

Fabio Miranda

POST DOCTORAL RESEARCH ASSOCIATE

NEW YORK UNIVERSITY

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Research Interests

I am interested in developing techniques that allow for the interactive visual analysis of large-scale data, combining methods from visualization, data management, machine learning and computer graphics. I have worked closely with domain experts from different fields and the outcome of these collaborations included not only research published in leading venues, but also systems that were made available to experts in academia, industry and government agencies. My work has also received extensive coverage from different media outlets, including The New York Times, The Economist, Architectural Digest, Curbed, among others.

Education

2012 - 2018

Ph.D. in Computer Science

New York, NY, USA

New York University (NYU)

Advised by Cláudio T. Silva.

Dissertation: “Data structures for the interactive visual analysis of urban data”.

2009 - 2011

M.S. in Computer Science

Rio de Janeiro, RJ, Brazil

Pontifical Catholic University of Rio de Janeiro (PUC-Rio)

Advised by Waldemar Celes.

Thesis: “Volume rendering of unstructured hexahedral meshes”.

2005 - 2009

B.S. in Computer Science

Belo Horizonte, MG, Brazil

Federal University of Minas Gerais (UFMG)

Advised by Luiz Chaimowicz.

Awards

2018

SIGMOD Best Demonstration Award

For “Interactive Visual Exploration of Spatio-Temporal Urban Data Sets Using Urbane”.

2018

Pearl Brownstein Doctoral Research Award

For doctoral research that shows the greatest promise, awarded by NYU.

2010-2012

CAPES and Petrobras Fellowships

Awarded during M.S. studies.

2006-2009

FINEP and CNPq Fellowships

Awarded during B.S. studies.

Selected Media Coverage

September 2017

Urban Pulse Uses Social Media Data to Show Cities in a New Light

Architectural Digest [↗](#)

September 2017

New program wants to improve cities with the power of tweets and Flickr uploads

Curbed [↗](#)

December 2016

Mapping the Shadows of New York City: Every Building, Every Block

The New York Times [↗](#)

October 2016

Listen to the music of the traffic in the city

The Economist [↗](#)

Publications

- 2020 Urban Mosaic: Visual Exploration of Streetscapes Using Large-scale Image Data
F. Miranda, M. Lage, H. Doraiswamy, M. Hosseini, G. Dove, C. T. Silva
2020 CHI Conference on Human Factors in Computing Systems.
Learning Geo-Contextual Embeddings for Commuting Flow Prediction
Z. Liu, **F. Miranda**, W. Xiong, J. Yang, Q. Wang, C. T. Silva
Thirty-Fourth AAAI Conference on Artificial Intelligence.
- 2019 Shadow Accrual Maps: Efficient Accumulation of City-Scale Shadows over Time
F. Miranda, H. Doraiswamy, M. Lage, L. Wilson, M. Hsieh, C. T. Silva
IEEE Transactions on Visualization and Computer Graphics, vol. 25, no. 3, pp. 1559-1574, Mar 2019.
[Featured on The New York Times](#)
- 2018 Time Lattice: A Data Structure for the Interactive Visual Analysis of Large Time Series
F. Miranda, M. Lage, H. Doraiswamy, C. Mydlarz, J. Salamon, Y. Lockerman, J. Freire, C. T. Silva
Computer Graphics Forum, vol. 37, no. 3, pp. 23-35, Jun 2018.
Interactive Visual Exploration of Spatio-Temporal Urban Data Sets using Urbane
H. Doraiswamy, E. Tzirita Zacharatou, **F. Miranda**, M. Lage, A. Ailamaki, C. T. Silva, J. Freire
2018 ACM SIGMOD Intl. Conf. on Management of Data - Demo.
[Best Demonstration Award](#)
Spatio-Temporal Urban Data Analysis: A Visual Analytics Perspective
H. Doraiswamy, J. Freire, M. Lage, **F. Miranda**, C. T. Silva
IEEE Computer Graphics and Application, vol. 38, no. 5, pp. 26-35, Sept/Oct 2018.
TopKube: A Rank-Aware Data Cube for Real-Time Exploration of Spatiotemporal Datasets
F. Miranda, L. Lins, J. Klosowski, C. T. Silva
IEEE Transactions on Visualization and Computer Graphics, vol. 24, no. 3, pp. 1394-1407, Mar 2018.
- 2017 Urban Pulse: Capturing the Rhythm of Cities
F. Miranda, H. Doraiswamy, M. Lage, K. Zao, B. Goncalves, L. Wilson, M. Hsieh, C. T. Silva
IEEE Transactions on Visualization and Computer Graphics, vol. 23, no. 1, pp. 791-800, Jan 2017.
[Featured on The Economist, invited to SIGGRAPH 2017 TVCG special session](#)
Data Visualization Tool for Monitoring Transit Operation and Performance
A. Kurkcu, **F. Miranda**, K. Ozbay, C. T. Silva
5th IEEE Intl. Conf. on Models and Technologies for Intelligent Transportation Systems (2017).
- 2016 TopKube: A Rank-Aware Data Cube for Real-Time Exploration of Spatiotemporal Datasets
F. Miranda, L. Lins, J. Klosowski, C. T. Silva
Data Systems for Interactive Analysis (DSIA) 2016.
- 2012 Volume Rendering of Unstructured Hexahedral Meshes
F. Miranda, and W. Celes
The Visual Computer Journal, vol. 28, no. 10, pp. 1005-1014, Oct 2012.
- 2011 Accurate Volume Rendering of Unstructured Hexahedral Meshes
F. Miranda, and W. Celes
24th Sibgrapi Conference on Graphics, Patterns and Images (2011).
Illustrative Volume Visualization for Unstructured Meshes Based on Photic Extremum Lines
A. Rocha, **F. Miranda**, and W. Celes
24th Sibgrapi Conference on Graphics, Patterns and Images (2011).

Research Experience

Fall 2018 - present

New York University

New York, NY, USA

Postdoctoral researcher

Development of new techniques for the interactive visualization of different types of large-scale data, such as streaming timeseries data and image data. Also responsible for mentoring PhD students.

Summer 2016

Argonne National Laboratory

Lemont, IL, USA

Research intern

Mentor: Venkatram Vishwanath

Developed a visualization tool to explore high-resolution volumetric weather simulations, focused in the Chicago metropolitan area, in order to understand the impact of built environment on the city climate.

Summer 2015

IBM T.J. Watson Research Center

Yorktown Heights, NY, USA

Research intern

Mentor: Bruce D'Amora

Developed a web-based graph visualization tool for the exploratory visualization of bitcoin transactions.

Summer 2014

AT&T Research

Middletown, NJ, USA

Research intern

Mentors: Lauro Lins and James Klosowski

Developed a distributed version of *Nanocubes*, a datacube-based approach for the visualization of massive spatiotemporal datasets.

Summer 2013

Sandia National Laboratories

Albuquerque, NM, USA

Research intern

Mentor: Patricia Crossno

Developed an adaptive kernel density estimation approach for scatterplots using GPUs.

2009 - 2012

TecGraf / PUC-Rio

Rio de Janeiro, Brazil

Research assistant

Mentor: Waldemar Celes

Developed an unstructured hexahedral volume renderer for a data visualization and analysis software used in most of Brazil's oil fields.

Research Projects

Spring 2018 - present

Integrated Analytics and Visualization for Multi-modality Transportation Data

New York University

Cities are complex systems of interrelated dynamic components. A city's physical appearance plays an important role in this system but, due to its qualitative nature, measuring and modeling the urban appearance has for long been a challenge in urban studies. This requires the identification of areas in the city having similar characteristics, such as urban fabric, building facade, or even specific item of interest such as broken curbs. This projects leverages a new data set composed of tens of millions of images from New York City captured over a period of a year by cameras mounted on top of cars. It makes use of recent advances in computer vision to efficiently handle such a large collection of complex images and provide stakeholders with a visual perspective of the city that was not possible before.

Fall 2016 - present

SONYC: Sounds of New York City

New York University

Noise pollution is an important problem with broad-ranging societal effects that apply to a significant portion of the population. It is therefore imperative to analyze and understand noise pollution at city-scale in an interactive and efficient manner. As part of this project, hundreds of sensors were deployed throughout NYC, measuring the decibel level at each second. The analysis of such data demands new techniques that can efficiently handle high resolution temporal data, offering different stakeholders, such as city agencies, an unique opportunity to gain new insights about noise pollution

Fall 2015 - present

Urban Data Management and Analytics

New York University

Recent technological innovations have enabled the automatic collection of enormous amounts of diverse qualitative data from cities, through conventional sensors (e.g. noise levels), as well as through GPS sensors in vehicles (e.g. taxi trips) and mobile devices (e.g. social media data). The visual exploration of these data sets can greatly help in understanding not only the data and its underlying context, but also the dynamics of the city. However, given the sheer number and size of the datasets, this task presents computational challenges in several fronts, from indexing and querying to analyzing the data. This project takes first steps towards addressing these challenges, by proposing a framework that enables different stakeholders to interactively explore and analyze different data sets.

Fall 2015 - Fall 2016

Data Storage and Access Platform for Transportation Data

New York University

Recent technological advances and extensive deployment of automated vehicle location technologies make GPS data sources a promising and cost-effective way to monitor transport system. In NYC, the bus system includes 233 routes, with more than five thousand buses and each bus provides a real-time update every 30 seconds, with information such as location and speed. This project proposes a powerful tool to acquire, store, process and visualize bus trajectory data, enabling stakeholders to determine how well the system is performing with respect to its service standards.

Summer 2014 - Spring 2016

Data Structures for Exploratory Visualization

AT&T Research

With the ever-increasing amount of user-generated content found online, ranks have never been so popular to our cultural landscape. "What's trending" has become a commonplace phrase used to capture the spirit of a time by looking at the most popular hashtags in a given region and time. This project proposes a data structure that can drive interactive visual exploration of top-k queries, considering spatiotemporal datasets.

2009 - 2012

Large Scale Oil Reservoir Visualization

TecGraf / PUC-Rio

The output of oil reservoir simulations is often large, with unstructured volumes of potentially millions of cells. This project proposes techniques to efficiently, and accurately, visualize and explore such volumetric data, leveraging the power of massively parallel processing units.

Teaching Experience

Fall 2019

CS GY 6533: Interactive Computer Graphics

New York University

Graduate course. Prepared and presented 2.5 hour lecture on shadows.

Fall 2014

CS UY 1133: Data Structures and Algorithms

New York University

Undergraduate course. Prepared and presented 2.5 hour lecture on C and C++ programming.

Fall 2014

CUSP GX 5003: Principles of Urban Informatics

New York University

Teaching assistant for Cláudio T. Silva, 50 students

Graduate course. Prepared and presented lectures on visualization, python, pandas and MySQL. Created and graded assignments, and held office hours.

Fall 2013

CUSP GX 5003: Principles of Urban Informatics

New York University

Teaching assistant for Cláudio T. Silva, 50 students

Graduate course. Developed and presented lectures on visualization, python, javascript, D3 and MySQL. Prepared and graded assignments, and held office hours.

Mentoring Experience

2018 -

Mentor Ph.D. Students

New York University

Mentor students to work with the Urbane framework, as well as on research projects.

Students: Zhicheng Liu (CS PhD student at Southeast University, China), Maryam Hosseini (Urban Systems PhD student at Rutgers), Shaoyu Chen (CS PhD student at NYU), João Rulff (CS PhD student at NYU).

Talks

December 2018	Exploration of Street-Level Images at Scale Pedestrian Movement Technology Showcase at Metro North	New York City, NY, USA
November 2018	Shadow Accrual Maps: Efficient Accumulation of City-Scale Shadows over Time IEEE Visualization Conference (VIS)	Berlin, Germany
June 2018	Time Lattice: A Data Structure for the Interactive Visual Analysis of Large Time Series EG/VGTC Conference on Visualization (EuroVis)	Brno, Czech Republic
October 2017	TopKube: A Rank-Aware Data Cube for Real-Time Exploration of Spatiotemporal Datasets IEEE Visualization Conference (VIS)	Phoenix, AZ, USA
September 2016	Visualizing and Exploring Urban Data Data Visualization Summit	Boston, MA, USA
October 2016	TopKube: A Rank-Aware Data Cube for Real-Time Exploration of Spatiotemporal Datasets Data Systems for Interactive Analysis Workshop (DSIA)	Chicago, IL, USA
October 2011	Accurate Volume Rendering of Unstructured Hexahedral Meshes Sibgrapi Conference on Graphics, Patterns and Images	Maceió, Brazil

Selected Open-Source Projects

2019	New York City Shadow Data Shadow data for New York City, also used by The New York Times. ↗
2018	Urban Pulse Open-source version of Urban Pulse paper. ↗
2017	Bus Explorer Open-source tool for the exploration of a large data set with bus tracking pings. Developed in close collaboration with the New York City Department of Transportation. ↗

Service

Program Committees: IEEE VIS 2020 Short papers, Sibgrapi 2020, IEEE VIS 2019 Short papers, Sibgrapi 2019.
Reviewer: IEEE Transactions on Big Data, IEEE InfoVis, IEEE SciVis, IEEE VAST, Sibgrapi, WWW, The Visual Computer Journal, Transportation Research Record Journal, International Conference on Pattern Recognition.