Eric Araújo

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Welcome

Eric investigates the spread of opinions, sentiments, and behaviors in complex systems through multiagent modeling and simulations, offering insights into social dynamics in politics, cooperation, health, criminology, and religion.

Therefore, the work I develop is multidisciplinary, using agent-based models and data science to solve problems in areas such as public security, the spread of fake news, promoting healthier lifestyles, etc.

Education

Ph.D. **Vrije Universiteit Amsterdam**, Computer Science — Amsterdam, Netherlands, Sept 2018
- Thesis title: Contagious: Modeling the Spread of Behaviours, Perceptions and Emotions in Social Networks

M.Sc. **Universidade Federal de Minas Gerais**, Computer Science — Minas Gerais, Brazil, Mar 2007 – Sept 2009

B.Sc. **Universidade Federal de Viçosa**, Computer Science — Minas Gerais, Brazil, Mar 2003 – Dec 2006

Experience

Calvin University, Associate Professor — Grand Rapids, MI, USA, July 2024 – present
- Computer Science Department, Calvin University

FIOCRUZ, Researcher — Rio de Janeiro, Brazil, 2022 – 2024
- FIOCRUZ is a leading institution in health research and development in Brazil. My work focuses on collecting data and analyzing it to understand medical circulation of health sciences among Brazilian researchers.

Vrije Universiteit Amsterdam, Guest Researcher — Oct 2018 – Apr 2022
- Collaborator in the Department of Computer Science, Vrije Universiteit Amsterdam
- Worked on criminology models with Prof. Dr. Charlotte Gerritsen.

Universidade Federal de Lavras, Associate Professor — Minas Gerais, Brazil, Feb 2011 – June 2024
- Computer Science Department, Universidade Federal de Lavras

Gammon Presbyterian Faculty, Professor — Minas Gerais, Brazil, Jan 2010 – Jan 2011
- Professor and Coordinator of the Information Systems course

Projects

Procores — UFMG, Brazil, May 2022 – present

Research group funded by CNPq (Brazil)
- ProCoReS is a research group funded by CNPq, dedicated to the study of social networks, mathematical modeling, contagion processes, and the analysis of complex data. The group brings together researchers from different fields to propose and analyze innovative models that consider multiple aspects of social networks and their dynamics.
- To model networks and contagion, most current approaches use graphs. However, these are not entirely realistic, and new models of contagion processes should allow for: representation of different classes of individuals and connections, linkage between concurrent and co-occurring processes, and connections involving two or

more individuals simultaneously. Understanding how connections are formed and how different types of flows permeate such networks is crucial to understanding how our society is organized and evolves. The goal is to propose mathematical, statistical, agent-based, and machine learning models that account for: multiple complex aspects of social contagion processes and parameterization through data sources (e.g., online social networks, mobility, collaborations). Such models should allow for classes of individuals and relationships; model co-occurrence, causality, and links between contagion processes; and represent multi-relationships.

- Funded by: CNPq Universal 2022

Socioeconomic Impacts in Territories Affected by Technological Disasters UFLA, Brazil
Sept 2022 – Feb 2024

- This project investigates the socioeconomic consequences of technological disasters in Brazil, which have increased significantly in recent decades. Between 2000 and 2020, Brazil recorded 96 technological disasters—ranging from dam collapses to oil spills—impacting over 42 million people and causing over USD 17 billion in damages (EM-DAT, 2021). Unlike natural disasters, which occur without human interference, technological disasters result from anthropogenic actions, such as industrial accidents or environmental contamination. These events often lead to material loss, environmental degradation, and serious public health issues, demanding robust mechanisms for community response and risk management.
- By analyzing historical data and specific case studies such as the Mariana (2015) and Brumadinho (2019) dam collapses, the project seeks to understand how these disasters affect the social and economic fabric of impacted territories. The ultimate goal is to identify patterns and develop frameworks that can inform policies for disaster prevention, mitigation, and recovery—contributing to more resilient communities in the face of growing technological risks.

Analysis of User Behavior on a University Campus Wi-Fi Network UFLA, Brazil
Mar 2021 – Sept 2023
Masters Project by Thiago do Prado Ramos

- This project aims to analyze the behavior of users on a university campus Wi-Fi network, focusing on connection patterns and user mobility. By examining connection logs, the project seeks to understand how users interact with the network, their mobility patterns, and how these factors influence network performance and user experience.
- The findings will help in optimizing network infrastructure, improving user experience, and informing future network design and management strategies.

Algorithms for the Optimization of Supply Chain Management Systems UFLA, Brazil
Mar 2021 – Mar 2022
Project in partnership with Prof. Mayron Moreira (UFLA, Brazil)

- This project developed and evaluated algorithms aimed at optimizing key components of supply chain management, including inventory control, logistics, and production scheduling. By modeling supply chains as dynamic systems, the project applied heuristic and metaheuristic approaches—such as genetic algorithms and simulated annealing—to improve efficiency, reduce costs, and enhance decision-making under uncertainty.
- The research focused on real-world constraints such as demand variability, delivery time windows, and resource limitations. The resulting algorithms demonstrated significant improvements in performance when compared to traditional methods, and provided a flexible framework that can be adapted to various industrial sectors seeking to enhance their operational processes.

Urban Tree Cover and Crime UFLA, Brazil
Mar 2020 – Mar 2024
Project in partnership with Prof. Michele Valquíria dos Reis (UFLA, Brazil)

- Urban tree cover provides vital ecosystem services that promote public health and well-being. However, there is a common perception—found in media reports and in-

formal discussions—that trees may facilitate crime by obstructing visibility or serving as hiding places. While some studies have linked vegetation to fear of crime, often recommending vegetation removal to improve safety, research from the Northern Hemisphere increasingly suggests a negative correlation between urban greenery and crime rates, indicating that vegetation may actually contribute to crime reduction.

- This project aims to investigate the relationship between urban tree cover and crime incidence in Brazilian cities. It integrates data from street tree inventories, georeferenced crime records from the Military Police, socioeconomic indicators from the national census (IBGE), citizen surveys on perceptions of vegetation and safety, and citizen requests for tree removal. The goal is to generate scientific insights into the social dimensions of urban greenery and to inform evidence-based environmental management policies. The findings are intended to support public agencies and civil society in designing safer, greener urban spaces.

Computational Modeling and Simulation of Contagion in Social Networks — UFLA, Brazil — Sept 2018 – June 2024

- Social contagion refers to the spread of behaviors, perceptions, and emotions through interactions among individuals. Often occurring unconsciously, this phenomenon plays a role in shaping collective opinion, promoting positive behaviors, and influencing public discourse. This project aims to simulate the diffusion of information originating from social media platforms across various contexts, using agent-based and network modeling approaches.
- The study investigates how network topology, individual agent characteristics, and intervention strategies affect the spread and quality of information. It explores methods for enhancing the visibility and influence of high-quality content while limiting the reach of misinformation or fake news. The results aim to inform the design of healthier and more reliable information ecosystems, with potential applications in communication policy, platform design, and digital education.

Skills

Programming: Proficient with Python, C++, Netlogo, and Git; good understanding of Web development

Languages: English (fluent), Portuguese (native), Dutch (basic)

Publications

Exploring the link between urban topology and street crime using complex networks: a case study from Southeast Brazil — July 2025
Matheus de Andrade Flausino, **Eric Araújo**, Angélica Sousa da Mata
10.1093/comnet/cnaf016 (Journal of Complex Networks)

The Use of Agent-based Modeling in the Study of Complex Systems (*In Portuguese*) — 2025
Clayton R. da Silva, Olivia Mesquita, **Eric Araújo**, Angélica S. Mata
10.1590/1806-9126-RBEF-2024-0464 (Revista Brasileira de Ensino de Física)

Understanding the complexities of Bluetooth for representing real-life social networks — Feb 2024
Simoski, Bojan, Klein, Michel C.A., Araújo, Eric Fernandes de Mello, van Halteren, Aart T., van Woudenberg, Thabo J., Bevelander, Kirsten E., Buijzen, Moniek, Bal, Henri
10.1007/s00779-020-01435-x (Personal and Ubiquitous Computing)

Police Planning Based on the Use of Business Intelligence (BI): The Police Manager's Perception Regarding the Violent Crime Rate in the 8th Battalion of the Military Police of Minas Gerais (PMMG) (*In Portuguese*) — 2023
Erich da Costa, Denis Renato de Oliveira, **Eric Araújo**
10.29377/rebesp.v16i01.614 (Revista Brasileira de Estudos de Segurança Pública)

Epidemiological Intelligence in Operation COVID-19: A New Decision Support Tool in Brazil's Military Logistics (*In Portuguese*) 2023

José Roberto Pinho de Andrade Lima, Mariza Ferro, **Eric Araújo**, Cristiano Barros, Ernesto Rademaker Martins, Beatriz Helena Felício Fuck Telles Ferreira

10.47240/revistadaesg.v38i82.1250 (Revista da Escola Superior de Guerra)

Political Polarization on Twitter During the COVID-19 Pandemic: A Case Study in Brazil 2022

Pedro Brum, Matheus Cândido Teixeira, Renato Vimieiro, **Eric Araújo**, Wagner Meira Jr, Gisele Lobo Pappa

10.1007/s13278-022-00949-x (Social Network Analysis and Mining)

Urban Afforestation and Public Safety: A Bibliometric Study Using the Consolidated Meta-Analytical Focus Theory (*In Portuguese*) 2022

Kelly Iapuque Rodrigues de Sousa, Michele Valquíria dos Reis, Rafael Rodrigues de Castro, **Eric Araújo**

10.5585/geas.v11i2.22965 (Revista de Gestão Ambiental e Sustentabilidade (GeAS))

Detecção e Classificação de Bots Utilizando Redes Neurais Artificiais e Análise de Sentimentos 2021

Gabrieli Silva, Eliaquim Ramos, Eric Araújo, Fábio Borges, Mariza Ferro

www.eamc.lncc.br/proceedings.html (Proceedings of the XIV Encontro Acadêmico de Modelagem Computacional)

The Virus and Socioeconomic Inequality: An Agent-based Model to Simulate and Assess the Impact of Interventions to Reduce the Spread of COVID-19 in Rio de Janeiro, Brazil Apr 2020

Vinícius Prata Klôh, Gabrieli Dutra Silva, Mariza Ferro, **Eric Araújo**, Cristiano Barros de Melo, José Roberto Pinho de Andrade Lima, Ernesto Rademaker Martins

10.34119/bjhrv3n2-192 (Brazilian Journal of Health Review)

Disconnecting for the Good: A Network-Oriented Model for Social Contagion of Opinions and Social Network Interventions to Increase Adherence to Social Distancing 2020

Eric Araújo, Mariza Ferro, Gabrieli Silva

10.5753/brasnam.2020.11170 (Proceedings of the IX Brazilian Workshop on Social Network Analysis and Mining)

Creating a Temporal Pattern for Street Robberies Using ABM and Data from a Small City in Southeast Brazil 2020

Eric Araújo, Charlotte Gerritsen

10.4324/9780429277177 (Agent-Based Modelling for Criminological Theory Testing and Development)

Identifying Influence Agents That Promote Physical Activity Through the Simulation of Social Network Interventions: Agent-Based Modeling Study Aug 2019

Thabo J. van Woudenberg, Bojan Simoski, **Eric Araújo**, Kirsten E. Bevelander, William J. Burk, Crystal R. Smit, Laura Buijs, Michel Klein, Moniek Buijzen

10.2196/12914 (Journal of Medical Internet Research)

A Social Network Model for Integration of Refugees 2019

Fabio Curi, Dimitris Nikolopoulos, **Eric Araújo**

10.5220/0007930601650175 (Proceedings of the 9th International Conference on Simulation and Modeling Methodologies, Technologies and Applications)

Parameter Optimization for Deriving Bluetooth-Based Social Network Graphs 2019

Bojan Simoski, Michel C.A. Klein, **Eric Araújo**, Aart T. Van Halteren, Thabo Van Woudenberg, Kirsten E. Bevelander, Moniek Buijzen, Henri Bal

10.1109/SmartWorld-UIC-ATC-SCALCOM-IOP-SCI.2019.00318 (2019 IEEE SmartWorld, Ubiquitous Intelligence & Computing, Advanced & Trusted Computing, Scalable Computing & Communications, Cloud & Big Data Computing, Internet of People and Smart City Innovation (SmartWorld/SCALCOM/UIC/ATC/CBDCom/IOP/SCI))

Contagious: Modeling the Spread of Behaviours, Perceptions and Emotions in Social Networks (PhD Thesis) 2018
Eric Araújo
research.vu.nl/en/publications/632878cc-e2e7-40ab-a34e-91bde40eaf50

Using Simulations for Exploring Interventions in Social Networks - Modeling Physical Activity Behaviour in Dutch School Classes 2018
Eric Araújo, Bojan Simoski, Thabo van Woudenberg, Kirsten Bevelander, Crystal Smit, Laura Buijs, Michel Klein, Moniek Buijzen
10.5220/0006857704140425 (Proceedings of 8th International Conference on Simulation and Modeling Methodologies, Technologies and Applications - SIMULTECH)

Applying Machine Learning Algorithms for Deriving Personality Traits in Social Network 2018
Eric Araújo, Bojan Simoski, Michel Klein
10.1145/3167132.3167377 (Proceedings of the 33rd Annual ACM Symposium on Applied Computing)

Detecting Dutch Political Tweets: A Classifier based on Voting System using Supervised Learning 2018
Eric Araújo, Dave Ebbelaar
10.5220/0006592004620469 (Proceedings of the 10th International Conference on Agents and Artificial Intelligence - Volume 1: ICAART)

Social Connection Dynamics in a Health Promotion Network 2017
Eric Araújo, Michel Klein, Aart van Halteren
10.1007/978-3-319-50901-3_66 (Complex Networks & Their Applications V)

Explaining Changes in Physical Activity Through a Computational Model of Social Contagion 2017
Julia S. Mollee, **Eric Araújo**, Adnan Manzoor, Aart T. van Halteren, Michel Klein
10.1007/978-3-319-54241-6_19 (Complex Networks VIII)

Exploring Parameter Tuning for Analysis and Optimization of a Computational Model 2017
Julia S. Mollee, **Eric Araújo**, Michel C. A. Klein
10.1007/978-3-319-60045-1_36 (Advances in Artificial Intelligence: From Theory to Practice)

A Temporal-Causal Model for Spread of Messages in Disasters 2017
Eric Araújo, Annelore Franke, Rukshar Wagid Hosain
10.1007/978-3-319-67077-5_37 (Computational Collective Intelligence)

A Computational Cognitive Model for Political Positioning and Reactions in Web Media 2017
Eric Araújo, Michel Klein
10.1109/ICCI-CC.2017.8109782 (2017 IEEE 16th International Conference on Cognitive Informatics & Cognitive Computing (ICCI*CC))

Analysis and Refinement of a Temporal-Causal Network Model for Absorption of Emotions 2016
Eric Araújo, Jan Treur
10.1007/978-3-319-45243-2_3 (Computational Collective Intelligence)

Online Sharing of Physical Activity: Does It Accelerate the Impact of a Health Promotion Program? 2016
Adnan Manzoor, Julia S. Mollee, **Eric Araújo**, Aart T. van Halteren, Michel C. A. Klein
10.1109/BDCloud-SocialCom-SustainCom.2016.40 (2016 IEEE International Conferences on Big Data and Cloud Computing (BDCloud), Social Computing and Networking (SocialCom), Sustainable Computing and Communications (SustainCom) (BDCloud-SocialCom-SustainCom))

Analysis and Evaluation of Social Contagion of Physical Activity in a Group of Young Adults 2015
Eric Araújo, Anita V. T. T. Tran, Julia S. Mollee, Michel C. A. Klein
10.1145/2818869.2818922 (Proceedings of the ASE BigData & SocialInformatics 2015)

An Analysis of TCP Protocol Issues in Asymmetric Networks and Existing Solutions (*In Portuguese*) - M.Sc. Thesis 2009
Eric Araújo
hdl.handle.net/1843/BUBD-9JWQ36

AnimEasy: Free Tool for Digital Inclusion Focused on Multimedia Using Inkscape (*In Portuguese*) - B.Sc. Senior Project 2007
Eric Araújo, Ricardo dos Santos Ferreira
VII Simpósio de Informática do Planalto Médio (SIPM 2007)

Research Skills

1. **Agent-based modeling:** Netlogo and Python tools for ABMs.
2. **Data Science and Machine Learning:** Python, R, Statistics.
3. **Social Network Analysis:** Gephi, NetworkX.
4. **Network-oriented modeling:** Techniques for modeling complex systems using network-oriented methods.

Recent Supervision

Katelin Jandris (Computer Science Senior Project) Calvin University, USA
A Cognitive Agent-Based Model of the Political Polarization in the US Churches June 2025 – present

Esther Asuquo and David Barry (Computer Science Senior Project) Calvin University, USA
Modeling Gram-Negative Bacterial Infections: An Agent-Based Approach Jan 2025 – present

Daniel Kwon and Jaden Brookens (Computer Science Senior Project) Calvin University, USA
Modeling Introversion in the Classroom: An Agent-Based Approach Sept 2024 – May 2025

Leonardo Biazoli (Statistics Ph.D. Student) UFLA, Brazil
Data-Driven Strategies for Inferring from Large-Scale Bibliometric Datasets Mar 2023 – Feb 2025

Denis de Sousa Cordeiro (Information Systems B.Sc. Student) UFLA, Brazil
Digital Hymnal: a database for the preservation and analysis of Brazilian evangelical music from the 20th century to the present day. Mar 2022 – June 2024

Alessandra Louzada Terra (Computer Science M.Sc. Student) UFLA, Brazil
Medical Doctors Mobility: Using Machine Learning and Complex Networks Metrics to understand the patterns of medical human resources in Brazil. Mar 2023 – Sept 2024

Clayton Ramos da Silva (Physics M.Sc. Student) UFLA, Brazil
Modeling the propagation of Visceral Leishmaniasis using complex networks and machine learning techniques. Mar 2022 – Sept 2024

Thiago Guedes de Jesus (Physics M.Sc. Student) UFLA, Brazil
Epidemic Modeling in Spatial Networks based on Evolutionary Dynamics of Game Theory. Mar 2022 – Sept 2024

Matheus de Andrade Flausino (Computer Science M.Sc. Student) UFLA, Brazil
Morphological and Urban Topological Analysis of Cities in Southeast Brazil to Understand Street Robberies Patterns. Mar 2022 – Sept 2024

Rolf Pagotto Veiga (Computer Science M.Sc. Student) UFLA, Brazil
Development of Guidelines for Automatic Classification Focused on Identifying Christian Music Mar 2022 – Aug 2024

Thiago do Prado Ramos (Computer Science M.Sc. Student) — UFLA, Brazil
Wireless Network Sizing of an University Campus Based in Connection Log Analysis — Mar 2021 – Sept 2023

Alessandra Louzada Terra (Computer Science B.Sc. Student) — UFLA, Brazil
Medical Students Mobility in Brazil: Understanding the flow of medicine students using Machine Learning and Social Network Analysis — Mar 2021 – Dec 2022

Kelly Iapuque Rodrigues de Sousa (Forest Engineering M.Sc. Student) — UFLA, Brazil
Street Trees and Criminology: A study-case of Lavras City, Brazil — Mar 2020 – Dec 2022

Álvaro Martins Espíndola (Computer Science B.Sc. Student) — UFLA, Brazil
Agent-based modelling for Criminology Theory Tests — Sept 2018 – Dec 2019

Aline Rodrigues Guimarães de Oliveira (Computer Science B.Sc. Student) — UFLA, Brazil
Social Contagion in Social Networks (Research scholarship grant by CNPq). — Sept 2018 – Dec 2019

Teaching

CS112 - Introduction to Data Structures — Calvin University, USA
An introduction to data structures and algorithms, focusing on the design and analysis of algorithms, data structures, and their applications. — Sept 2024 – present

CS354A - Databases Management Systems — Calvin University, USA
An introduction to database management systems, covering data modeling, query languages, and database design. — Jan 2025 – present

CS300b - Agent-based Modeling — Calvin University, USA
An introduction to agent-based modeling, focusing on the design and implementation of agent-based models for complex systems. — Sept 2024 – present