Prashant Shekhar, PhD

Contact Information

Embry-Riddle Aeronautical University,
1 Aerospace Boulevard,
Daytona Beach, Florida, 32114,
United States

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Research Interests

Interpretable Machine Learning, Data Science, Computer Vision, AI

Education

The State University of New York at Buffalo, Buffalo, NY, USA

Ph.D., *Computational Data Science*, September 2019

- Title: "Localized Hierarchical Approximations for Data Reduction and Learning" [Link]
- Advisor: Dr. Abani Patra

The State University of New York at Buffalo, Buffalo, NY, USA

M.S., *Mechanical Engineering*, September, 2016

Indian Institute of Technology, Kharagpur, WB, India

B.Tech., *Industrial and Systems Engineering*, July, 2014

Professional Experience

Assistant Professor of Data Science (Tenure Track) **Aug. 2021 - present**
Department of Mathematics,
Embry-Riddle Aeronautical University, Daytona Beach, FL, USA

Data Scientist/Postdoctoral Scholar **Oct. 2019 - July 2021**
Data Intensive Studies Center,
Tufts University, Medford, MA, USA

Applied Data Science Lecturer **Jan. 2020 - April 2020**
M.S. in Engineering Management Program, Tufts Gordon Institute,
Tufts University, Medford, MA, USA

Graduate Research/Teaching Assistant **Sept. 2014 - Sept. 2019**
Institute for Computational and Data Sciences ,
The State University of New York at Buffalo, Buffalo, NY, USA

Student Assistant **May 2013 - July 2013**
Department of Industrial and Systems Engineering,
The Hong Kong Polytechnic University, Hung Hom, Hong Kong

Research Intern **May 2012 - July 2012**
Indian Institute of Management
Lucknow, Uttar Pradesh, India

Grant Support

ERAU: Faculty Innov. Research in Science and Tech. (FIRST), ~$24,000, 2022-23

Title: *Identifying the Structure and Dynamics of Sub-Glacial Lakes Under Antarctic Icesheet using AI and Machine Learning*
Role: *Principal Investigator (Share 100%)*

Journal Publications

Shekhar P., Babu M., and Patra A. Hierarchical regularization networks for sparsification based learning on noisy datasets. *Foundations of Data Science*. 2023; doi: 10.3934/fods.2023009 [Link][arXiv] [*Code*].

Babu, M., Franciosa, P., **Shekhar, P.**, and Ceglarek, D. Object Shape Error Modelling and Simulation During Early Design Phase by Morphing Gaussian Random Fields. *Computer-Aided Design*, 2023; 158, 103481.[*Link*]

Parida, S. S., Bose, S., Butcher, M., Apostolakis, G., and **Shekhar, P.**. SVD enabled data augmentation for machine learning based surrogate modeling of non-linear structures. *Engineering Structures*, 2023; 280, 115600. [*Link*]

Shekhar P. and Patra A., A Forward Backward Greedy Approach for Sparse Multiscale Learning. *Computer Methods in Applied Mechanics and Engineering*. 2022; 400: 115420.[*Link*] [arXiv] [*Code*]

Vora, N., **Shekhar, P.**, Esmail, M., Patra, A., and Georgakoudi, I. Label-free flow cytometry of rare circulating tumor cell clusters in whole blood. *Nature Scientific Reports*. 2022 ;12(1): 1-14. [*Link*]

Shekhar P. and Patra A., Hierarchical approximations for data reduction and learning at multiple scales. *Foundations of Data Science*. 2020;2(2):123-154. [*Link*] [*arXiv*] [*Code*]

Shekhar P., Csathó B., Schenk T., Roberts C. and Patra A., ALPS: A Unified Framework for Modeling Time Series of Land Ice Changes. *IEEE Transactions on Geoscience and Remote Sensing*. 2020 Oct 16. [*Link*] [*arXiv*] [*Code*]

Chan F.T., **Shekhar P.** and Tiwari M.K., Dynamic scheduling of oil tankers with splitting of cargo at pickup and delivery locations: a Multi-objective Ant Colony-based approach. *International Journal of Production Research*. 2014 Dec 17;52(24):7436-53. [*Link*]

Conference Publications

Vora, N., **Shekhar, P.**, Kwan, J., Esmail, M., Patra, A., and Georgakoudi, I. Meet the clusters: a deep learning approach for label-free detection of circulating tumor cell clusters using flow cytometry. In *Multiscale Imaging and Spectroscopy IV (p. PC123630A). SPIE*. 2023 March. [*Link*]

Dasarla Giri Babu, V., Chao, Y., Lopes, N. C., Ricklick, M., **Shekhar, P.**, and Boetcher, S. Impact of Data Representation on Artificial Neural Network Performance in sCO2 Cooling Applications. In *AIAA SCITECH* (p. 0390). 2023 January. [*Link*]

Georgakoudi, I., Vora, N., **Shekhar, P.**, and Patra, A. Label-free flow cytometric detection of circulating tumor cell clusters is enabled in whole blood samples by machine learning-based signal analysis. In *Unconventional Optical Imaging III (p. PC121360U). SPIE*. 2022 May. [*Link*]

Vora, N., **Shekhar, P.**, Esmail, M., Patra, A., and Georgakoudi, I. Detection of Rare Circulating Tumor Cell Clusters in Whole Blood Using Label-free, Flow Cytometry. In *Microscopy Histopathology and Analytics (pp. MW3A-3)*. Optica Publishing Group. 2022 April. [*Link*]

Shekhar P., Csatho B., Schenk T. and Patra A., Localized time series modeling of Greenland ice sheet elevation changes. In *Proceedings of the 8th International Workshop on Climate Informatics: CI 2018* (No. NCAR/TN-550+PROC). doi:10.5065/D6BZ64XQ.

Shekhar P., Patra A. and Csatho B., Multiscale and Multiresolution methods for Sparse representation of Large datasets. *Procedia Computer Science*. 2017 Jan 1;108:1652-61. [*Link*]

Shekhar P. and Rai R., Anomaly Detection in Complex Spatiotemporal Networks Through Loca-

tion Aware Geospatial Big Data Sets. In *International Design Engineering Technical Conferences and Computers and Information in Engineering Conference* 2016 Aug 21 (Vol. 50190). American Society of Mechanical Engineers. [*Link*]

Shekhar P., Patra A and Stefanescu ER., Multilevel methods for sparse representation of topographical data. *Procedia Computer Science*. 2016 Jan 1;80:887-96. [*Link*]

Professional Talks

Building Multiscale Representations and Surrogate Using a Greedy Approach, at the *SIAM Conference on Uncertainty Quantification (UQ22)*, Atlanta, USA (April 2022): **Invited Talk**

Ensemble Methods: Boosting, at *Data Science and Machine Learning, Warwick Manufacturing Group*, University of Warwick, Coventry, UK (April 2022): **Invited Talk**

Multiscale Models for Sparsity Constrained Data Reduction, at the *AMS Sectional Meeting: Special Session on Mathematics of Data Science*, Boston, USA (March 2022): **Invited Talk**

Greedy Multiscale Surrogates for Uncertainty Quantification, at the *Annual Fall Meeting for American Geophysical Union*, New Orleans, USA (Dec 2021).

Greedy Multiscale Strategies for Sparse Modeling and Emulation Tasks, at the 16^{th} *US National Congress on Computational Mechanics*, (July 2021)

Multiscale models for sparsity constrained data reduction, at the *Department of Biostatistics, Harvard T.H. Chan School of Public Health, Harvard University*, Boston, USA (May 2021)

Hierarchical Regularization and Sparse Representation of Noisy Data sets, at *Data-driven science with uncertainty quantification, machine learning, and optimization, 14th World Congress in Computational Mechanics and ECCOMAS Congress*, Paris (Jan 2021).

Model Selection in Machine Learning, at *Warwick Manufacturing Group*, University of Warwick, Coventry, UK (Nov 2020): **Invited Talk**

A Novel Hierarchical Learning Method for Remote Sensing Data, with Applications of Greenland Ice Sheet Changes from Laser Altimetry, at the *Annual Fall Meeting for American Geophysical Union*, San Francisco USA (Dec 2019).

ALPS: A framework for modeling time series of land ice changes, at *Department of Geology, SUNY Buffalo*, Buffalo, USA (Nov 2019): **Invited Talk**

Selected Professional Presentations

Exploiting the Redundancy in ICESat-2 Geolocated Photon Data (ATL03), a Multiscale Data Reduction Approach, at the *Annual Fall Meeting for American Geophysical Union*, San Francisco USA (Dec 2020)

Hierarchical Regularization Networks for Learning on Noisy Datasets, at *Graduate Student Poster Session, School of Engineering and Applied Sciences*, SUNY Buffalo, Buffalo, NY, USA (April 2019)

A Novel Approach Using Localized Time Series for Modeling Greenland Ice Sheet Elevation Changes from Long-Term Altimetry Record, at the *Annual Fall Meeting for American Geophysical Union*, Washington DC, USA (Dec 2018)

Localized Time Series Modeling of Greenland Ice sheet Elevation Changes, at *8th International Workshop on Climate Informatics: CI 2018*, Boulder Colorado, USA (Sept 2018).

Localized Statistical Modeling for Elevation Change Time Series Data in Parts of Greenland Ice-Sheet, at *International Symposium on Timescales, Processes and Ice Sheet Changes*, Buffalo, NY, USA (June 2018)

Multi-scale Modeling for Data Sparsification, at *Graduate Student Poster Session, School of Engineering and Applied Sciences*, SUNY Buffalo, Buffalo, NY, USA (April 2018)

Multi-Scale approaches for Data Sparsification and Modeling, at *CDSE days, Institute for Computational and Data Sciences*, SUNY Buffalo, Buffalo, NY, USA (April 2018)

Honors and Awards

- Graduate Student Association's conference funding award, *SUNY Buffalo*, 2018.
- Best poster award, annual poster competition, *Institute for Computational and Data Sciences, SUNY Buffalo*, 2018.
- Travel award, Workshop on Distributed and Parallel Data Analysis (DPDA), *Statistical and Applied Mathematical Sciences Institute (SAMSI)*, Research Triangle Park, Raleigh, NC, 2016
- Dean's Graduate Fellowship award, *SUNY Buffalo*, 2014
- Best undergraduate thesis award, *IIT Kharagpur*, 2014
- Travel and research award, *Department of Industrial and Systems Engineering, The Hong Kong Polytechnic University*, 2013

Courses Supervised

DS 625: Computing for Data Compression, Image and Signal Processing **Spring 2023**
Institute: Embry-Riddle Aeronautical University
Role: Course Instructor

MA 540: Data Mining **Spring 2022/2023**
Institute: Embry-Riddle Aeronautical University
Role: Course Instructor

MA 432: Linear Algebra **Spring 2022 and Fall 2021/23**
Institute: Embry-Riddle Aeronautical University
Role: Course Instructor

MA 506: Probability and Statistical Inference **Fall 2021/22/23**
Institute: Embry-Riddle Aeronautical University
Role: Course Instructor

EM 0212: Applied Data Science **Spring 2020**
Institute: Tufts University
Role: Course Instructor

Math 190: Uncertainty Quantification for Large Scale Comp. Modeling **Spring 2020**
Institute: Tufts University
Role: Supporting Instructor for Dr. Abani Patra,

Summer Course (15 hrs): Matrix Methods and Machine Learning **Summer 2020**
Institute: Tufts University
Role: Co-instructed with Dr. Abani Patra

EAS 595: Probability for Machine Learning **Fall 2017**
Institute: SUNY Buffalo
Role: Teaching Assistant

MAE 364: Manufacturing Processes **Spring 2015**
Institute: SUNY Buffalo
Role: Teaching Assistant

MAE 376: Applied Mathematics for Mech. and Aero. Engr. **Fall 2014**
Institute: SUNY Buffalo
Role: Teaching Assistant

Leadership roles

Vice President **2018-2019**
Earthquake Engineering Research Institute (EERI),
SUNY Buffalo, Buffalo, NY, USA

General Secretary **2012-2014**
Radhakrishnan Hall of Residence,
IIT Kharagpur, Kharagpur, WB, India

Supervising Committees

- Jordan Sanders (Chair, MS thesis committee in Data Science)
- Shashi Bhushan Jha (Member, PhD dissertation committee in Computer Science)
- Vinusha Dasarla Giri Babu (Member, MS thesis committee in Aerospace Engineering)

Student Researchers

- Thomas Fiello II (MS in Data Science)
- Wairimu Mwangi (MS in Data Science)
- Cole Montrose (BS in Computer Science)
- Noemi Miguelez-Gomez (PhD in Computer Science)
- Ke Feng (PhD in Computer Science)
- Juan Ortiz-Couder (PhD in Computer Science)
- Justus Renkhoff (PhD in Computer Science)
- Aaron Van De Brook (MS in Computer Science)

Course Development

- MA625 Computing for Data Compression, Image and Signal Processing
- MA506 Probability and Statistical Inference (Course Monitor at ERAU)
- Matrix Methods and Machine Learning (Summer course at Tufts University)

Reviewing Activities

- Nature Scientific Reports
- Journal of Computational Science (JOCS)
- International Design Engineering Technical Conferences and Computers and Information in Engineering Conference, The American Society of Mechanical Engineers (ASME)
- International Journal of Production Economics (IJPE)

Professional Memberships

- Institute of Electrical and Electronics Engineers (IEEE)
- Society for Industrial and Applied Mathematics (SIAM)
- American Geophysical Union (AGU)

Computer Skills

- *Languages:* Python, C, C++, MATLAB, with experience in R
- *HPC skills:* MPI, OpenMP and Elemental Distributed Memory Linear Algebra library
- *Machine Learning Packages:* Numpy, Scipy, Statsmodel, Scikit-Learn, Pandas, PyTorch
- *Big Data Packages:* Hadoop and Spark
- *Data Visualization packages/Softwares*: Matplotlib, Plotly, Tableau
- *Data handling packages*: netCDF4, HDF5
- *Presentation Skills:* Powerpoint/Excel/Word or LaTeX for reports, papers and presentations.
- *Operating Systems:* Unix/Linux, Mac and Windows.

Professional references

- Dr. Abani Patra
  Director, Data Intensive Studies Center
  Tufts University, Medford, USA
  abani.patra@tufts.edu
- Dr. Manoj Babu
  Assistant Professor
  WMG, University of Warwick, UK
  m.babu@warwick.ac.uk