Mohamed Badhrudeen Mohamed Rawoof

Boca Raton, FL
https://mohamedbadhrudeen.github.io

EDUCATION

University of Illinois at Chicago (UIC)   **Aug. 2017 - May 2022**
PhD, Civil Engineering   *Chicago, IL*
- 4.0/4.0 GPA; Dissertation title: "Urban Intelligence: Tools and Models for Smart Cities" under the supervision of Dr. Sybil Derrible.
- **Relevant Courses**: Causal Inference and Learning, Transportation Project Appraisal, Introduction to Data Science, Transportation System Analysis, Urban Travel Forecasting, Advanced Transportation Demand Analysis, GIS for Planners, Cities and Sustainability.

National Institute of Technology Karnataka   **Sep. 2011 - July 2013**
MTech, Transportation Engineering   *Mangalore, India*
- 7.94/10.0 CGPA; Thesis title: "Travel Time Estimation and Prediction using Data Fusion."

Government College of Engineering Salem   **Aug. 2007 - May 2011**
BE, Civil Engineering   *Salem, India*
- 8.66/10.0 CGPA; Graduated with distinction.

RESEARCH EXPERIENCE

Intelligent Transportation Systems Laboratory, Florida Atlantic University   **July 2022 – Present**
Postdoctoral Research Fellow   *Boca Raton, FL*
- Studying the car following and lane changing behavior of Electric Vehicles (EV) in an of automated driving setting when interacting with the human drivers. Collected the field data to study the driving behavior of EVs. Understanding the impact of different gap settings on the overall traffic behavior like capacity to accurately model the behavior.
- Conducted an extensive literature review to aid Florida Department of Transportation (FDOT) in developing a plan for the implementation of Connected Vehicles Pilot project and Traffic Incidence Management project. Suggested a different number of options for the data collection appropriate to FDOT's requirements for the project evaluation.

Adjunct Faculty   *Boca Raton, FL*
- Taught a class of 44 students the course titled "Introduction to Transportation Engineering" in the Fall of 2022.

Complex and Sustainable Urban Networks Lab, University of Illinois at Chicago   **Aug. 2017 – Dec. 2021**
PhD Candidate   *Chicago, IL*
- Developed a methodology to group cities that have similar topological and geometrical properties of urban road networks in collaboration with researchers from TU Delft, Gustave Eiffel University, and Sharif University of Technology.
- Gathered 4395 scientific articles related to smart cities and urban infrastructure – energy, transport, water, technology – from Scopus database and extracted and encoded articles' objective in aa knowledge graph. Performed clustering analysis by making use of Hausdorff distance to identify similar articles based on their objectives.
- Developed a conceptual model – urban intelligence – for smart cities by adopting integrated systems' approach to act as decision support system for policymakers in designing and prioritizing sustainable smart city policies.
- Served as a reviewer for multiple reputed scientific journals e.g., Physica A, Scientific Reports, Journal of Infrastructure Systems, and The Institution of Engineers (India): Series A.

Graduate Research Assistant   *Chicago, IL*
- Utilized a statistical technique (Mann-Kendall) to identify depopulating places in Illinois and characterized the places based on socio-economic and spatial variables.
  - Collected population data from US census and found 19.4% of all places in Illinois were depopulating.

- o Analyzed socio-economic and spatial variables using machine learning method to determine location-specific policy variables to understand depopulation. Contributed to the writing of first draft of final report.
- Developed a framework to standardize CAD to GIS conversion process that minimizes information loss.
  - o Conducted literature review to identify existing conversion methods and their limitations.
  - o Illustrated the use of framework by converting underground stormwater infrastructure CAD data into georeferenced GIS data.
  - o Developed a tool using decision tree learning algorithm to automatically detect errors in the converted GIS data. No such tools are currently available.
- Mentored an undergraduate student on creating synthetic CAD data for developing machine learning tools.

PROFESSIONAL EXPERIENCE

Intelligent Transportation Systems Lab, Indian Institute of Technology Madras   Aug. 2013 – June 2017
Project Officer   *Chennai, India*
- Operated and evaluated the performance of two traffic sensors (TIRTL and Gridsmart) under heterogenous traffic conditions; organized and conducted 7 traffic surveys at different locations to assess sensors' performance under different traffic conditions, e.g., arterial roads, highways etc.
- Developed a probabilistic model for time headway distributions for different vehicle pairs using empirical data to improve VISSIM simulation; analyzed traffic characteristics to modify the existing Robertson's platoon dispersion model that accurately reflects the heterogeneous behavior to help improve the design of coordinated signal systems for Indian traffic conditions.
- Conducted 70+ interviews to collect data to assist in developing a freight trip generation model for city of Chennai, India.
- Processed GPS data to extract the acceleration/deceleration profiles from public transit buses to map the location of bus stops and signalized intersections.
- Published 3 research papers and presented them at national and international conferences.
- Co-authored a technical report titled "Development and Evaluation of Traffic Sensors under Indian Traffic Conditions".

Intelligent Transportation Systems Lab, Indian Institute of Technology Madras   Oct. 2012 – Mar. 2013
Intern
- Developed a method to estimate link's aggregate travel time by integrating sensors' data with data from probe vehicles. Upon validating the method using VISSIM simulation data, more than 20% increase in accuracy was observed. Utilized the estimated travel time to predict traffic congestion using 'grey systems theory'.

TEACHING EXPERIENCE

Department of Civil, Materials, and Environmental Engineering   Jan. 2018 – Dec. 2021
Teaching Assistant   *Chicago, IL*
Water Resource Engineering: Spring 18', 19' and Fall 21'
- Delivered lectures on seepage analysis, flow nets to a classroom of 40+ students.
- Conducted labs to a class of 50+students, which involved explaining theories and lab procedures.
- Engaged with students on a weekly basis to help them with homework.
- Taught students software such as SeepW, ArcGIS, and EPANET.
- Graded the students' homework on time.

Mechanics of Materials: Spring 20'
- Supervised midterm exams.
- Kept a weekly office hour to engage with students and help them with homework.
- Graded the students' homework on time.

JOURNAL PUBLICATIONS
- **Badhrudeen M**, and Derrible S. "Knowledge graph extraction from the smart cities literature in the context of urban infrastructure." *In Preparation.*
- **Badhrudeen M,** Derrible S, Verma T, Kermanshah A, and Furno A. "A Geometric classification of World Urban Road Networks." *Urban Science,* 2022, 6(1), 11.

- **Badhrudeen M**, Boria E, Fonteix G, Derrible S, and Siciliano M. "The C2G Framework to convert infrastructure data from Computer Aided Drawing (CAD) to Geographic Information Systems (GIS)." Informatics, 2022, 9(2),42.
- Balasubramani BS, **Badhrudeen M**, Derrible S, and Cruz I. "Smart data management of urban infrastructure using Geographic Information Systems." *Journal of Infrastructure Systems*, 2020, 26(4).
- **Badhrudeen M**, Vanajakshi LD, Subramanian SC, Sharma A, Thomas H. "Recurrence Theory – Based Platoon Analysis under Indian Traffic Conditions." *Journal of Transportation Engineering, Part A: Systems* 2018, 144(8).
- **Badhrudeen M**, Thomas H, Vanajakshi LD, Sharma A. "Platoon Dispersion Analysis based on Diffusion theory." *6th International Conference on Transportation and Traffic Engineering (ICTTE),*124, 01003, 2017.
- **Badhrudeen M**, Raj J, Vanajakshi L.D. "Short Term Prediction of Traffic Parameters -- Performance Comparison of Data Driven and Less Data Required Approaches." *Journal of Advanced Transportation,* 2016, 50(4), pp. 647-666.

CONFEERENCE PUBLICATIONS AND PRESENTATIONS

- **Badhrudeen M**, Naranjo N, Movahedi A, and Derrible S. "Machine learning based tool for identifying errors in CAD to GIS converted data." In: Ha-Minh C., Dao D., Benboudjema F., Derrible S., Huynh D., Tang A. (eds) CIGOS 2019, *Innovation for Sustainable Infrastructure*. Lecture Notes in Civil Engineering, vol 54. Springer, Singapore.
- **Badhrudeen M**, Ramesh V, Vanajakshi LD. "Headway Analysis using Automated Sensor Data under Indian Traffic Conditions." *11th Transportation Planning and Implementation Methodologies for Developing Countries*, Transportation Research Procedia, 2016, 17, pp. 331- 339.
- Maripini, H, **Badhrudeen, M**, Vanajakshi, LD. "Analysis of Indian Traffic Characteristics using Automated Sensor Data." *4th Conference on Transportation Systems Engineering and Management*, Anna University, Chennai, India, May 12 – 13, 2017.
- **Badhrudeen M**, Derrible S, Verma T, Kermanshah A, and Furno A. "A Geometric classification of World Urban Road Networks." *Presented at Christpher B. and Susan S. Burke Civil Engineering Graduate Student Poster Competition*, University of Illinois at Chicago, April 19, 2019.
- **Badhrudeen M**, Boria E, Fonteix G, Derrible S, and Siciliano M. "A framework to convert infrastructure data from Computer Aided Drawing (CAD) to Geographic Information Systems (GIS): C2G Framework." *Presented at the GISDay, Urban Data Visualization lab, College of Urban Planning and Public Affairs, UIC,* 2018.
- **Badhrudeen M**, Raj J, Vanajakshi LD. Short Term Prediction of Traffic Parameters – Performance Comparison of Data Driven and Less Data Required Approaches. *Transportation Research Board 93rd Annual Meeting*, Washington DC, USA, January 12 – 16, 2014.
- Kalaanidhi S, Gunasekaran K, **Badhrudeen M**, Velmurugan S. Review of Data Collection Methods for Establishing the Capacity of Intercity Highway. *Presented at the 11th Transportation Planning and Implementation Methodologies for Developing Countries*, IIT Bombay, Mumbai, India, December 10 – 12, 2014.
- **Badhrudeen M**, Thomas H, Vanajakshi LD, Sharma A. "Platoon Dispersion Analysis based on Diffusion theory." *6th International Conference on Transportation and Traffic Engineering (ICTTE)*,124, 01003, 2017.

TECHNICAL REPORT

- "**Development and Evaluation of Traffic Sensors under Indian Traffic Conditions**", Center of Excellence in Urban Transport, Indian Institute of Technology Madras, Sponsored by Ministry of Urban Development, Government of India, 2016. Available at: https://coeut.iitm.ac.in/Sensor_Evaluation%20Report.pdf.

SKILLS & INTERESTS

- **Computer:** Python, R, VISSIM, MATLAB, GitHub, AutoCAD, ArcGIS, EPANET (Water distribution systems modeling software), SeepW (groundwater flow modeling program).
- **Analytical:** Statistical analysis, probabilistic modeling, network analysis, predictive modeling, simulation, web scraping, natural language processing, data science.
- **Soft:** Organizational ability, quick learner, literature review, presentation, multitasking, teamwork, problem solving.
- **Language:** English (fluent), Tamil (native), Hindi (basic).
- **Interests:** eastern philosophies; sustainability; meditation.

RELEVANT COURSE PROJECTS

Transportation System Analysis

- Developed an optimization algorithm to identify individual rides that has the potential to be converted into shared rides.
- Collected individual rides data from a dynamic rideshare platform called RideAustin.
- Grouped the individual rides with others based on the waiting time and distance restrictions.

- Developed method grouped 85% of individual trips, thus reducing 2200 km from the total distances travelled.

Causal Inference and Learning

- Analysed the socio-economic and travel behaviour variables to understand the causal nature of mode choice behaviour of individuals: car, bus, rail, bike, etc.
- Used the 2017 National Household Travel Survey data for this study.
- Employed different causal structure learning methods including Bayesian networks-based algorithms (PC and FCI) to identify causal structure influencing the mode choices.
- Overcame the problem of mixed data types by adopting Copula method, which was implemented in R to estimate the covariance matrix for mixed data types.
- Combined the covariance matrix to the PC algorithm and FCI method to learn the causal representations of different variables.