Pablo Guarda

United States

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Education

Carnegie Mellon University (CMU) **Pittsburgh, PA**

PhD in Civil and Environmental Engineering *August 2023*

- Thesis: Inferring demand and supply characteristics of transportation networks through multi-source system-level data
- Award: Tata Consultancy Services (TCS) Presidential Fellowship 2021-2022

Master of Science in Machine Learning *December 2022*

- Coursework: Machine Learning with Large Datasets, Graduate Artificial Intelligence, Convex Optimization, Intermediate Deep Learning, Deep Reinforcement Learning and Control, Probabilistic Graphical Models

University College London (UCL) **London, United Kingdom**

Master of Science in Cognitive and Decision Sciences *July 2017*

- Thesis: Understanding route choice decisions in public transport: Lab experiments in London, UK and Santiago, Chile
- Award: CONICYT Becas Chile Master Fellowship 2016 - 2017

Pontifical Catholic University of Chile (PUC) **Santiago, Chile**

Master of Science in Transportation Engineering *July 2015*

- Thesis: What is behind fare evasion in public transport? An econometric approach
- Coursework: Transportation Economics, Econometrics Theory, Travel Demand Modeling, Transportation Externalities

Bachelor of Science in Industrial Engineering *December 2013*

- Award: John Paul II Foundation Undergraduate Fellowship 2009 - 2013
- Coursework: Linear Algebra, Optimization, Network Flows, Stochastic Models, Simulation, Operations Research

Skills

Programming Languages: Python, R, C#, Bash, Java, Visual Basic
Developer Tools: VS Code, PyCharm, RStudio, Docker, Git, Github, Gitlab, Linux terminal, Eclipse, Spyder, Conda
Data Science: Pandas, Numpy, Scikit-learn, NetworkX, GeoPandas, Tidyverse, SQL, Tableau, QGIS, ArcGIS, Stata, SPSS
Cloud and Parallel Computing: AWS, IBM Cloud, Spark
Simulation and Optimization: SciPy, CVXpy, Matlab, Octave, Arena, Pyomo, Pulp, Gurobi, AMPL, Maple
Deep Learning Frameworks: TensorFlow, PyTorch, Torchvision, Rastervision
Languages: Advanced level in reading, writing and conversational English and Spanish (native)

Professional Experience

Fujitsu Research, Convergence Technologies Lab **Pittsburgh, PA**

Principal Researcher *August 2024 - Present*

- Presented demos to multiple stakeholders on a traffic simulation technology that performs end-to-end optimization for the allocation and pricing of tolls and estimates the local and network-wide impacts of traffic incidents and road closures
- Prototyped a computer vision pipeline for road segmentation in transportation networks, leveraging high-resolution Airbus satellite imagery, Meta's Segment Anything model, and OpenStreetMap road centerlines

Senior Researcher *August 2023 - July 2024*

- Built and led a team of data scientists to successfully integrate the data-driven traffic simulator developed during my PhD into Fujitsu's Social Digital Twin platform, enabling fast, automated and scalable city-wide traffic simulation
- Filed a patent with Carnegie Mellon University researchers and presented a paper at the IEEE ITSC conference on a world-first traffic simulator that can be trained using satellite imagery and multi-source spatiotemporal data
- Developed and deployed a machine learning pipeline that leverages state-of-the-art computer vision algorithms and geospatial packages to estimate road traffic at a city scale using satellite imagery and OpenStreetMap data

AT&T Labs, Network Analytics and Automation **Remote**

Research Intern, PhD *June 2022 - August 2022*

- Implemented a machine learning pipeline to predict cellular traffic using open-source and AT&T proprietary datasets
- Filed a patent of a machine learning system to predict cellular traffic and rank optimal locations to build cellular towers
- Prototyped a web-based tool using Python and Kepler.GL to support AT&T cellular network planning in San Jose, CA

Inter-American Development Bank (IDB) **Santiago, Chile**

External Consultant *February 2018 - July 2018*

- Processed datasets with millions of smartcard transactions and fare evasion records collected from a bus system in Chile
- Trained random forest, support vector machines and logistic regression models to identify bus stops with high evasion

World Resources Institute (WRI), Ross Centre for Sustainable Cities **Washington, DC**

External Consultant *August 2016, August 2017*

- Computed data quality KPIs with scraped data from BRTData.org to improve the website's data collection strategy
- Estimated multiple linear and ordinal logistic regression models to capture the relationship between performance and design elements of bus rapid transit systems worldwide using R and BRTData.org data

Transport Research Intern *February 2016 - July 2016*

- Leveraged classic statistical methods and publicly available datasets to benchmark bus rapid transit systems in China
- Published a journal article and a grey paper that convey the research findings to practitioners and policymakers
- Created a Tableau dashboard to benchmark bus rapid transit systems worldwide based on the article's methodology

Research Experience

Carnegie Mellon University (CMU) **Pittsburgh, PA**

Graduate Research Assistant *August 2019 – July 2023*

- Released three open-source repositories to model travel behavior and traffic flow dynamics in transportation networks
- Leveraged computational graphs and neural networks to compute traffic equilibrium, estimate city-wide traffic flow and travel time, and learn time-varying origin-destination matrices in large-scale transportation networks
- Developed new large-scale optimization algorithms and a hypothesis test framework to estimate travelers' route choice preferences using traffic counts and diverse geospatial data sources at the network-level
- Implemented Python modules to automatically process multiple geospatial and spatio-temporal data sources, including traffic incidents, transportation infrastructure, U.S Census features, traffic counts and travel time measurements

Centre of Excellence for Bus Rapid Transit (BRT-CoE) **Santiago, Chile**

Research Assistant *November 2017 – August 2018*

- Implemented a lab experiment in Python Qt to simulate route choices in public transport using animations
- Estimated discrete choice models to capture the impact of travel time variability and time perception on route choices
- Presented research findings in four international conferences in the fields of Cognitive Science and Transportation Science

Centre for Sustainable Urban Development (CEDEUS) **Santiago, Chile**

Research Assistant *April 2015 – January 2016*

- Leveraged econometric and optimization methods to improve the allocation of bus ticket inspectors at a city-wide scale
- Published a journal article on fare evasion in buses that earned the best paper award at a transportation conference

Publications

Liu, J., **Guarda, P.**, Niinuma, K., Qian, S., 2024. Enhancing multi-class mesoscopic network modeling with high-resolution satellite imagery. *2024 IEEE 27th International Conference on Intelligent Transportation Systems (ITSC)*, Edmonton, Canada.

Guarda, P., Qian, S., 2024. Traffic estimation in unobserved network locations using data-driven macroscopic models. Under review at *Transpormetrica A: Transport Science*. Preprint available at https://doi.org/10.48550/arXiv.2401.17095

Guarda, P., Battifarano, M., Qian, S., 2023. Estimating network flow and travel behavior using day-to-day system-level data: a computational graph approach. *Transportation Research Part C: Emerging Technologies* 158.

Guarda, P., Qian, S., 2023. Statistical inference of travelers' route choice preferences with system-level data. *Transportation Research Part B: Methodological* 179.

Geng, K., Wang, Y., Cherchi, E., **Guarda, P.**, 2023. Commuter departure time choice behavior under congestion charge: Analysis based on cumulative prospect theory. *Transportation Research Part A: Policy and Practice* 20, 55-71.

Astroza, S., **Guarda, P.**, Carrasco, J., 2022. Modeling the relationship between food purchasing, transport, and health outcomes: Evidence from Concepcion, Chile. *Journal of Choice Modelling* 42, 100341.

Guarda, P., Velásquez J., Tun H. , Chen, X., Zhong, G., 2017. Comparing Chinese and non-Chinese Bus Rapid Transit: Evidence from evaluation of global BRT based on BRT design indicators. *Transportation Research Record* 2647, 118-126.

Velásquez J. , Tun H., Hidalgo, D., Ramos, C., **Guarda, P.**, Chen, X., Zhong, G., 2017. Bus Rapid Transit in China: A Comparison of Design Features with International Systems. World Resources Institute, Washington D.C., USA. Available at http://www.wri.org/publication/bus-rapid-transit-in-china

Guarda, P., Galilea, P., Handy, S., Muñoz, J.C., Ortúzar, J. de D., 2016. Decreasing fare evasion without fines? A microeconomic analysis. *Research in Transportation Economics* 59, 151-158.

Guarda, P., Galilea, P., Paget-Seekins, L., Ortúzar, J. de D., 2016. What is behind fare evasion in urban bus systems? An econometric approach. *Transportation Research Part A: Policy and Practice* 20, 55-71.

Patents

Guarda, P., Liu, J., Niinuma, K., Qian, S., 2024, Traffic simulator adjustment using satellite imagery and multi-source spatiotemporal data, U.S. Patent 18/791,147, filed on July 31, 2024, with Fujitsu Research. Patent pending.

Liu, Z., Chen, X., Liu, Y., Hsu, C., Shahi, N. **Guarda, P.**, 2022, Cellular traffic prediction using open transportation data, U.S. Patent 18/536,791, filed on December 12, 2023, with AT&T labs. Patent pending.