Marcos Oliveira

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Research Interests

My research interests stem from my desire to understand complex social phenomena. I am interested in understanding real-world complex systems using data-driven approaches, with a focus on cities, human dynamics, and self-organizing mechanisms. In particular, my work explores how urban crime emerges and produces regularities in cities. I also investigate the mechanisms behind inequality in urban areas and social environments.

keywords: complex systems | crime science | computational social science | city science | swarm intelligence

Academic Positions

2020 – present Lecturer (Assistant Professor) in City Science & Analytics
University of Exeter, Exeter, UK

2018 – 2021 Postdoctoral researcher
GESIS–Leibniz Institute for the Social Sciences, Cologne, Germany

2017 – 2017 Graduate Research Assistant
Florida Institute of Technology, Melbourne, USA

Education

2013–2017 Ph.D. Computer Science, *Florida Institute of Technology*, USA
Dissertation: "The Growth, Structure, and Dynamics of Crime in Cities"

2011–2013 M.Sc. Computer Engineering, *Universidade de Pernambuco*, Brazil
Thesis: "Assessing and Modifying Information Flows in Particle Swarm Optimizers"

2006–2011 B.Sc. Computer Engineering, *Universidade de Pernambuco*, Brazil
Project: "Hopfield Neural Networks in FPGA for Routing in Communication Networks"

Administrative Responsibilities

2020 – present Director of Global Development, Computer Science, University of Exeter, UK

Publications

List also at Google Scholar. Total citations: 343, h-index: 11, i10-index: 13 (December 2022).

Journal

- **Oliveira, M.**, Karimi, F., Zens, M., Schaible, J., Génois, M., and Strohmaier, M. Group mixing drives inequality in face-to-face gatherings. *Nature Communications Physics* (2022) **5**, 7.
- **Oliveira, M.** More crime in cities? On the scaling laws of crime and the inadequacy of per capita rankings—a cross-country study. *Crime Science* (2021) **10**:27.
- Santana, C., **Oliveira, M.**, Bastos-Filho, C., and Menezes, R. Beyond exploitation: Measuring the impact of local search in swarm-based memetic algorithms through the interactions of individuals in the population. *Swarm and Evolutionary Computation* (2021) **7**.
- **Oliveira, M.**, Pinheiro, D., Macedo, M., Bastos-Filho, C., and Menezes, R. Uncovering the social interaction network in swarm intelligence algorithms. *Applied Network Science* (2020) **5**:24.
- **Oliveira, M.**, Ribeiro, E., Bastos-Filho, C., and Menezes, R. Spatio-temporal variations in the urban rhythm: the travelling waves of crime. *EPJ Data Science* (2018) **7**:29.
  • Highlight on SpringerBlog, EPJ.org, and PLOS Complexity Channel
- **Oliveira, M.**, Bastos-Filho, C., and Menezes, R. The scaling of crime concentration in cities. *PLOS ONE* (2017) **12**(8): e0183110. • Highlight on Florida Tech's Blog
- **Oliveira, M.**, Bastos-Filho, C., and Menezes, R. Using Network Science to Assess Particle Swarm Optimizers. *Social Network Analysis and Mining* (2015) **5**.1.

Conference (refereed)

- Kulshrestha, J., **Oliveira M.**, Karaçalık, O., Bonnay, D., and Wagner, C. Web Routineness and Limits of Predictability: Investigating Demographic and Behavioral Differences Using Web Tracking Data.

In: *Proceedings of AAAI International Conference on Web and Social Media (ICWSM)*, 2021.

- Taw, L., Gurrapadi, N., Macedo, M., **Oliveira M.**, Pinheiro, D., Bastos-Filho, M., and Menezes, R. Characterizing the Social Interactions in the Artificial Bee Colony Algorithm. In: *IEEE Congress on Evolutionary Computation (IEEE CEC)*, 2019. Wellington, New Zealand.
- Barbosa, H., **Oliveira, M.**, Pacheco, D., Menezes, R., and Goshal, G. "The Influence of the Circadian and Ultradian Rhythms to Human Mobility: Empirical Evidences from Location-Based Check-Ins" In: *First Northeast Regional Conference on Complex Systems*, 2018. Binghamton, NY, USA.
- Pacheco, D., **Oliveira, M.**, and Menezes, R. Towards a framework to assess social disorganization in neighborhoods using social media: a case study on football supporters in the United Kingdom. In: *AI4BigData at the 30th International FLAIRS Conference*, 2017. Marco Island, Florida, USA.
- Elliott, D., Tomasini, M., **Oliveira, M.**, and Menezes, R. Tippers and Stiffers: an Analysis of Tipping Behavior in Taxi Trips. In: *IEEE Ubiquitous Intelligence and Computing*, 2017. San Francisco, California, USA.
- **Oliveira, M**., Pinheiro, D., Macedo, M., Bastos-Filho, C., and Menezes, R. Better Exploration–Exploitation Pace, Better Swarm: Examining the Social Interactions. In: *4th IEEE Latin American Conference on Computational Intelligence (LA-CCI)*, 2017. Arequipa, Peru.
- **Oliveira, M.**, Pinheiro, D., Andrade, B., Bastos-Filho, C., and Menezes, R. Communication Diversity in Particle Swarm Optimizers In: *Tenth International Conference on Swarm Intelligence (ANTS)*, 2016. Brussels, Belgium.
- **Oliveira, M.**, Serrano, H., Yehle, T., White, S., and Menezes, R. From Criminal Spheres of Familiarity to Crime Networks. In: *The 6th Workshop on Complex Networks (Complenet)*, 2015. New York, USA.
- White, S., Yehle, T., Serrano, H., **Oliveira, M.**, and Menezes, R. The Spatial Structure of Crime in Urban Environments. In: *The 6th International Conference on Social Informatics. First Workshop on Criminal Network Analysis and Mining*, 2014. Barcelona, Spain.
- **Oliveira, M.**, Bastos-Filho, C., and Menezes, R. Towards a Network-based Approach to Analyze Particle Swarm Optimizers. In: *Proceedings of IEEE Swarm Intelligence Symposium*, 2014. Orlando, USA.
- **Oliveira, M.**, Bastos-Filho, C., and Menezes, R. Political Social Networks Reveal Strong Party Loyalty in Brazil and Weak Regionalism In: *The Sixth ASE International Conference on Social Computing*, 2014. Stanford, USA.
- **Oliveira, M.**, Bastos-Filho, C., and Menezes, R. Assessing Particle Swarm Optimizers Using Network Science Metrics. In: *Studies in Computational Intelligence*. Springer Berlin Heidelberg, 2013.
- **Oliveira, M.**, Bastos-Filho, C., and Menezes, R. Using Network Science to Define a Dynamic Communication Topology for Particle Swarm Optimizers. In: *The 3rd Workshop on Complex Networks (Complenet)*, 2012. Melbourne, Florida, USA.
- **Oliveira, M.** and Bastos-Filho, C. Uma Implementação em FPGA de Redes Neurais de Hopfield para Roteamento em Redes de Comunicação (in Portuguese) In: *Anais do X Congresso Brasileiro de Inteligência Computacional*, 2011. Fortaleza, Brazil.
- **Oliveira, M.**, Lacerda, M., Barbosa, E., Barbosa, P., and Bastos-Filho, C. Car Setup Optimization Using Multi-Objective Swarm Algorithms" In: *Anais do X Congresso Brasileiro de Inteligência Computacional*, 2011. Fortaleza, Brazil.
- Bastos-Filho, C. J. A., **Oliveira, M.**, Silva, D., and Santana, R. Optimizing a Routing Algorithm Based on Hopfield Neural Networks for Graphic Processing Units In: *Proceedings of IEEE Symposium on Foundations of Computational Intelligence*, 2011. Paris, France.
- Bastos-Filho, C., **Oliveira, M.**, Nascimento, D., and Ramos, A. Impact of the Random Number generator quality on particle swarm optimization algorithm running on graphic processor units In: *Proceedings of the Tenth IEEE International Conference on Hybrid Intelligent Systems*, 2010. Atlanta, USA.

Book Chapter

- Schaible, J., **Oliveira, M.**, Zens, M., and Génois, M. Sensing close-range proximity for studying face-to-face interaction. In: *Handbook of Computational Social Science*. Routledge, 2021.
- **Oliveira, M.**, and Menezes, R. "Spatial concentration and temporal regularities in crime" To appear in: *Understanding Crime through Science* (Springer, 2022). **[arxiv]**
- Lins, A., Bastos-Filho, C.J.A., Nascimento, D., **Oliveira, M.**, and Lima-Neto, F. Analysis of the Performance of the Fish School Search Algorithm Running in Graphic Processing Units. In: *Theory and New Applications of Swarm Intelligence*. 1ed.: InTech, 2012, v. 1, p. 17-32.
- Bastos-Filho, C.J.A., **Oliveira, M.**, and Nascimento, D. Running Particle Swarm Optimization on Graphic Processing Units. In: *Search Algorithms and Applications.* 1ed.: InTech, 2011, v. 1, p. 47-68.

Others

- Karimi, F., **Oliveira, M.**, and Strohmaier, M. Marginalization Effects in Face-to-face Social Networks. Invited post on *SIAM News Blog*, 2022.

Manuscripts

Under Review

- Karimi, F., and **Oliveira, M.** "On the inadequacy of nominal assortativity for assessing homophily in networks" (*manuscript submitted for publication*) **[arxiv]**
- Karimi, F., **Oliveira, M.**, and Strohmaier, M. "Minorities in networks and algorithms" (*manuscript submitted for publication*) **[arxiv]**
- Génois, M., Zens, M., **Oliveira, M.**, Lechner, C., Schaible, J., and Strohmaier, M. "Combining sensors and surveys to study social contexts: Case of scientific conferences" (*manuscript submitted for publication*) **[arxiv]**
- Pacheco, D., **Oliveira, M.**, Chen, Z., Barbosa, H., Foucault-Welles, B., Ghoshal, G., and Menezes, R. "Predictability states in human mobility" (*manuscript submitted for publication*) **[arxiv]**

In Preparation

- **Oliveira, M.**, Kulshrestha, J., Griffiths, D., Yang, J., and Bonnay, D. "Online habits reveal our identities on the Web"
- Kulshrestha, J., **Oliveira, M.**, Rahmati, N., Yang, J., and Bonnay, D. "Online unlockdown accompanied COVID-19 lockdowns"
- Zeng, W., and **Oliveira, M.** "Explaining the limits of scalability in particle swarm optimizers"
- **Oliveira, M.**, Lietz, H., and Wagner, C. "Measuring mobility inequality in cities"

Grants

2021-2022 "News diets & citizenship: A study combining web tracking data and surveys." (co-PI) Facebook Foundational Integrity & Impact Research: Misinformation and Polarization, Facebook Inc, $50,000.

2021-2022 "Lockdown on the Web: The unequal impact of the COVID19 pandemic on people's web browsing behaviour." (co-PI) Independent Research Grant, Universität Konstanz, €10,000.

2020-2021 "Automated Model Build for Decarbonisation and Climate Resilience." (co-PI) Innovate UK grant with City Science Ltd., UKRI, £265,561.

Supervision

2021 Postdoctoral researcher: Dr. Ned Taylor (co-supervision)
UKRI/Innovate project: "Automated Model Build for Decarbonisation and Climate Resilience"

2021- PhD student: Sima Farokhnejad (co-supervision)
Project: "Modelling the movement of livestock trade under uncertain conditions"

2020-2022 MSc students: supervision of 14 students' 4-month projects. Highlights:
Wenkai Zeng. "On the scalability limits of particle swarm optimizers" (2021 Best Project Award)
Daniel Griffiths. "The privacy bounds of web-browsing datasets"

Teaching Experience

2020-2022 *Social and Professional Issues of the Information Age* (University of Exeter)
Module in the CS programme (received 4.2/5 total rating from student evaluations in 2021)

2022 *Learning from Data* (University of Exeter)
Module in the CS programme.

2021 *Human dynamics and city science*
Online mini-module at the Exeter School on Urban Analytics, Exeter, UK

2019 *Introduction to Python's graph-tool*
Tutorial at the 4th European Conference on Social Networks, Zürich, Switzerland

2019 *Introduction to Social Network Science with Python*
GESIS Methodenseminar, Cologne, Germany

2018 *Performing embarrassingly parallel data analysis with IPython*
Tutorial at Complexity72h, Lucca, Italy

Professional Service

2021 Sustainability Summer Programme (co-organizer) • Highlight on Excelence in Education
Summer school on sustainability at the University of Exeter, Exeter, UK

CompleNet—International Conference on Complex Networks
2021 12th CompleNet Live 2021 (co-organizer) [proceedings]
2020 11th CompleNet, Exeter, UK (poster chair) [proceedings]

Social Complex Networks (co-organizer)
2019 Session at the 4th European Conference on Social Networks, Zürich, Switzerland

NetCrime—Symposium on the Structure and Mobility of Crime (co-organizer)
2019 Satellite workshop at NetSci 2019, Burlington, USA (27 May)
2018 Satellite workshop at NetSci 2018, Paris, France (11 June)
2017 Satellite workshop at NetSci 2017, Indianapolis, USA (19 June)
2015 Satellite workshop at NetSci 2015, Zaragoza, Spain (1 June)

Reviewing & Editing

Ad Hoc Reviewer: Journal of Quantitative Criminology, EPJ Data Science, Journal of the Royal Society Interface, IEEE Transactions on Evolutionary Computation, PLOS One, Applied Network Science, Heliyon, Engineering Optimization, IEEE Computational Intelligence Magazine, MethodsX.

Guest Editor: Applied Network Science journal
Special issue: "Structure and dynamics of crime."

Awards

2017 Outstanding Graduate Student of the Year, Florida Institute of Technology
2016 Outstanding Graduate Student of the Year, Florida Institute of Technology

Personal

Birthplace: Recife, Brazil
Current city: Exeter, UK