.
https://www.timeshighereducation.com/world-university-rankings/2026/latin-america-university-rankings

Dissertation received a university-level Honorable Mention, ranking among the top three theses in the exact sciences.

M.Sc. in Physics, Computational Physics | University of São Paulo, São Carlos Institute of Physics | 2007-2009

B.Sc. in Physics, Computational Physics | University of São Paulo, São Carlos Institute of Physics | 2003-2006

Selected Publications and Preprints

1. Nasrollahi, F. S. F.; **Silva, F. N.**; Liu, S.; Chaudhuri, S.; Yu, M.; Wang, J.; Nho, K.; Saykin, A. J.; Bennett, D. A.; Sporns, O.; Fortunato, S. "Network clustering algorithms and preprocessing pipelines for robust cell type identification in single-cell RNA sequencing data." *Scientific Reports*, 2026. https://doi.org/10.1038/s41598-026-49033-w
2. Elmas, T.; **Silva, F. N.**; Pote, M.; Dey, P.; Chang, K.-C.; Ye, J.; Luceri, L.; Buntain, C.; Ferrara, E.; Flammini, A.; Menczer, F. "Israel-Hamas War on X: A Case Study of Coordinated Campaigns and Information Integrity." *arXiv*, 2026. https://doi.org/10.48550/arXiv.2604.10566
3. Dalsgaard, J. A.; **Silva, F. N.**; Ai, J. "Linking Global Science Funding to Research Publications." *arXiv*, 2026. https://doi.org/10.48550/arXiv.2603.24147
4. Bezerra, D. A.; **Silva, F. N.**; Amancio, D. R. "Leveraging GANs for citation intent classification and its impact on citation network analysis." *Journal of Informetrics*, 2026, 101791. https://doi.org/10.1016/j.joi.2026.101791
5. **Silva, F. N.**; Kojaku, S.; Flammini, A.; Radicchi, F.; Fortunato, S. "Scale invariance and statistical significance in complex weighted networks." *Physical Review E*, 2026. https://doi.org/10.1103/4124-dyj8
6. Radicchi, F.; **Silva, F. N.**; Flammini, A.; Fortunato, S.; Kojaku, S. "Detectability threshold in weighted modular networks." *Physical Review E*, 2026. https://doi.org/10.1103/bt2h-b7kb
7. Vital, A.; **Silva, F. N.**; Amancio, D. R. "Recovering link-weight structure in complex networks with weight-aware walks." *Information Sciences*, 2026, 754, 123702. https://doi.org/10.1016/j.ins.2026.123702
8. Vital, A.; **Silva, F. N.**; Oliveira Jr., O. N.; Amancio, D. R. "Predicting citation impact of research papers using GPT and other text embeddings." *Physica A*, 2025, 130789. https://doi.org/10.1016/j.physa.2025.130789
9. Ai, J.; Steinberg, R. S.; Guo, C.; **Silva, F. N.** "Triadic Novelty: A Typology and Measurement Framework for Recognizing Novel Contributions in Science." *arXiv*, 2025. https://doi.org/10.48550/arXiv.2506.17851
10. Seckin, O. C.; **Silva, F. N.**; Truong, B. T.; Kim, S.; Huang, F.; Liu, N.; Flammini, A.; Menczer, F. "The Rise of Bluesky." *arXiv*, 2025. https://doi.org/10.48550/arXiv.2504.12902
11. Varga, A.; Kojaku, S.; **Silva, F. N.** "Measuring research interest similarity with transition probabilities." *Quantitative Science Studies*, 2025. https://doi.org/10.1162/qss.a.13
12. Hayashi, S.; Caron, B.; Heinsfeld, A. S.; et al., including **Silva, F. N.** "brainlife.io: a decentralized and open-source cloud platform to support neuroscience research." *Nature Methods*, 2024. https://doi.org/10.1038/s41592-024-02237-2

13. Brito, A. C. M.; Oliveira, M. C. F.; Oliveira Jr., O. N.; **Silva, F. N.**; Amancio, D. R. "History of Chemistry of Materials According to Topic Evolution Based on Network Analysis and Natural Language Processing." *Chemistry of Materials*, 2024, 36(1), 1-7. https://doi.org/10.1021/acs.chemmater.3c02 962
14. **Silva, F. N.**; Albeshri, A.; Thayananthan, V.; Alhalabi, W.; Fortunato, S. "Robustness modularity in complex networks." *Physical Review E*, 2022, 105(5), 054 308. https://doi.org/10.1103/PhysRevE.105.054308
15. **Silva, F. N.**; Vega-Oliveros, D. A.; Yan, X.; Flammini, A.; Menczer, F.; Radicchi, F.; Kravitz, B.; Fortunato, S. "Detecting climate teleconnections with Granger causality." *Geophysical Research Letters*, 2021, 48(18), e2021GL094 707. https://doi.org/10.1029/2021GL094 707
16. Börner, K.; **Silva, F. N.**; Milojević, S. "Visualizing big science projects." *Nature Reviews Physics*, 2021. https://doi.org/10.1038/s42 254-021-00 374-7
17. Gewers, F. L.; Ferreira, G. R.; de Arruda, H. F.; **Silva, F. N.**; Comin, C. H.; Amancio, D. R.; Costa, L. da F. "Principal component analysis: A natural approach to data exploration." *ACM Computing Surveys*, 2021, 54(4), 1-34. https://doi.org/10.1145/3 447 755
18. Comin, C. H.; Peron, T. K. D. M.; **Silva, F. N.**; Amancio, D. R.; Rodrigues, F. A.; Costa, L. da F. "Complex systems: features, similarity and connectivity." *Physics Reports*, 2020. https://doi.org/10.1016/j.physrep.2020.03.002
19. Brito, A. C. M.; **Silva, F. N.**; Amancio, D. R. "A complex network approach to political analysis: Application to the Brazilian Chamber of Deputies." *PLOS ONE*, 2020, 15(3), e0 229 928. https://doi.org/10.1371/journal.pone.0229928
20. **Silva, F. N.**; Amancio, D. R.; Bardosova, M.; Oliveira Jr., O. N.; Costa, L. da F. "Using network science and text analytics to produce surveys in a scientific topic." *Journal of Informetrics*, 2016, 10(2), 487-502. https://doi.org/10.1016/j.joi.2016.03.008

Authors with underlined names contributed equally.

Complete publication list: https://filipinascimento.github.io/publications/

Selected Research Software

- **Helios Web** | Creator and lead developer | 2022-Present | https://heliosweb.io | WebGPU-first and WebGL2-compatible interactive visualization for million-node networks and embeddings, paired with a WebAssembly graph store.
- **OpenAlex Networks** | Creator | 2023-Present | https://github.com/filipinascimento/openalexnet | Python and command-line tools for producing citation and collaboration networks from OpenAlex.
- **TP Similarity** | Creator | 2024-Present | https://github.com/filipinascimento/tpsimilarity | Research-interest similarity based on transition probabilities.
- **CoordinationZ** | Creator | 2024-Present | https://github.com/filipinascimento/coordinationz | Statistical coordination analysis for social and behavioral data.
- **RModularity** | Creator | 2022-Present | https://github.com/filipinascimento/rmodularity | Robustness-aware community detection and evaluation.
- **OSoMe Network Tool** | Core contributor | 2022-2025 | https://osome.iu.edu/tools/networks/ | Public interface for network construction and visualization from social-media data.
- **Big Science Visualization** | Co-creator | 2021 | https://bigscience.github.io | Interactive visual essay and data exploration supporting a Nature Reviews Physics article.
- **brainlife.io Network Apps** | Contributor | 2021-2024 | https://brainlife.io/apps#network | Reusable neuroscience network-analysis applications in an open cloud workflow.
- **Scholarometer** | Contributor | 2019 | https://scholarometer.indiana.edu | Public scholarly-impact and discipline-aware bibliometrics tool.

Grant Writing and Funded Projects

- **APTO: Global Observatory and Virtual Laboratory for Science and Technology** | National Science Foundation | Senior Personnel, 2024-2026 | Contributed goals, methodology, data integration, and analytical strategy during proposal development for the $7.5M funded program.
- **Integrative Study of Local Microbiome Function in Chronic Rhinosinusitis** | National Institutes of Health | Senior Personnel, 2024-2027 | Contributed network-methods conceptualization and writing during development of the funded proposal.

- **UPSCALE: Universal Population Segmentation and Characterization Algorithms for Online Environments** | DARPA | Researcher, 2023-2024 | Participated in the funded program and developed computational and network methods for large-scale online environments.
- **A National Network for Critical Technology Assessment: A First-Year Pilot** | National Science Foundation | Senior Personnel, 2022-2023 | Participated in the funded pilot and contributed technology-assessment and science-of-science methods.
- **Science Genome: A Scholarly Graph Embedding Framework** | U.S. Department of Defense, Minerva Research Initiative | Researcher, 2020-2024 | Participated in the funded program and developed network and embedding representations of science.

Teaching and Mentorship

- Instructor, **INFO-I 590: Data Visualization**, Luddy School of Informatics, Computing, and Engineering, Indiana University, Spring 2025, in person. Project-based course on visual perception, exploratory and multidimensional analysis, maps, text and embeddings, networks, interaction, and web deployment with Python and JavaScript. Course: https://filipinascimento.github.io/dataviz/
- Instructor, **INFO-I 513: Usable Artificial Intelligence**, Luddy School of Informatics, Computing, and Engineering, Indiana University, Spring 2025, online. Applied Python course covering data preparation, regression, classification, clustering, evaluation, feature selection, explainability, natural-language processing, embeddings, and responsible use of large language models. Course: https://filipinascimento.github.io/usable_ai/
- Guest lecturer, "Visualizing Complex Networks," University of São Paulo complex-networks course, 2020-2024.
- Supervised graduate and undergraduate research in interactive network visualization, graph and text embeddings, LLM interfaces, scientific software, artistic and historical representations, and urban networks.
- Mentored Google Summer of Code contributors Bruno Messias (2021), Mohamed Agour (2022), and João Floriano (2023) on FURY/Helios projects under the Python Software Foundation.
- Organized the IC2S2 2024 tutorial "Exploring Emerging Social Media: Acquiring, Processing, and Visualizing Data with Python and OSoMe Web Tools."
- Organized and taught the IUNI workshop "An Introduction to Network Visualization" (2022) and a CADRE workshop for ISSI (2021).
- Assistant Lecturer Internship, Mathematical and Computational Modeling, University of São Paulo, 2014, 120 hours.

Technical Expertise

- **Programming and systems:** Python, JavaScript, C, C++, Objective-C, WebGPU, WebGL2, OpenGL, WebAssembly, parallel and GPU computing, command-line tools, web applications, and scientific software architecture.
- **Data and AI:** large-scale data pipelines, machine learning, natural-language processing, transformer models, LLM APIs and agents, PyTorch, TensorFlow, graph embeddings, text embeddings, information extraction, and evaluation.
- **Networks and visualization:** network science, dynamic networks, community detection, robustness, random walks, similarity, citation and coauthorship networks, interactive 2D/3D visualization, GUI development, and visual analytics.
- **Research leadership:** grant and scientific writing, interdisciplinary collaboration, project planning, workshop organization, research mentoring, open-source development, and public research infrastructure.

Academic Service

- Academic editor for PLOS ONE and PeerJ.
- Reviewer for IEEE Transactions on Network Science and Engineering, Physical Review E, Nature Human Behaviour, Communications Physics, Scientific Reports, Journal of Informetrics, Physics Letters A, Physica A, Entropy, Complexity, IC2S2, and NetSci.
- Program committee member for IC2S2 (2024-2025) and NetSci (2025).
- Contributor and mentor in the FURY open-source visualization community under the Python Software Foundation.
- Contributor to public research tools including OSoMe Network Tool, Scholarometer, brainlife.io network applications, and related open-source projects.
- Member of the Indiana University COVID-19 Response Task Force, 2020-2021; contributed analytical criteria for hybrid instruction, course assignments, and university housing.

Languages and Work Authorization

Portuguese (native); English (fluent). Brazilian citizen and United States permanent resident.

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