Nathan Trouvain

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Machine Learning and Data engineer.

Building simple and efficient tools to make AI techniques more accessible.

Research experience

2024 - 2022 — **PhD. research project** @ Mnemosyne - Inria/IMN/LaBRI — Bordeaux, France

Modelling Action-Perception Mechanisms for Vocal Gestures with Hierarchical Reservoirs

Computational neuroscience research project, aiming at modelizing vocal perception and production in songbirds, and eventually in humans.

2020 — **Research internship** @ Mnemosyne - Inria/IMN/LaBRI — Bordeaux, France

ML based automated annotation pipeline for bird songs

Development of an automatic birdsong annotation pipeline using machine learning tools (Reservoir Computing).

Engineering experience

2022 - 2020 — **Research engineer** @ Mnemosyne - Inria/IMN/LaBRI — Bordeaux, France

Open source software development for Reservoir Computing

Development of *reservoirpy*, a Python library aimed at providing standardized Reservoir Computing tools. Software architecture, development, tests, documentation, deployment, public outreach (presentations, tutorials and scientific papers.)

2019 — **Engineering internship** @ Wiidii — Bordeaux, France

Building NLP tools for a multipurpose chatbot

NLP models (BERT, Flair) fine-tuning for intent categorization and named entity recognition (NER). Model serving within company micro-service architecture.

Software and projects

> **reservoirpy**
A simple and flexible code for Reservoir Computing architectures like Echo State Networks. [1]

> **canapy**
Automatic audio annotation tools for animal vocalizations.

> **canarygan**
A Pytorch+Lightning reimplementation of Pagliarini et al. (2021): a generative model to explore songbirds vocal production capabilities. [2]

Education

2020 — **Master degree - "Diplôme d'ingénieur"** @ École Nationale Supérieure de Cognitique (ENSC) — Talence, France

Machine Learning, Computer Sc., Cognitive Sc.

2017 — **"Classes préparatoires aux grandes écoles"** @ Toulouse INP — Toulouse, France

Biology, Mathematics, Physics

Skills

> **Programming:** Python, Python scientific stack (numpy, scipy, pandas...), Visualization and dashboarding (matplotlib, bokeh, panel), Pytorch/TensorFlow, HPC (Lightning, Slurm), Web development (HTML/CSS/SCSS, React.js), C#, R, GNU Linux.

> **Software engineering:** SQL databases, ORM (SQLAlchemy), API development (FastAPI, Flask, Pydantic), CI/CD (Git, Github Actions, Docker), Testing (Pytest), Documentation (Sphinx).

> **Design and typsetting:** LaTeX/**typst**, Adobe Illustrator/Figma.

> **Languages:** English (fluent), French (native).

Teaching

> **Timeseries analysis and modelization**
ENSC/ENSEIRB-MATMECA | 2021-2024
Theoretical and pratical courses. Master II level.

> **Machine Learning**
ENSC | 2021-2024
Theoretical and pratical courses. Master I level.

Academic services

> **1st Open Science Workshop - Bordeaux Neurocampus**
Organizer | 2023

> **AI4Industry workshop**
Mentor - scientific advisor | 2021-2024

> **Peer-review**
CogSci 2022, ICANN 2021, ICANN 2020 | 2021-2024

Publications and presentations

[1] N. Trouvain, L. Pedrelli, T. T. Dinh, and X. Hinaut, "ReservoirPy: An Efficient and User-Friendly Library to Design Echo State Networks," in *Artificial Neural Networks and Machine Learning – ICANN 2020*, I. Farkaš, P. Masulli, and S. Wermter, Eds., Springer International Publishing, 2020, pp. 494–505. doi: 10.1007/978-3-030-61616-8_40.

[2] S. Pagliarini, N. Trouvain, A. Leblois, and X. Hinaut, "What Does the Canary Say? Low-dimensional GAN Applied to Birdsong," 2021. [Online]. Available: https://hal.science/hal-03244723v2

[3] X. Hinaut and N. Trouvain, "Which Hype for My New Task? Hints and Random Search for Echo State Networks Hyperparameters," in *Artificial Neural Networks and Machine Learning – ICANN 2021*, I. Farkaš, P. Masulli, S. Otte, and S. Wermter, Eds., Springer International Publishing, 2021, pp. 83–97. doi: 10.1007/978-3-030-86383-8_7.

[4] S. R. Oota, N. Trouvain, F. Alexandre, and X. Hinaut, "MEG Encoding Using Word Context Semantics in Listening Stories," in *Proc. Interspeech 2023*, 2023, pp. 5152–5156. doi: 10.21437/Interspeech.2023-282.

[5] S. Reddy Oota, N. Trouvain, F. Alexandre, and X. Hinaut, "Past Word Context Enables Better MEG Encoding Predictions than Current Word in Listening Stories." [Online]. Available: https://inria.hal.science/hal-04154794

[6] N. Trouvain, D. Das, and X. Hinaut, "ReservoirPy sprint: Amélioration de ReservoirPy, un outil simple de reservoir computing." [Online]. Available: https://hal.science/hal-04401731v1

[7] N. Trouvain and X. Hinaut, "Canary Song Decoder: Transduction and Implicit Segmentation with ESNs and LTSMs," in *Artificial Neural Networks and Machine Learning – ICANN 2021*, I. Farkaš, P. Masulli, S. Otte, and S. Wermter, Eds., Springer International Publishing, 2021, pp. 71–82. doi: 10.1007/978-3-030-86383-8_6.

[8] N. Trouvain, N. Rougier, and X. Hinaut, "Create Efficient and~Complex Reservoir Computing Architectures with~ReservoirPy," in *From Animals to Animats 16*, L. Cañamero, P. Gaussier, M. Wilson, S. Boucenna, and N. Cuperlier, Eds., Springer International Publishing, 2022, pp. 91–102. doi: 10.1007/978-3-031-16770-6_8.

[9] N. Trouvain and X. Hinaut, "Reservoir Computing : de la théorie à la pratique avec ReservoirPy." [Online]. Available: https://sed-paris.gitlabpages.inria.fr/ai-community/slides/2022-03-22/SCAI-ReservoirPy_01.pdf

[10] N. Trouvain and X. Hinaut, "Reservoir Computing : traitement efficace de séries temporelles avec ReservoirPy." [Online]. Available: https://www.youtube.com/watch?v=CDzQ9giWTCs