Akshay Kale

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Research Interests

Explainable Artificial Intelligence, Data Science, Machine Learning.

Education

2019 - Present	**University of Nebraska**, Omaha, NE. Information Technology, Doctor of Philosophy Dissertation: Developing Interpretable Methods for Machine Learning Models to Identify Bridge Maintenance Patterns
2016–2019	**University of Nebraska**, Omaha, NE. Computer Science, Master of Science Thesis: Identifying predictors of bridge deterioration in the United States from a data science perspective
2013-2015	**University of Mumbai**, India. Mathematics Master of Science
2010-2013	**University of Mumbai**, India. Mathematics Bachelor of Science

Research Experience

2019–Present — **Graduate Assistant**, *University of Nebraska, Omaha*.

- Collaborated with civil engineers, bridge managers, and researchers to develop and implement machine learning and deep learning models for prediction of bridge maintenance, resulting in 3 research publications and other ongoing work.
- Trained bridge maintenance machine learning models, with 98% accuracy, an improvement of 10% compared to state-of-the-art.
- Communicated analysis results through interactive visualizations, written reports, and presentations.
- Introduced new explainability and interpretability research directions in data science and machine learning, focusing on building tools for decision-making.

2017–2019 — **Research Assistant**, *University of Nebraska, Omaha*.

- Developed novel metrics for measuring bridge component deterioration performance and identified bridge maintenance types from raw inspection records, resulting in a research publication.
- Created web-crawlers for scraping precipitation, snowfall, freeze-thaw, and bridge inspection-related records, resulting in a collection of over 21 million records.
- Designed, developed, and maintained No-SQL MongoDB of over 21 million survey inspection records, reducing development time by 80
- Created novel combinations of deterioration analysis and modeling techniques for over 600,000 bridges.
- Trained deep learning, light boosting, xgboost, gradient boosting, and random forest classifiers to determine with 95% accuracy.

Publications Journals (Peer-reviewed)

2021	Kale, Akshay; Ricks, Brian; Gandhi, Robin. "New Measure to Understand and Compare Bridge Conditions Based on Inspections Time-Series Data." Journal of Infrastructure Systems, vol. 27, no. 4, Dec. 2021, p. 04021037. DOI.org (Crossref), https://doi.org/10.1061/(ASCE)IS.1943-555X.0000633.
2023	Kale, Akshay; Kassa, Yonas; Ricks, Brian; Gandhi, Robin. "A Comparative Assessment of Bridge Deck Wearing Surfaces: Performance, Deterioration, and Maintenance." Applied Science. vol. 13, Oct. 2023, 108833. https://doi.org/10.3390/app131910883

Publications Conference (Peer-reviewed)

2023   Ramsey, A., Kale, A., Kassa, Y., Gandhi, R., & Ricks, B. (2023, May). "Toward Interactive Visualizations for Explaining Machine Learning Models". In Proceedings of the Information Systems for Crisis Response and Management Conference, Omaha, NE, USA (pp. 28-31).

Publications (In progress)

2024   Kale, A.; Kassa, Y; Ricks, B; Gandhi, R; Haas, C. Exploring Performance and Explainability of Machine Learning Models for Bridge Maintenance

2024   Kale, A.; Ricks, B; Gandhi, R; Haas, C. Building Decision Trees to Analyze Bridge Health and Maintenance

2024   Chin, O.; Kale, A.; Lacy, B; Linzel, D; Sim, C; Khazanchi, D; Haas, C; Ricks, B; Gandhi, R. Examination of bridge maintenance patterns across US states using actuarial methods

2024   Kale, A.; Dynamic Optimization of Bridge Maintenance Strategies Using Reinforcement Learning: A Q-Learning Approach for Integrating Age, State, Budget, and Intervention Costs in Structural Health Monitoring

Presentations

2023   How to select Machine Learning model for Bridge Maintenance Pattern, Akshay at Bridging Big Data Workshop

2023   Developing Interpretable Methods for Machine Learning Models to Identify Bridge Maintenance Patterns by Kale, Akshay at University of Texas at Dallas

2022   Interpretable Machine Learning Models by Kale, Akshay at MWBPP

2022   Interpretable models at the Student Research and Creative Activity Fair organized by University of Nebraska at Omaha

2021   Building interpretable methods to analyze bridge health, deterioration, and maintenance by Kale, Akshay at MBDH Regional Community Meeting

2019   Understanding the effects of various factors on Bridge Condition Rating at the Bridging Big Data Workshop organized by University of Nebraska at Omaha and University of Nebraska at Lincoln

2019   Understanding the effects of Precipitation on Bridge Health in the US at the Student Research and Creative Activity Fair organized by University of Nebraska at Omaha

Workshops and Seminars

2023   Participated in the Bridging Big Data Workshop organized by University of Nebraska at Omaha and University of Nebraska at Lincoln

2023   Participated in the Information Systems for Crisis Response and Management organized by University of Nebraska at Omaha

2022   Participated in the Bridging Big Data Workshop organized by University of Nebraska at Omaha and University of Nebraska at Lincoln

2021   Participated in the Bridging Big Data Workshop organized by University of Nebraska at Omaha and University of Nebraska at Lincoln

2020   Participated and presented at the Student Research and Creative Activity Fair organized by University of Nebraska at Omaha

2019   Participated in the Bridging Big Data Workshop organized by University of Nebraska at Omaha and University of Nebraska at Lincoln

2017   Participated in the Bridging Big Data Workshop organized by University of Nebraska at Omaha and University of Nebraska at Lincoln

Awards and Scholarship

2019   Best Visualization Award Runners Up Datapalooza, Data Analytics competition 2019 Conducted by Mutual of Omaha in collaboration with Holland Computing Center, Lincoln, Nebraska.

2016–2017   University of Nebraska at Omaha - Advantage Scholarship

2013   Best Speaker - Annual Debate Competition Conducted by Pillai College of Arts, Commerce, and Science, University of Mumbai, India