Piyush Mishra piyushmishra12.github.io piyush.mishra@univ-amu.fr

PhD Student, Mathematics & Computer Science

Development & analysis of foundational data-driven algorithms

EXPERIENCE

2023-Present — **PhD — Aix Marseille University (Philippe Roudot Group)**

a. Developed a hybrid attention based particle tracking algorithm **imposing interpretability** in its latent space, to filter trajectories using **Bayesian inference**
b. Proved that transformers scale effectively to multiple particle tracking problems **achieving up to 70% accuracy improvement in silico**, where the motion itself is simple but the challenge arises from the super-exponential hypothetical paths that a particle could take
c. Increased scores **2x for studying virus trafficking**

2023 — **Research Intern — Maths Institute of Marseille (MS Capstone project)**

a. Validated the superior computational efficiency of attention-based tracking, **saving compute by >2x**, relative to track ambiguity through empirical testing and theoretical complexity analysis
b. Established **evidence of flow-aligned glandular growth** in liver organoids achieving a first-of-its-kind automated quantification of morphogenesis by early-stage prototyping an image-segmentation framework and **3D reconstruction**

2022 — **Student Research Consultant — State University of New York**

Developed an LLM for **human DNA analysis, pretrained on 500,000 sequences**, improving sequence representations by integrating learning from both nearby and distant DNA patterns

2021 — **Software Dev. Intern — Quantiphi Inc., Mumbai (BTech Capstone project)**

Optimised internal legal operations by reducing processing latency by **building 15+ major features** of a custom software framework for automated contract handling

2019 — **Research Intern — Indian Institute of Technology, Patna**

Achieved **10% higher accuracy and +0.08 normalised mutual information** for gene clustering across 3 disease types by designing a multi-omics gene clustering framework

2018 — **Research Intern — Calcutta University**

Improved **human activity recognition accuracy by 7%,** designing a deep learning strategy that surpassed traditional machine learning benchmarks

EDUCATION

- PhD, CS / Mathematics, Aix-Marseille University and CNRS (FR) 2023-Present
- MS, Computational and Mathematical Biology, Aix-Marseille University (18.13 / 20) (FR) 2021-2023
- BTech, Computer Science and Engineering, IIIT Bhubaneswar (8.51 / 10) (IN) 2017-2021

PUBLICATIONS

1. **Mishra** & Roudot; Attention Bayesian Hybrid Approach to Modular Multiple Particle Tracking, arXiv, 2025
2. Rajendiran et al; Bioscaffold guidance drives liver periportal area tubulogenesis in hIPSC organoids, biorXiv, 2025
3. **Mishra** & Roudot; Comparative study of transformer robustness for multiple particle tracking without clutter, EUSIPCO, 2024
4. **Mishra** et al; Disease diagnosis in grapevines–a hybrid resnet-jaya approach, IACC, 2021
5. **Mishra** et al; Minimised Jaya algorithm based structure optimisation for heterogeneous WSNs, ICCCS, 2020
6. Dutta, **Mishra** & Saha; Incomplete multi-view gene clustering with data regeneration using shape boltzmann machine, Computers in Biology and Medicine, 2020
7. **Mishra** et al; Human activity recognition using deep neural network, ICDSE, 2019

PEER RECOGNITION

- Invited speaker at Paris Descartes Informatics Lab; invited by **Garance Martin** (IUT de Paris - Rives de Seine), 04.2026
- French round table on informatics oriented theses in Marseille; invited by **Véronique Buat** (Director of the Doctorate School of Physics and Material Sciences), Marseille, 03.2025
- Workshop on AI and Physical Sciences; invited by **Sandrine Anthoine** (Maths Inst. of Marseille) & **Valentin Emiya** (Laboratory of Informatics & Systems), Marseille, 11.2024

SCIENTIFIC COMMUNICATION & OUTREACH

- Colloquium on Learning and Optimisation, **CIRM**; Marseille, 06.2026
French colloquium on **AI for biomedical imaging** (IABM); Lyon, 03.2026
- French autumn school on **AI and Planetary Boundaries**; organised by **Sylvain Bouveret** (Grenoble Informatics Laboratory), Aussois (FR), 10.2025
- Climathiques, French conference on mathematics, climate and ethics; organised by **Indira Chatterjee** (Univ. Côte d'Azur) & **CIRM**, Marseille, 01.2025
- 3 Minute-Thesis competition: **13th rank**; organised by the **European Association for Signal Processing**, Lyon, 07.2024

GRANTS

- Helped secure funding of **EUR 419,000** by producing preliminary data for the 2025 **PEPR Math-Vives Grant** "Hybrid Hidden Markov Chain Modelling for the spatial mapping of intracellular trafficking in 3D developing tissues", by **Philippe Roudot** (Fresnel Inst.) & **Claudio Collinet** (Devt. Biology Inst. of Marseille)
- Secured funding of **EUR 22,000** for doctoral research completion from **Turing Centre for Living Systems**

Technical stack: ML for science, Neural networks (Transformer, CNN, LSTM),
Probabilistic models (Bayesian filtering, HMM, Kalman filtering),
Representation learning,
Interpretability and opening the black box,
Algorithm design, Complexity analysis, Population-based heuristics

Languages: fluent in English, French, Hindi, Odia