Arun Sharma

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EDUCATION

UNIVERSITY OF MINNESOTA, TWIN CITIES — Minneapolis, MN
Doctor of Philosophy (Ph.D.) in Computer Science — Expected December 2024
Advisor: Prof. Shashi Shekhar | Spatial Computing Research Group, UMN

STATE UNIVERSITY OF NEW YORK AT BUFFALO — Buffalo, NY
Master in Science (M.S.) in Computer Science — August 2016 - June 2018

WORK EXPERIENCE

ESRI - ENVIRONMENTAL SYSTEMS RESEARCH INSTITUTE — Redlands, CA
Software Engineering Intern - Ph.D. (Manager: Dr. Erik G. Hoel) — June 2023 – August 2023

- Developed and executed a graph-based representation framework for maritime traffic flow, converting navigational waypoints to nodes and shipping lanes to edges
- Extracted standardized traffic patterns, leading to a 30 % improvement in route optimization and efficiency in open waters.
- Developed a state-of-the-art LSTM encoder-decoder with evidential deep learning (EDL) for anomaly detection in vessel trajectory prediction and classification by estimating data and model uncertainties, improving accuracy from 55 % to 86 %.

UNIVERSITY OF MINNESOTA, TWIN CITIES — Minneapolis, MN
Graduate Research Assistant — January 2020 – Present

- Led a project to apply physics-aware parameters for detecting irregular mobility patterns in maritime and road networks
- Optimized algorithms to detect complex patterns like clandestine rendezvous, enhancing user insights with GIS tools.
- Developed and implemented an algorithm to detect aberration patterns in multi-attribute trajectory gaps, substantially reducing processing time for anomaly detection tasks.

STATE UNIVERSITY OF NEW YORK AT BUFFALO — Buffalo, NY
Graduate Project Assistant — June 2017 – August 2017

- Designed and implemented an end-to-end framework to analyze climate change impacts using scientific data (NetCDF) on Apache Spark and Hadoop. The framework incorporates a Gaussian process-based algorithm to detect extreme temperature events, including excessive heat and winter storms.
- Proposed an efficient algorithm to reduce the complexity of GP regression models from $O(N^3)$ to $O(N^2)$ using matrix factorization, scaled on Apache Spark, enhanced data interpretation with geographic visualizations, user-friendly UX/UI, and reproducible Jupyter Notebooks for data scientists.

TECHNICAL SKILLS

Languages: Python, Java, R, SQL, Scala, C/C++
Machine Learning: MLflow, XGBoost, MLlib, LLMs, RAG, LangChain, VectorDB
Big Data: Spark, Hadoop, Flink, Presto, Trino, Hive, Pig, HDFS, Kafka, PySpark, Databricks Delta Lake, Docker, Kubernetes
Deep Learning: TensorFlow, Keras, PyTorch, JAX, MXNet, ONNX, AWS Sagemaker, Jumpstart, Bedrock

HONORS AND ACHIEVEMENTS

DOCTORAL DISSERTATION FELLOWSHIP — **2022 - 2023**
University of Minnesota, Twin Cities

SELECTED PUBLICATIONS

[1] Abnormal Trajectory-Gap Detection
ACM Transactions in Intelligent Systems and Technology, 2024 (Accepted with Minor Revision)
Arun Sharma and Shashi Shekhar

[2] Analyzing Trajectory Gaps for Possible Rendezvous Regions

ACM Transactions in Intelligent Systems and Technology, 2022
Arun Sharma and Shashi Shekhar

[3] Towards a Tighter Bound on Possible-Rendezvous Areas: Preliminary Results
30th International Conference on Advances in Geographic Information Systems, 2022
Arun Sharma, Jayant Gupta, Subhankar Ghosh, and Shashi Shekhar

[4] Abnormal Trajectory-Gap Detection: A Summary (Short Paper)
15th International Conference on Spatial Information Theory (COSIT 2022)
Arun Sharma, Jayant Gupta, and Shashi Shekhar

[5] Spatiotemporal Data Mining: A Survey
Handbook of Spatial Analysis for the Social Sciences, Edward Elgar, 2022
Arun Sharma, Zhe Jiang, and Shashi Shekhar

[6] Analyzing Trajectory Gaps for Possible Rendezvous: A Summary of Results
30th International Conference on Advances in Geographic Information Systems, 2022
Arun Sharma, Xun Tang, Jayant Gupta, Majid Farhadloo and Shashi Shekhar

[7] WebGlobe: A cloud-based framework for interacting with climate data
International Workshop on Analytics for Big Geospatial Data (SIGSPATIAL) 2018
Arun Sharma, SM Arshad Zaidi, Varun Chandola, Melissa R Dumas, Budhendra L Bhaduri

[8] Understanding COVID-19 effects on mobility: A community-engaged approach
25th AGILE Conference on Geographic Information Science, 2022
Arun Sharma, Majid Farhadloo, Yan Li, Jayant Gupta, Aditya Kulkarni, and Shashi Shekhar

[9] Towards Spatially-Lucid AI Classification in Non-Euclidean Space: An Application for MxIF Oncology Data
SIAM International Conference on Data Mining, 2024 (Accepted)
M Farhadloo, **Arun Sharma,** J. Gupta, A. Leontovich, S N. Markovic, and Shashi Shekhar

TEACHING EXPERIENCE

CSCI 8715 Spatial Data Science Research **Spring 2024**
Graduate Teaching Assistant

CSCI 8715 Spatial Data Science **Fall 2019**
Graduate Teaching Assistant

CSCI 8715 Database Systems **Spring 2019**
Graduate Teaching Assistant

CSCI 8715 Data Structure and Algorithms **Fall 2018**
Graduate Teaching Assistant

SERVICE AND LEADERSHIP

Monitoring COVID-19 for Minnesota Management and Budget **2020-2021**

- Reporting State-Level Mobility Traffic to Research Scientists and Policymakers}
- Published periodic mobility reports for informed decision-making by domain experts.
- Advised multiple high school students who are considering a research career.

INVITED PRESENTATIONS

RENDEZVOUS PATTERN DETECTION FROM AIS SHIP TRAJECTORIES **2020**
University of Maryland, College Park

ADDRESSING DATA DISTORTIONS: A PHYSICS-BASED APPROACH **2023**
University of Michigan, Ann Arbor