

Rachel Topno

Gmail | [LinkedIn](#) | [Github](#)

Current Position

Post-Doc at Computational Systems Biology Lab
Laboratory of pathogens and host immunity (LPHI) | Montpellier, France

Group Leader : Ovidiu Radulescu

Research Interests

- Passionate about leveraging **AI/ML** and **data science** to drive innovation in **biotech** and **healthcare**.
- Deep Learning and image analysis
- Stochastic Modelling

Technical Skills

- **Programming:** Python, R, MATLAB, Bash, Git, Shell
- **Image Processing & Computer Vision:** Scikit-Image, OpenCV, Image Segmentation, Edge Detection, Spot Detection, Object Tracking, Signal Processing
- **Machine Learning & Deep Learning:** PyTorch, TensorFlow, CNNs, U-Net, Genetic Algorithms, Signal Reconstruction, Time-series Data Analysis
- **Bioinformatics & Computational Biology:** RNA-Seq, Microarray, ChIP-Seq, Gene Expression Analysis, Gene Ontology, Transcriptomics, Co-expression Networks, Mathematical Modelling and simulation
- **Data Science & Statistics:** Big Data Handling, Data Cleaning, Clustering, Statistical Analysis, Model Validation, Statistical Learning, Hypothesis Testing
- **Project Management:** Cross-functional collaboration, Leadership, Grant Writing, Technical Documentation, Interdisciplinary Research

Professional Experience

Research Engineer | Institut de Génétique Humaine | Montpellier, France

JANUARY 2025 – PRESENT

Group Leader : Edouard Bertrand

- Currently building and deploying deep learning solutions for advanced microscopy and high-dimensional biological data analysis. Developed end-to-end pipelines using **PyTorch**, **TensorFlow**, **Scikit-Image** and **OpenCV** for spot detection, object classification, and tracking, addressing challenges like noise and variable morphology.
- Investigating hierarchical noise in biological systems through mathematical modeling.

Doctoral Research | Université de Montpellier | Montpellier, France

OCTOBER 2020 – DECEMBER 2024

Supervisors : Edouard Bertrand and Ovidiu Radulescu

- Led interdisciplinary projects aimed at understanding HIV-1 latency exit using advanced computational and imaging techniques. I developed robust **software pipelines** for microscopy **image analysis**, implementing advanced techniques such as edge detection, segmentation, spot detection, classification, and tracking to automate and scale data

processing. I developed a cross-correlation–based mathematical framework to analyze **dynamic time-series** imaging data, validated using synthetic simulations. Working in an interdisciplinary environment, I created a user-friendly Python GUI application employing **Machine Learning** (genetic algorithms) to reconstruct biological signals and extract meaningful statistical features. This tool contributed to a **top-tier journal publication**.

Bioinformatics Research Trainee | Amity University | Noida, India

2017 – 2020

Supervisors: Manoj Kumar and Pallavi Agarwal

- Executed large-scale analysis of transcriptomic and genomic datasets to uncover functional and evolutionary insights. Conducted RNA-Seq, microarray, and ChIP-Seq data analysis to identify differentially expressed genes using clustering and functional annotation methods. Built gene co-expression networks and performed topological analyses to identify hub genes. Identified novel RNA thermosensors in *Mycobacterium tuberculosis* through motif discovery and RNA secondary structure prediction. Ensured statistical robustness and biological relevance through rigorous data validation and enrichment analyses.

Customer Relations Executive | CashKaro | Gurgaon, India

2013 – 2014

- Enhanced support operations by proposing API-level automation to streamline query resolution, significantly improving response time and customer satisfaction. Trained and managed a team of five, overseeing daily workflows and ensuring high-quality service delivery. Coordinated internal and client-facing events, facilitating cross-functional collaboration and smooth execution.

Education

- **Doctorate | Université de Montpellier** 2020 – 2024
Institute of Human Genetics, Laboratory of Host and Pathogen Immunity | Montpellier, France
- **Post Graduate Diploma in Applied Statistics** 2018 – 2019
Indira Gandhi National Open University, New Delhi, India
- **M.Sc. in Physics St. Stephen's College** 2015 – 2017
Department of Astrophysics and Astronomy, University of Delhi, India
- **B.Sc. in Physics | St. Stephen's College** 2010– 2013
University of Delhi, India

Publications

- **Topno, R.** [†], Karaki H.[†] (in preparation | tentative August 2025) HIV-1 transcriptional noise is driven by intrinsic promoter dynamics during latency and cell specific heterogeneities during reactivation
- Karaki H.[†], Mazzarda F.[†], **Topno, R.** [†] (in preparation | tentative June 2025) Imaging HIV-1 transcription in live latent T cells reveals rare viral transcriptional bursts
- **Topno, R. et al** (in preparation | tentative July 2025) Quantifying Intrinsic and Extrinsic Gene Expression Noise in Dynamic Environments.
- Slaninova, V.[†], Mazzarda F.[†], Dalakishvili L., Depierre D., Moene C.J.I, **Topno R**,et al (in submission |tentative May 2025) Single-Molecule DNA Footprinting and Transcription Imaging Reveal Molecular Mechanisms of Promoter Dynamics
- **Topno R.** [†], Douaihy M.[†], et al BurstDECONV: A signal deconvolution method to uncover mechanisms of transcriptional bursting in living cells. Nucleic Acids Research (2023) DOI : <https://doi.org/10.1093/nar/gkad629>

- Tantale, K. et al Stochastic pausing at latent HIV-1 promoter generates transcriptional bursting. Nat Comm (2021) DOI : 10.1186/s12885-021-07928-z
- **Topno, R.** et al Integrated bioinformatic analysis identifies UBE2Q1 as a potential prognostic marker for high grade serous ovarian cancer. BMC Cancer 21, 220 (2021). DOI: 10.1038/s41467-021-24462-5
- **Topno, R.[†]** , Nazam, N.[†] et al Integrative genome wide analysis of protein tyrosine phosphatase identifies CDC25C as prognostic and predictive marker for chemoresistance in breast cancer, Cancer Biomarker (2021). DOI : 10.3233/cbm-200858

Conferences and Scientific Talks

Selected Talks

- Annual meeting of the **Physics of Living Systems (PoLS)** 2024 | **ICTP**, Triest, Italy | Oral Presentation
- **CBS2** day 2023 | Oral Presentation
- Advanced Lecture Course on Computational Systems Biology, **INRIA Aussois** 2021 | Poster presentation
- LabMUSE mini-symposium on **Transcriptional Noise** 2023 | Oral Presentation
- Annual Meeting of the International Physics of Living Systems (**iPoLS**) Network 2022 | Poster presentation | Flash Talk

Grants and Awards

- Best Interdisciplinary **Thesis Award 2025** organised by Le Collège Doctoral de l'Université de Montpellier (CDUM)
- **LabMUSE** EpiGenMed PhD Scholarship (2020-2023)
- **Sidaction** funding of 4th year PhD (accepted)
- **ANRS** funding of 4th year PhD (awarded)
- **Virendra Kumar Memorial Prize (M.Sc. Physics) [2016]** | Awarded for securing maximum marks in my subject.

Workshops

- Advances Lecture on **Computational Systems Biology** 2021 | **INRIA Aussois**, France
- Biomat School on **Multiscale Model** in Life Sciences 2022 | **Universidad de Granada**, Spain
- **Chemical Reaction Networks** Summer School 2022 | Torgnon (Organized by the Department of Mathematical Sciences - **Politecnico di Torino**)
- **IMPRS-CSBD** Summer School in **Systems Biology** 2019 | Dresden, Germany

References

- **Prof. Ovidiu Radulescu** ovidiu.radulescu@umontpellier.fr
Full Professor, University of Montpellier
Team leader, Laboratory of Pathogens and Host Interactions (LPHI) UMR 5235
Montpellier, France
- **Dr. Edouard Bertrand** edouard.bertrand@igh.cnrs.fr
Team leader at Institute of Human Genetics - CNRS UMR9002
Montpellier, France