Christian Ferreyra

PhD candidate in Neuroscience

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EDUCATION

Aix-Marseille University Nov 2023 - Present
PhD, Neuroscience Marseille, France
Thesis: *Representational interactions in auditory brains and machines*

Favaloro University Feb 2016 – Mar 2022
Biomedical Engineer Buenos Aires, Argentina
Final project: *EEGFLOW*

SELECTED PUBLICATIONS AND CONFERENCES

- Ferreyra C, Plegat M, Marinato G, *et al. Auditory redundant and synergistic representations between brain and artificial neural networks revealed by information-theoretic decomposition.* Poster presented at: International Conference on Auditory Cortex; September, 2025; Maastricht.
- Ferreyra C, Plegat M, Marinato G, *et al. Disentangling redundant and synergistic interactions in the alignment between auditory brains and machines.* Poster presented at: Computational Cognitive Neuroscience; August, 2025; Amsterdam.
- Neri M, Vinchhi D, Ferreyra C, *et al. HOI: A Python toolbox for high-performance estimation of Higher-Order Interactions from multivariate data.* J Open Source Softw. 2024;9(103):7360.
- Ferreyra C, Plegat M, Marinato G, *et al. Model-based partial information decomposition of the dynamic brain response to natural sounds.* Poster presented at: Neural Net; November, 2024; Paris, France.

RESEARCH EXPERIENCE

Institut de Neurosciences de la Timone Nov 2023 - Present
Researcher, PhD candidate Marseille, France

- Analyzing biological and artificial neural representations of natural sounds using geometric and information-theoretic approaches.
- Developing a new methodology to analyze neural representational geometries using partial information decomposition (PID).
- Studying the emergence and dynamics of the semantic representation.

Institut de Neurosciences des Systèmes May 2022 - Oct 2023
Engineer Marseille, France

- Computed biomarkers in human SEEG data for the localization of the epileptogenic zone.
- Analyzed high frequency oscillations in mouse SEEG data using time-frequency techniques with MNE-Python.
- Developed an AnyWave plugin to analyze brain-heart interactions.
- Developed and maintained BIDS Manager software.

Favaloro University Aug 2019 - Jul 2020
Research Scholar Buenos Aires, Argentina

- Worked on an image processing algorithm to get the centerline of a vessel with MATLAB and C#.

TEACHING EXPERIENCE

Classgap Nov 2021 - Apr 2022
Professor Online

- Subjects: Classical Mechanics, Electromagnetism, Biophysics, Mathematics, Electrical circuits.

Favaloro University Mar 2017 – Feb 2021
Teaching Assistant Professor Buenos Aires, Argentina

- Subjects: Quantum Mechanics and Solid State Physics, Signals, Systems and Circuits, Electromagnetism, Vector Calculus, Complex Analysis, Linear Algebra.

ALL PUBLICATIONS AND CONFERENCES

- Ferreyra C, Marinato G, Plegat M *et al. Reliable estimation of representational dissimilarity matrices on magnetoencephalography data.* Poster presented at: PracticalMEEG; October, 2025; Aix-en-Provence.

- Ferreyra C, Plegat M, Marinato G, *et al. Auditory redundant and synergistic representations between brain and artificial neural networks revealed by information-theoretic decomposition.* Poster presented at: International Conference on Auditory Cortex; September, 2025; Maastricht.

- Marinato G, Ferreyra C, Plegat M *et al. Learned semantic associations from real world events co-occurrences influence the auditory perceptions of naturalistic sounds scenes.* Poster presented at: International Conference on Auditory Cortex; September, 2025; Maastricht.

- Plegat M, Marinato G, Ferreyra C *et al. Temporal dynamics of natural sounds representation in the human brain.* Poster presented at: International Conference on Auditory Cortex; September, 2025; Maastricht.

- Araújo Vitória M, Plegat M, Marinato G, Ferreyra C *et al. Acoustic-to-semantic transformation of natural sounds: The role of frontal areas.* Poster presented at: International Conference on Auditory Cortex; September, 2025; Maastricht.

- Ferreyra C, Plegat M, Marinato G, *et al. Disentangling redundant and synergistic interactions in the alignment between auditory brains and machines.* Poster presented at: Computational Cognitive Neuroscience; August, 2025; Amsterdam.

- Plegat M, Marinato G, Ferreyra C *et al. Temporal dynamics of natural sounds representation in the human brain.* Poster presented at: Computational Cognitive Neuroscience; August, 2025; Amsterdam.

- Neri M, Vinchhi D, Ferreyra C, *et al. HOI: A Python toolbox for high-performance estimation of Higher-Order Interactions from multivariate data.* J Open Source Softw. 2024;9(103):7360.

- Ferreyra C, Plegat M, Marinato G, *et al. Model-based partial information decomposition of the dynamic brain response to natural sounds.* Poster presented at: Neural Net; November, 2024; Paris, France.

CERTIFICATIONS AND WORKSHOPS

Mathematical Institute, University of Oxford Aug 2025
Representation learning and Generative AI Oxford, United Kingdom

NeuroMatch Jul 2024
NeuroAI Online

Max Planck institute of the Physics of Complex Systems Jun 2023
Decomposing Multivariate Information in Complex Systems Dresden, Germany

WORK EXPERIENCE

NEORIS Apr 2021 - Jul 2021
Data Science Consultant Buenos Aires, Argentina

- Developed vehicle detection and plate segmentation models with PyTorch and Darknet on a Jetson Nvidia.
- Developed an events handler with FastAPI and MongoDB.
- Deployed models on Docker containers.

Wuru Apr 2019 - Oct 2019
Trainee Data Scientist Buenos Aires, Argentina

- Developed a data adapter pipeline with Pandas and cleaned data.
- Created SQL queries with mysql Python package.

PROJECTS

Jax based representational analysis Nov 2023 - Present

- Jax-based optimized implementation of similarity and dissimilarity measures.
- Representational similarity analysis on brain data.

HOI: High-Performance Estimation of Higher-Order Interactions Nov 2023 - Nov 2024

- Jax-based estimation of higher-order interactions using information theoretic metrics like O-Information, Interaction information, Total information, etc.
- Entropy and Mutual information for continuous and discrete variables.

EEGFlow Jun 2020 - Mar 2022

- Developed a web application for cloud computing EEG using block diagrams. Tools used: React.js, Django REST Framework, MNE-Python y SciPy.

SOFTWARE AND SKILLS

- **Programming Languages**: Python, MATLAB, JavaScript.
- **Deep Learning**: PyTorch, Jax.
- **Scientific Computing**: Scikit-Learn, Numpy, Pandas, SciPy, HOI, MNE-Python.
- **Engineering**: Git, Linux, VSCode, SSH, Docker, Apptainer, Bash.
- **Data Engineering**: BIDS, MongoDB.
- **Publishing**: Latex, InkScape.

LANGUAGES

- **Spanish**: Native
- **English**: Advanced
- **French**: Intermediate