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Fangzhou Sun

Ph.D. Candidate in Computer Science

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EDUCATION

- **Ph.D., Computer Science,** Vanderbilt University, Nashville, TN, USA — May 2018 (Expected)
- **M.S., Computer Science,** Vanderbilt University, Nashville, TN, USA — Aug. 2015
- **B.S., Computer Science and Technology,** Nanjing University, Nanjing, Jiangsu, China — July 2013

SUMMARY

- Multi-timescale data analytics mechanisms for predicting and optimizing the performance of transit systems.
- Deep learning models for identifying non-recurring traffic congestion.
- Cyber-attack detection system for web applications that combines machine learning and unit tests.
- Demonstrated research, mobile and web applications in various global venues that include journals, conferences, workshops, and demos.

PROJECTS

Transit Hub – *Predicting and Optimizing the Performance of Urban Mobility* Mar. 2015 - Present
(Funded by the National Science Foundation (NSF) and the Siemens Corp.)

- Designed a *convolutional neural network* to identify non-recurring traffic congestion, achieving a 98.73% accuracy with low false positive and false negative rates [3].
- Developed a short-term bus delay prediction model that combines unsupervised clustering analysis and *Kalman filters*. The root-mean-square-error is only 60 seconds, which outperforms the state-of-the-art in accuracy [1,4].
- Applied long-term predictive analytics on historical *General Transit Feed Specification* (*GTFS*) and time-point bus data through MongoDB using *scikit-learn* and *Matplotlib Python* libraries [1,4].
- Developed unsupervised mechanisms for optimizing the on-time performance of fixed schedule transit vehicles [6].
- Designed and implemented the *T-HUB iOS* App which features route planning, delay estimation and real-time navigation, using *Objective-C*, *Core Data*, *Google Map SDK* for *iOS*, *GTFS*, *GPS* and *RESTful APIs*, and it's used by hundreds of bus riders in Nashville.
- Implemented a graph visualization web front-end dashboard using *HTML*, *JavaScript*, *Google Map JavaScript API*, *D3.js*, *Bootstrap*, *Socket.IO* with a *Python Flask RESTful* server for Nashville Metro Transportation Authority.

Robust Software Modeling Tool - *Detecting Cyber-Attacks Using Machine Learning and Unit Tests* Oct. 2014 – Oct. 2015
(Funded by the Office of Naval Research (ONR))

- Developed a web service that applies various *machine learning* algorithms (*naive Bayes*, *Random Forests* and *SVM*) to detect the top 10 cyber-attacks from the OWASP [5].
- Captured the data flows in the target application using *aspect-oriented programming* (*AOP*); employed *ElasticSearch*, *Logstash*, *Kibana* (*ELK*) for log parsing, analysis and storage, the *Weka* library for *machine learning*; used *Dockers* and *Containers* to wrap up and deploy the server and applications.
- Created unit testing to evaluate the performance of the *machine learning* classifiers.
- Detected *XSS*, *SQL injection* and *directory traversal* attacks of over 90% accuracy.

Traffic Control System for Cardiology Patients – *Patient Management Using an Advanced Web App* Oct. 2015 - Present

- Designed a traffic control system for Vanderbilt University Medical Center to manage cardiology patients that are needed to be transferred into the hospital or assigned to medical teams.
- Created a *Spring Boot* + *AngularJS* web application using *Java Hipster, WebSocket*.
- Deployed the application as *Docker* containers on *AWS* for beta testing.

Diabetes Patient Tracker - *Tracking the Status of Teenagers with Diabetes with A Mobile App* Aug. 2014 – Apr. 2015

- Developed the *MyDay Pro* iOS app, which helps teenagers with diabetes to track their responses to daily questions as well as blood sugar values, and provides feedbacks.
- Released on App Store in Oct. 2014, used by teens enrolled in a research program of School of Nursing, Vanderbilt.

PUBLICATIONS

Journal Papers

[1] Fangzhou Sun, Abhishek Dubey, Jules White, Aniruddha Gokhale, Transit-Hub: A Smart Public Transportation Decision Support System with Multi-Timescale Analytical Services, Journal of Cluster Computing, Special Issue on Dynamic Data Driven Applications Systems (DDDAS)

Conference Papers

[2] Fangzhou Sun, Abhishek Dubey, Jules White, Deep Neural Networks for Explaining Non-Recurring Traffic Congestion, IEEE BigData 2017 - 3rd Special Session on Intelligent Data Mining, December 11-14, 2017, Boston, MA, USA (to appear)

[3] Fangzhou Sun, Yao Pan, Jules White, and Abhishek Dubey, Real-time and Predictive Analytics for Smart Public Transportation Decision Support System, 2016 IEEE International Conference on Smart Computing, May 18-20, 2016, St. Louis, Missouri, USA (34% acceptance rate)

[4] Fangzhou Sun, Peng Zhang, Jules White, Douglas C. Schmidt, Jacob Staples, and Lee Krause. A Feasibility Study of Autonomically Detecting In-process Cyber-Attacks. 3rd IEEE International Conference on Cybernetics (CYBCONF-2017), Special Session on Cyber Security, June 21-23, 2017, Exeter, UK (35% acceptance rate)

[5] Fangzhou Sun, Chinmaya Samal, Jules White and Abhishek Dubey, Unsupervised Mechanisms for Optimizing On-Time Performance of Fixed Schedule Transit Vehicles, SMARTCOMP2017: Smart Computing Technologies and Applications, May 29-31, 2017, Hong Kong, China (37% acceptance rate)

[6] Aparna Oruganti, Fangzhou Sun, Hiba Baroud, Abhishek Dubey, DelayRadar: A Multivariate Predictive Model for Transit Systems, IEEE Big Data 2016 Conference Special Session on Intelligent Data Mining, December 5-8, 2016, Washington D.C. USA

Workshop Papers

[7] Chinmaya Samal, Fangzhou Sun, Abhishek Dubey, SpeedPro: A Cluster-Based Predictive Model for Urban Traffic Speed Estimation, SmartSys2017: Second International Workshop on Smart Service Systems, May 29-31, 2017, Hong Kong, China

[8] Shashank Shekhar, Subhav Pradhan, Fangzhou Sun, Abhishek Dubey, and Annirudha Gokhale, Empowering the Next Generation City-Scale Smart Systems, In Proceedings of the 2015 IEEE 22nd International Conference on High Performance Computing Workshops (HiPCW), December 19-22, Hyderabad, India

Book Chapter

[9] Shashank Shekhar, Fangzhou Sun, Abhishek Dubey, Aniruddha Gokhale, Himanshu Neema, Martin Lehofer, Dan Freudberg, Transit Hub: A Smart Decision Support System for Public Transit Operations, Internet of Things and Data Analytics Handbook, John Wiley & Sons, 2016

POSTERS AND DEMOS

Posters

[1] Abhishek Dubey, Fangzhou Sun, Chinmaya Samal, Anne Zou, Baosen Zhang, Lillian Ratliff, Liyuan Zheng, Tanner Fiez, Socially Optimal Multi-modal Routing Platform, US Ignite Application Summit 2017

[2] Fangzhou Sun, Abhishek Dubey, PhD Forum: Robust Sensing and Analytics in Urban Environment, SMARTCOMP2017: Smart Computing Technologies and Applications, 2017

[3] Abhishek Dubey, Jules White, Fangzhou Sun, Hiba Baroud, Martin Lehofer, Public Transportation Decision System with Multi-Timescale Analytical Services, 2016 CPS PI Meeting

[4] Fangzhou Sun, Abhishek Dubey, PhD Forum: Heterogeneous and Multi-Domain Data Analytics Platforms for Smart Cities, 2016 IEEE International Conference on Smart Computing, May 18-20, 2016, St. Louis, Missouri, USA

[5] Abhishek Dubey, Subhav Pradhan, Fangzhou Sun, Aniruddha Gokhale, Resilient Platform for Heterogeneous Big Data Driven CPS, NSF Workshop

[6] Abhishek Dubey, Subhav Pradhan, Fangzhou Sun, Aniruddha Gokhale, Gautam Biswas, Martin Lehofer, Dan Freudberg, Platform for Enabling Optimal Multi-Modal Transportation Planning Service, The 2016 Global City Teams Challenge (GCTC) Expo

[7] Fangzhou Sun, Shashank Shekhar, Abhishek Dubey, Himanshu Neema, Aniruddha Gokhale, Sandeep Neema, Jules White, Transit Hub Smart Decision Support System for Public Transportation, The 2015 Global City Teams Challenge (GCTC) Expo

Demos

[8] Cyber Security for Smart Manufacturing, 2017 CSD R&D Showcase Tech Demo

[9] Socially Optimal Multi-modal Routing Platform, US Ignite Application Summit 2017

[10] Transit Hub and City Hub Demo, 2016 CPS PI Meeting

FEATURED SKILLS

- **Languages:** Python, Java, Objective-C, SQL, JavaScript
- **Mobile and Web Development:** iOS Development, AngularJS, Django, Flask, Kibana, Logstash, ElasticSearch
- **Databases:** MySQL, MongoDB
- **Operating Systems:** macOS, Linux