Michael P. Wilbur

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SUMMARY

I am a graduate student (PhD) in computer science at Vanderbilt University where I work as a research assistant at the Institute for Software Integrated Systems. My research focus is data-driven analysis and resilient distributed cyber-physical systems for smart and connected communities.

RESEARCH INTERESTS

Data-driven energy optimization for mixed-fleet transit systems: Through the use of predictive machine learning models and reinforcement learning I am developing a real-time dynamic dispatching system to improve energy efficiency and reduce costs for the public bus system in Chattanooga, TN.

Privacy preserving distributed transportation applications: In this work I have optimized traditional routing algorithms for distributed fog networks by using predictive models to guide the search path and therefore limit communication overhead. By training the predictive models with federated learning, users maintain greater control over their data.

Resilient distributed fog networks for smart cities: I have developed lightweight anomaly detection and validation approaches for streaming sensor data in hybrid fog-cloud architectures.

Integrating micro-mobility and micro-transit services with fixed line transit: In this work I am looking at the interaction of on-demand micro-mobility services (dock-less scooter, bicycles, on-demand ride-share) with existing Fixed-Route Transit (FRT) systems. I am using data-driven methods for micro-mobility to bridge the gap between ridership and coverage in Nashville and Chattanooga TN.

EDUCATION

Vanderbilt University, Nashville, TN (VU) *2018 – Current*
Doctor of Philosophy, Computer Science

Northwestern University, Evanston, IL (NU) *2017 – 2018*
Master of Science, Civil and Environmental Engineering

University of Notre Dame, South Bend, IN (ND) *2008 – 2012*
Bachelor of Science, Civil and Environmental Engineering

RESEARCH EXPERIENCE

Graduate Research Assistant *2018 – Current*
Institute for Software Integrated Systems, VU

- Effective online data storage mechanisms for high-fidelity streaming spatio-temporal data.
- Middleware for decentralized fog networks for smart cities.
- Fast real-time anomaly detection for data integrity and security of smart city data.
- Multi-modal decentralized active prediction and routing in urban transportation networks.
- Energy optimization in transit networks.

- Micro-mobility analytics and modeling.

2017 - 2018

Graduate Research Assistant
Northwestern University Transportation Center (NUTC), NU

- Transportation analytics.
- Multi-modal routing and analysis.
- Data-driven structural health monitoring.

PUBLICATIONS

Journal Articles

- W. Barbour, **M. Wilbur**, R. Sandoval, C. Van Geffen, B. Hall, A. Dubey, and D. Work. Data Driven Methods for Effective Micromobility parking." In Proceedings of the Transportation Research Board Annual Meeting, Washington, D.C., 2020.
- Chen, Y., Hyland, **M., Wilbur**, M. P., & Mahmassani, H. S. (2018). Characterization of Taxi Fleet Operational Networks and Vehicle Efficiency: Chicago Case Study. Transportation Research Record, 2672(48), 127-138.

Conference Publications

- Ayman, A., **Wilbur, M.,** Sivagnanam, A., Pugliese, P., Dubey, A., & Laszka, A. (2020). Data-Driven Prediction of Route-Level Energy Use for Mixed-Vehicle Transit Fleets. 2020 IEEE International Conference on Smart Computing (SMARTCOMP) (In Proceedings). IEEE.
- **Wilbur, M.,** Samal, C., Talusan, J. P., Yasumoto, K., & Dubey, A. (2020, May). Time-dependent Decentralized Routing using Federated Learning. In 2020 IEEE 23rd International Symposium on Real-Time Distributed Computing (ISORC) (pp. 56-64). IEEE.
- Talusan, J. P., **Wilbur, M.,** Dubey, A., & Yasumoto, K. (2020, April). On Decentralized Route Planning Using the Road Side Units as Computing Resources. In 2020 IEEE International Conference on Fog Computing (ICFC) (pp. 1-8). IEEE.
- W. Barbour, **M. Wilbur,** R. Sandoval, A. Dubey, and D. Work. Streaming computation algorithms for spatiotemporal micromobility service availability." In Proceedings of the International Workshop on Design Automation for CPS and IoT, Sydney, Australia, 2020.
- **Wilbur, M.,** Dubey, A., Leão, B., & Bhattacharjee, S. (2019, June). A decentralized approach for real time anomaly detection in transportation networks. In 2019 IEEE International Conference on Smart Computing (SMARTCOMP) (pp. 274-282). IEEE.
- Talusan, J.P., Tiausas, F., Yasumoto, K., **Wilbur, M.,** Pettet, G., Dubey, A., & Bhattacharjee, S. (2019, June). Smart transportation delay and resiliency testbed based on information flow of things middleware. In 2019 IEEE International Conference on Smart Computing (SMARTCOMP) (pp. 13-18). IEEE.

Journal Articles Under Review (Pre-prints Available)

- **Wilbur, M.,** Ayman, A., Ouyang, A., Poon, A., Kabir, R., Vadali, A., Pugliese, P., Freudberg, D., Laszka, A., and Dubey, A. Impact of COVID-19 on Public Transit Accessibility and Ridership. In Preprint at Arxiv, 2020. (Submitted to Transportation Research Board Annual Meeting, 2021).
- Sivagnanam, A., Ayman, A., **Wilbur, M.,** Pugliese, P., Dubey, A., and Laszka, A. Minimizing Energy Use of Mixed-Fleet Public Trnaist for Fixed-Route Service, in Preprint at Arxiv, 2020.

PRESENTATIONS

- **Wilbur, M. 2020.** Time-dependent Decentralized Routing using Federated Learning. ISORC 2020.
- **Wilbur, M. 2019.** “High Integrity and Secure Spatiotemporal Decision Procedures for Large Scale Urban Systems.” Ph.D. Forum SMARTCOMP 2019.

- **Wilbur, M. 2019.** “A Decentralized Approach for Real-Time Anomaly Detection in Transportation Networks”. SMARTCOMP 2019

AWARDS

- NSF Student Travel Grant – SMARTCOMP 2019

LEADERSHIP

Nashville Metro Data Architecture: designed and implemented Nashville Metro’s main data storage architecture. I provide continued support and guidance for the project. Architecture includes efficient streaming and long term storage of geospatial data collected by the city, deployed on AWS.

Structural engineer: worked for four years at a structural engineering firm in Chicago, IL. Advanced from entry engineer to lead project engineer where I led a structural design team of four. Was main point of contact for all coordination with architecture and construction teams on our projects. Managed projects ranging up to $100,000 for structural services, $20 million total construction cost.

Greater Nashville Regional Council (GNRC): I mainly provide insight into modelling methods used in my research in continued discussions regarding the GNRC’s transportation improvement programs.

TEACHING

Guest Lecturer *Fall 2019*
CS 5891: Resilient Distributed Computing

- Lecture on resilient real time stream processing.
- Helped with preparation of course materials.

Vanderbilt Teaching Assistant *Fall 2018*
CS 1101: Programming and Problem Solving

- Guest lectures.
- Assisted students with coursework and grading.

PROFESSIONAL EXPERIENCE

Project Engineer *2012 – 2017*
Johnson Wilbur Adams Inc, Wheaton, IL

- Advanced to lead design engineer and project manager.
- Provided structural engineering design and analysis services.
- Seismic and wind modeling and analysis.
- Lead project engineer. Highlighted projects include multiple 40,000 sf LA Fitness facilities, Red Robin Restaurants and community centers (Naperville and Woodridge, IL).

Project Management Intern
Clark Construction LLC, Bethesda, MD *Summer 2011*

- Worked on two 14 story apartment complexes.
- My role was implementing and monitoring the LEED requirements for project.

Civil Engineering Intern
City of Elmhurst, Elmhurst, IL *Summer 2010*

- Design and survey of roads.

PROFESSIONAL LICENSING AND SOCIETIES

- Graduate Student Member, IEEE (2019-present)
- Certified Engineer In Training (E.I.T)
- LEED Green Associate

SERVICE

Appalachia Building Project: spent a week participating in volunteer home repair in Kentucky. *March 2011*

Gleaners Community Food Bank: volunteered for ten weeks organizing, preparing and delivering lunches for the Summer Feeding Program. This program provided lunches to summer programs for youth in need. *Summer 2009*