Mohamed-Badhrudeen Mohamed-Rawoof

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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**: Cities and Sustainability, Transportation Project Appraisal, Introduction to Data Science, Transportation System Analysis, Causal Inference and Learning, Urban Travel Forecasting, Advanced Transportation Demand Analysis.

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.

SKILLS & INTERESTS

- **Computer:** Python, R, 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; mythologies; meditation.

RESEARCH EXPERIENCE

Complex and Sustainable Urban Networks Lab, UIC   **Aug. 2017 – Dec. 2021**
PhD Candidate   *Chicago, IL*
Smart Cities -
- Conducted research on smart cities specifically on transportation in collaboration with researchers from other educational institutions.
- 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 scientific articles related to smart cities and urban infrastructure – energy, transport, water, technology – from Scopus database.
- Analyzed the articles using natural language processing methods to study articles' objectives by organizing information using Knowledge Graphs.
- Used a distance measure (Hausdorff distance) to calculate similarities between Knowledge Graphs.
- Employed clustering technique (Hierarchical clustering) to group the articles based on their objectives. 10 classes of objectives emerged from analyzing 4395 scientific articles.

Urban Intelligence -
- Developed a conceptual model – urban intelligence – 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.

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 places in Illinois to be depopulating.
  - 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.
  - Conducted literature review to identify existing conversion methods and their limitations.
  - Illustrated the use of framework by converting underground stormwater infrastructure CAD data into georeferenced GIS data.
  - 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 (ITS) Lab, IIT Madras   **Aug. 2013 – June 2017**
Project Officer   *Chennai, India*
- The lab is sponsored by Indian government to enable real-time traffic monitoring and evaluation, and to encourage interdisciplinary research in transportation.
- Managed two traffic sensors (TIRTL and Gridsmart) and evaluated their performance under heterogenous traffic conditions.
  - Organized and conducted 7 surveys at different locations to assess sensors' performance under different traffic characteristics.
  - Effectively communicated performance issues to technical support team to resolve them in a timely manner.
  - Coordinated with municipality to organize and carry out sensors' installations.
  - Briefed my supervisor on the status of the sensors and research progress on a weekly basis.
- Independently carried out research to develop greater understanding of Indian traffic characteristics.
  - Created a probabilistic model for time headway distributions for different vehicle pairs using empirical data to improve VISSIM simulation model.
  - Analyzed traffic characteristics to modify Robertson's platoon dispersion model that accurately reflects the heterogeneous behavior to help improve the design of coordinated signal systems for Indian traffic conditions. The research was in collaboration with a researcher from Iowa State University.
  - Studied the effect of amount of data in predicting traffic parameters using two models: one requires more data (ANN) and other less data (Grey theory). The results showed grey model achieved similar accuracy as ANN with less data.
  - Published 3 research papers and presented them at national and international conferences.
- Collaborated with graduate students on a variety of activities including data collection, coding, and literature review.
- Assisted my team with organizing the Indo-US workshop on Big Data Analysis for Transportation Engineering Systems hosted by IIT Madras.
- Interviewed 70+ survey participants to collect qualitative data to assist the research team in developing freight trip generation model for city of Chennai, India.
- Co-authored a technical report titled "Development and Evaluation of Traffic Sensors under Indian Traffic Conditions".

Intelligent Transportation Systems (ITS) Lab, IIT 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**

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 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)." *Under Review.* Informatics, 2022.
- 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.

OTHER PUBLICATIONS

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." *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." *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. *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.