# Pablo Guarda

United States

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## Education

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

*PhD in Transportation 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*

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

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

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

- Thesis: A psychological approach to understanding decisions about time in public transport.
- Award: Becas Chile - Conicyt 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

*Bachelor of Science in Industrial Engineering* *December 2013*

- Award: John Paul II Foundation Undergraduate Fellowship 2009 - 2013

## 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, 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*

- Presenting demos to multiple stakeholders of a new traffic simulation technology that performs end-to-end optimization for toll allocation and pricing, and estimates the local and network-wide impacts of traffic incidents and road closures
- Developing a computer vision pipeline to perform more accurate road segmentation on high-resolution satellite imagery using Meta Segment Anything (SAM) model and point prompts sampled from OpenStreetMap street 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
- Presented a conference paper and filed a patent with Carnegie Mellon University researchers on an innovative traffic simulator that can be trained with 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 that ranks the best locations to build new cellular towers
- Prototyped a web-based tool to support AT&T network planning operations 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 data from BRTData.org

*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 that simulated with animations the route choice in public transport
- 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*

- Integrated econometric and mathematical programming methods to optimize the allocation of bus ticket inspectors
- Published a journal article and received the best paper award at an international 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 filings

Traffic simulator adjustment using high-resolution satellite imagery, USPTO, July 2024. Filed at Fujitsu Research.
Cellular traffic prediction using open transportation data, USPTO, December 2023. Filed at AT&T labs.