Sourabh Palande | CV

sourabh.palande@gmail.com | sourabh@sci.utah.edu

I am a graduate student pursuing PhD in Computing (image and data analysis). I work as a research assistant at the Scientific Computing and Imaging (SCI) Institute, University of Utah. I'm interested in theoretical, algorithmic as well as applied research in topological and geometric data analysis and machine learning.

Education

- **PhD in computing** — **Aug 2015 - Present**
  School of Computing, University of Utah, Current GPA : 3.85/4.0 — *Salt Lake City, USA*
  Advisors : Dr. Bei Wang, Dr. P Thomas Fletcher
- **M.Sc. in Applied Mathematics** — **Sep 2013 - Oct 2014**
  School of Mathematics, University of Manchester, 69.5%, Merit — *Manchester, UK.*
  Awarded Industrial funding for dissertation research, Advisor : Prof. Bill Lionheart
- **Graduate Coursework in Computer Science** — **Jul 2008 - May 2009**
  Computer Science Department, University of Pune — *Pune, India*
- **B.Sc. in Mathematics** — **Jun 2004 - Oct 2007**
  Fergusson College, University of Pune, 64.5%, First Class — *Pune, India*
  Major in Computational Mathematics, Minor in Statistics and Physics

Experience

- **Graduate Research Assistant** — **May 2016 - Present**
  Scientific Computing and Imaging Institute — *Salt Lake City, USA*
  Modeling relationships between data points as networks, higher order objects (simplicial complexes). Developing statistical, machine learning tools to learn from their geometry and topology of these objects.
- **Visiting Graduate Researcher** — **Aug 2018 - Dec 2018**
  Simons Institute for Theory of Computing — *Berkeley, USA*
  Part of the semester long "Foundations of Data Science" program. Participated in workshops focused on randomized linear algebra and applications, robust and high dimensional statistics, sub-linear algorithms and nearest neighbor search.
- **Quantitative Analyst** — **Jun 2011 - Jun 2013**
  AlgoAnalytics Financial Consultancy Pvt. Ltd. — *Pune, India*
  Developed prediction models for security price movements using time series analysis, machine learning
  Developed automated trading systems, systems for data collection, performance monitoring and reporting

Technical skills

- **Programming :** C, C++. Basic familiarity with OpenMP and Cuda.
- **Numerical / Data Analysis :** Python (with NumPy, SciPy, Scikit-learn), Matlab, R.
- **Web and back-end:** HTML, JavaScript with D3, Python (Django, Flask)
- **Other tools:** Version Control : Git, Virtualization : Anaconda, VirtualBox

Publications

Preprints / ArXiv

[2] B. Osting, **Palande, Sourabh**, and B. Wang, "Spectral sparsification of simplicial complexes for clustering and label propagation," *Submitted to Journal of Computational Geometry JoCG, 2019, [Online]. Available: `http://arxiv.org/abs/1708.08436`.

Journal Articles

[1] **Palande, Sourabh**, V. Jose, B. A. Zielinski, J. S. Anderson, P. T. Fletcher, and B. Wang, "Revisiting abnormalities in brain network architecture underlying autism using topology-inspired statistical inference.," *Brain Connectivity*, PMID: 30543119. DOI: `10.1089/brain.2018.0604`.

Conference Papers

[3] K. L. Anderson, J. S. Anderson, **Palande, Sourabh**, and B. Wang, "Topological data analysis of functional mri connectivity in time and space domains," in *Connectomics in NeuroImaging*, **Best Paper** at CNI 2019 Workshop, Springer International Publishing, 2018, pp. 67–77.

[4] E. Wong, **Palande, Sourabh**, B. Wang, B. Zielinski, J. Anderson, and P. T. Fletcher, "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)*, Apr. 2016, pp. 1303–1306. DOI: `10.1109/ISBI.2016.7493506`.

Teaching

- **Computational Topology** — **Spring '17**
  Teaching Assistant — *School of Computing, University of Utah*
  Graduate level course on topological data analysis techniques and their applications.
  Significant teaching and grading load. It was a project based course (approx. 30 final projects)
- **Advanced Scientific Computing** — **Fall '16**
  Teaching Assistant — *School of Computing, University of Utah*
  Graduate level course on algorithms for matrix factorization, numerical integration and differentiation, interpolation and approximation etc. Covered algorithm implementations, efficiency and error analysis.

Affiliations

- **Society for Industrial and Applied Mathematics (SIAM)** — **2013 - Present**
  Applied Mathematics
  Activity groups : Data mining and analytics, Imaging science, Applied algebra and geometry
- **Global Association of Risk Professionals (GARP)** — **2011 - Present**
  Financial Risk Management
  Became a Certified Financial Risk Manager (FRM) in 2017
- **CFA Institute** — **2009 - Present**
  Financial Analysis
  Candidate member. Passed CFA Level II examination in 2011

Projects

PhD Research Projects

- *'Spectral algorithms for simplicial complexes' :* Spectral algorithms like sparsification, clustering, label propagation for graphs are well known. Currently working on extending these to simplicial complexes which encode higher order (3-way, 4-way) relationships between nodes. Reported some preliminary results in a recent submission to SoCG 2018. Also designed an interactive visualization tool for sparsification. Implementation : Python. Visualization : Javascript with D3, Python (Flask) back-end
- *'Statistical inference with topological summaries of networks' :* Applied to study of autism. Covariances of intensities from structural MRIs across subjects between brain regions modeled as group level networks (autism vs control). Designed tests to identify brain regions and pairs that show statistically significant differences between autism and control using topological summaries of networks. Currently working on relations between topological summaries, random fields, covariance and inverse covariance matrices etc. Scripting and analysis : Python
- *'Machine learning with topological features of brain networks' :* Brain networks were extracted from fMRI (nodes : brain regions, edges : correlation between activation signals). Persistent homological features of the networks were used for classification (SVM), regression against behavioral scores in study of autism Implementation, analysis : R, Python

M.Sc. Dissertation (with Industrial Collaborators)

- *'Analysis of the Source Trajectory in Cone Beam Micro Computed Tomography' :* Comparative analysis of various scan trajectories for cone beam micro CT using iterative reconstruction. Synthetic projection data sets generated with custom 3D phantom for each trajectory. Reconstructed volumes compared with the phantom (ground truth) and with each other. Also performed spectral analysis of the projection matrices. Synthetic data : C, iterative reconstruction : C++ with CUDA, Analysis and comparisons : MATLAB

Projects at AlgoAnalytics

- *'Price prediction and automated trading system' :* Developed models to predict movements of securities and commodities prices over various time intervals using time series and machine learning techniques. Also built automated trading systems based on the price movement prediction and inventory management. Prototyping : MATLAB, Final implementation : C, C++.
- *'Portfolio and pair trading strategies' :* Equity portfolio trading leveraging differences in daily and intra-day volatility by re-balancing two identical portfolios (one long one short) at different time intervals. Commodity pair trading used co-integration to identify commodity pairs to trade and Kalman filter based rules to suppress trading signals.

References

- References available on request