

SOURABH PALANDE | CURRICULUM VITAE

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SUMMARY

I'm a data scientist, an applied mathematician, and a researcher in machine learning theory, algorithms, and applications. I focus on developing methods that leverage topology and geometry in machine learning, statistical analysis, and visualization. I've collaborated with scientists from a range of domains, including mathematics, neuroscience, biology, and social science. I've published research articles in leading journals and conferences in biomedicine, computational geometry, visualization, etc. I have experience working with imaging (MRI, fMRI, X-Ray CT, RGB) and network-structured (brain networks, *omics) data. I enjoy solving complex problems. I'm passionate about advancing science and making a real-world impact through my research.

EDUCATION

PhD in Computing

📅 Aug 2015–Jul 2020

School of Computing, University of Utah

📍 Salt Lake City, USA

- Thesis: "Utilizing Topological Structures of Data for Machine Learning."
- PhD advisor: Dr. Bei Wang-Phillips.

MSc in Applied Mathematics

📅 Sep 2013–Oct 2014

School of Mathematics, University of Manchester

📍 Manchester, UK

- Dissertation: "Analysis of the Source Trajectory in Cone Beam Micro CT."
- Dissertation advisor: Prof. Bill Lionheart.

BSc in Mathematics

📅 Jul 2004 –Oct 2007

Fergusson College, University of Pune

📍 Pune, India

- Major: Computational Mathematics, Minors: Statistics, Physics.

RESEARCH EXPERIENCE

Postdoctoral Research Associate

📅 Oct 2020–Present

CMSE, Michigan State University

📍 East Lansing, USA

- Lead interdisciplinary collaborative projects with a team of mathematicians, computer scientists and biologists.
- Developed and implemented image analysis pipeline to extract shape information from plant 3D XRay CT scans.
- Developed machine learning model to extract leaf vasculature from 2D RGB images.
- Developed exploratory visual analytic framework for plant morphology and cross-species gene expression data.
- Helped design and publish a novel interactive book (using Jupyter Book) introducing python programming to biology students: [Plants & Python](https://plantsandpython.github.io/PlantsAndPython). (<https://plantsandpython.github.io/PlantsAndPython>)

Graduate Research Assistant

📅 May 2016–Jul 2020

SCI Institute, University of Utah

📍 Salt Lake City, USA

- Collaborated with neuroscientists, applying topological data analysis and machine learning in autism research.
- Implemented MRI and fMRI processing pipelines, performed comparative analysis of different pipelines.
- Developed and implemented novel machine learning and data analysis methods for brain networks.
- Generalized semi-supervised and unsupervised graph learning algorithms to simplicial complexes, hypergraphs.
- Developed novel metrics to evaluate and visualize local, node-level uncertainty in graph coarsening.
- Developed a framework to compare and perform computations on ensembles of trees structures.
- Contributed in designing tools to aid visual analysis of the behavior of trained neural networks: [TopoAct](https://tdavislab.github.io/TopoAct/) (<https://tdavislab.github.io/TopoAct/>)

AWARDS AND HONORS

Americal Mathematical Society (AMS)

📅 2022-2023

Models and Methods for Sparse (Hyper) Network Science

- Invited to participate in Mathematical Research Communities (MRC) program:
<https://www.ams.org/programs/research-communities/2022MRC-HyperNet>
- Received travel awards to attend conferences, and funding for continuing collaborative work.

Simons Institute for Theory of Computing, UC Berkeley

📅 Fall 2018

Foundations of Data Science

- Invited as a visiting graduate researcher in the program on mathematical foundations of data science:
<https://simons.berkeley.edu/programs/datascience2018>

XRadia (Zeiss) and University of Manchester

📅 Summer 2014

- Awarded GBP 3000 in funding towards masters dissertation research.

TEACHING

Plants and Python

📅 Fall 2020

Guest Instructor

📍 Department of Horticulture, Michigan State University

- A graduate level course introducing biology students to data analysis and computational biology.
- Trained students to apply topological data analysis techniques in plant biology; guided course projects.

CS 6170: Computational Topology

📅 Spring 2017

Teaching Assistant

📍 School of Computing, University of Utah

- Graduate level course, 50% teaching, 100% grading responsibilities.
- Trained students to apply topological data analysis techniques to a variety of real-world datasets.
- Guided student projects, leading to publications and one master's dissertation.

CS6210: Advanced Scientific Computing

📅 Spring 2017

Teaching Assistant

📍 School of Computing, University of Utah

- A graduate level course with 50% teaching, full grading responsibilities.
- Trained students to implement numerical algorithms and to perform efficiency and error analysis.

OTHER WORK EXPERIENCE

Quantitative Analyst

📅 Jun 2011–Jun 2013

AlgoAnalytics Financial Consultancy

📍 Pune, India

- Developed security and commodity price prediction models using machine learning and time series analysis.
- Designed and implemented fully and semi-automated high frequency trading systems.

Trader and Portfolio Manager

📅 Jan 2008–May 2011

Self Employed

📍 Pune, India

- Analyzed financial data, historical prices and economic trends to identify trading opportunities.
- Managed a portfolio of securities delivering over 80% annualized profit and tripling assets in three years.

PUBLICATIONS

Preprints / ArXiv

- [1] **Sourabh Palande**, Joshua A.M. Kaste, Miles D. Roberts, *et al.*, “The topological shape of gene expression across the evolution of flowering plants,” bioRxiv:2022.09.07.506951, 2022.
- [2] Sarah Percival, **Sourabh Palande**, Beronda Montgomery, *et al.*, “Using mapper graphs to reveal morphological relationships in passiflora leaves,” Authorea Preprints authorea:essoar.10508822.1, 2022.
- [3] Mingzhe Li, **Sourabh Palande**, Lin Yan, and Bei Wang, “Sketching merge trees for scientific data visualization,” arXiv:2101.03196 [cs.CG], 2021.

Journal Articles

- [4] Robert VanBuren, Alejandra Rougon-Cardoso, Erik J. Amézquita, *et al.*, “Plants & Python: A series of lessons in coding, plant biology, computation, and bioinformatics,” *The Plant Cell*, vol. 34, no. 7, e1–e1, 2022.
- [5] Archit Rathore, Nithin Chalapathi, **Sourabh Palande**, and Bei Wang, “Topoact: Visually exploring the shape of activations in deep learning,” *Computer Graphics Forum*, vol. 40, no. 1, pp. 382–397, 2021.
- [6] Braxton Osting, **Sourabh Palande**, and Bei Wang, “Spectral sparsification of simplicial complexes for clustering and label propagation.,” *Journal of Computational Geometry (JoCG)*, vol. 11, no. 1, pp. 176–211, 2020, *Authors listed alphabetically.
- [7] **Sourabh Palande**, Vipin Jose, Brandon Zielinski, *et al.*, “Revisiting Abnormalities In Brain Network Architecture Underlying Autism Using Topology-Inspired Statistical Inference.,” *Brain Connectivity*, vol. 9, no. 1, pp. 13–21, 2019. eprint: <https://doi.org/10.1089/brain.2018.0604>.






Conference Proceedings

- [8] Fangfei Lan, **Sourabh Palande**, Michael Young, and Bei Wang, “Uncertainty visualization for graph coarsening,” in *2022 IEEE International Conference on Big Data (Big Data)*, 2022, pp. 2922–2931.
- [9] Archit Rathore, **Sourabh Palande**, Jeffrey Anderson, *et al.*, “Autism Classification Using Topological Features And Deep Learning: A Cautionary Tale.,” in *Medical Image Computing and Computer Assisted Intervention – MICCAI 2019*, Springer International Publishing, 2019, pp. 736–744.
- [10] Keri Anderson, Jeffrey Anderson, **Sourabh Palande**, and Bei Wang, “Topological Data Analysis Of Functional MRI Connectivity In Time And Space Domains.,” in *Connectomics in NeuroImaging (CNI) at Medical Image Computing and Computed Assisted Intervention (MICCAI)*, **Best Paper Award**: CNI at MICCAI 2018, Springer International Publishing, 2018, pp. 67–77.
- [11] **Sourabh Palande**, Vipin Jose, Brandon Zielinski, *et al.*, “Revisiting Abnormalities In Brain Network Architecture Underlying Autism Using Topology-Inspired Statistical Inference,” in *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, vol. 10511 LNCS, Springer, Cham, 2017, pp. 98–107.
- [12] Eleanor Wong, **Sourabh Palande**, Bei Wang, *et al.*, “Kernel Partial Least Squares Regression For Relating Functional Brain Network Topology To Clinical Measures Of Behavior.,” in *2016 IEEE 13th International Symposium on Biomedical Imaging (ISBI)*, 2016, pp. 1303–1306.

INVITED TALKS

- [13] “Leveraging topological structure in data analysis, machine learning, and visualization,” Seattle Children’s Research Institute, 2023.
- [14] “The topological shape of gene expression across the evolution of flowering plants,” SIAM Conference on Mathematics of Data Science (MDS) 2022 Minisymposium on Topological Data Analysis with Mapper, 2022.
- [15] “TDA + ML: Utilizing topological structures of data for machine learning,” Michigan State University Topological Data Analysis Seminar, 2020.

SERVICE

Organizer		MSU Topological Data Analysis Seminar		Fall 2021–Present
Reviewer		Biomedical Signal Processing and Control (BSPC)		Jan 2022–Present
Reviewer		Topology, Algebra, and Geometry in Data Science (TAG-DS) Workshop at CVPR 2023		2023
Reviewer		Medical Image Computing and Computer Aided Intervention (MICCAI)		2023
Sub-Reviewer		Symposium on Computational Geometry (SoCG)		2023