

# Lucas Emanuel Resck

## PERSONAL INFORMATION

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Full name: Lucas Emanuel Resck Domingues  
MSc in Mathematical Modeling  
Fundação Getulio Vargas, Rio de Janeiro, Brazil

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My research interests are **Machine Learning** (ML), **Natural Language Processing** (NLP), and **Explainable Artificial Intelligence** (XAI). I am particularly interested in improving the degree of explainability of ML and NLP models.

## EDUCATION

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| Incoming  | <b>PhD, Computation, Cognition and Language</b><br>University of Cambridge, ELLIS PhD Program                                    |
| 2022–2024 | <b>MSc, Mathematical Modeling</b><br>Fundação Getulio Vargas   |
| 2018–2021 | <b>BSc, Applied Mathematics</b><br>Fundação Getulio Vargas<br>GPA: 3.86/4.0 — 1st in class, 9.66/10.0, lowest passing grade of 6 |
| 2015–2017 | <b>Technical Education, Mechatronics</b><br>Federal Center for Technological Education of Minas Gerais (CEFET-MG), Brazil        |

## RESEARCH EXPERIENCE

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| 2020–present | <b>Visual Data Science Lab</b><br>Fundação Getulio Vargas<br>Master's and Undergraduate Researcher<br><b>Supervisor:</b> Jorge Poco<br><br><b>Improving NLP model explanations using human annotations</b> <ul style="list-style-type: none"><li>Developed a novel contrastive-inspired loss to incorporate human annotations into NLP classification in a model- and explainer-agnostic way (<b>NAACL Findings 2024</b>, Lat-inX in NLP, MSc Thesis).</li><li>Employed a multi-objective optimizer to explore the trade-off between the contrastive and the original losses.</li><li>Significantly improved the plausibility of post-hoc explanations (relative increase of 3.49% for a language model) without substantially degrading model performance.</li></ul> <b>Design of a novel explainer for GNN node classification</b> <ul style="list-style-type: none"><li>“Distill n’ Explain” (<b>AISTATS 2023</b>) first distills the original GNN into an interpretable one and then explains the latter.</li><li>Designed and proved lemmas and theorems that guarantee the method’s explanation faithfulness.</li><li>The proposed explainer outperformed previous methods in explanation accuracy while being orders of magnitude faster.</li></ul> <b>Development of a visual analytics system to explore citations in legal documents</b> <ul style="list-style-type: none"><li>“LegalVis” (<b>TVCG 2023</b>, <b>VIS 2022</b>, BSc Thesis) employs ML, NLP, XAI, and data visualization to infer non-explicit citations in Brazilian legal documents.</li><li>Tested a diverse set of NLP classifiers (Transformers, word embeddings, and bag-of-words) and achieved high accuracy (96%) in identifying citations.</li></ul> |
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- Employed a model-agnostic explainer (LIME) to explain the inferred citations.

2022

### Vision, Language, and Learning Lab

Rice University, Houston, USA

Visiting Scholar (3 months)

**Supervisor:** Vicente Ordóñez

Explored training data attribution methods, e.g., influence functions, and ways to improve them. This activity continued after the visit.

2016–2017

### Federal Center for Technological Education of Minas Gerais

High School Researcher Fellow and Volunteer

- Circuits for driving low power direct current motors (Fellow)
- Brazilian Robotics Olympiad (OBR) 2016, Practical Modality (Volunteer)

## PUBLICATIONS

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### Conferences

1. **Lucas Resck**, Marcos M. Raimundo, and Jorge Poco. Exploring the Trade-off Between Model Performance and Explanation Plausibility of Text Classifiers Using Human Rationales. In *Findings of the Association for Computational Linguistics: NAACL 2024*, June 2024. Also presented as a poster at the LatinX in NLP at NAACL 2024 workshop. URL: <https://aclanthology.org/2024.findings-naacl.262>
2. Tamara Pereira, Erik Nascimento, **Lucas E. Resck**, Diego Mesquita, and Amauri Souza. Distill n' Explain: explaining graph neural networks using simple surrogates. In *International Conference on Artificial Intelligence and Statistics (AISTATS)*, April 2023. URL: <https://proceedings.mlr.press/v206/pereira23a.html>

### Journal Publications

1. **Lucas E. Resck**, Jean R. Ponciano, Luis Gustavo Nonato, and Jorge Poco. LegalVis: Exploring and Inferring Precedent Citations in Legal Documents. *Transactions on Visualization and Computer Graphics (TVCG)*, 29(6), June 2023. Presented at Visualization and Visual Analytics (VIS) 2022. URL: <https://ieeexplore.ieee.org/document/9716779/>

### Theses

1. **Lucas Emanuel Resck Domingues**. *Balancing performance and explanation plausibility: a multi-objective approach to text classification with human rationales*. MSc thesis, Fundação Getulio Vargas, Rio de Janeiro, Brazil, May 2024. URL: <https://hdl.handle.net/10438/35362>
2. **Lucas Emanuel Resck Domingues**. *Inferring and Explaining Potential Citations to Binding Precedents in Brazilian Supreme Court Decisions*. BSc thesis, Fundação Getulio Vargas, Rio de Janeiro, Brazil, December 2021. URL: <https://hdl.handle.net/10438/31845>

### Technical Reports

1. **Lucas Emanuel Resck Domingues** and Júlia Gandini Blahun. Circuits for Driving Low Power Direct Current Motors. High school research project report, Federal Center for Technological Education of Minas Gerais, Varginha, Brazil, 2018
2. Júlia Gandini Blahun, Luiza de Souza Pinto Regina, and **Lucas Emanuel Resck Domingues**. Brazilian Robotics Olympiad – OBR'2016, Level II Practical Modality. High school research project report, Federal Center for Technological Education of Minas Gerais, Varginha, Brazil, 2016

### Contributions to Other Papers

1. Beatriz Sabdin Chagas, Carla Marcondes Damian, and Raphaël Tinarrage. The Impact of the Súmula Vinculante 26 on the Decrease of Similar Demands at the STF: a Quantitative Analysis With Machine

Learning Models. Chile, October 2022. URL: [https://raphaeltinarrage.github.io/files/Paper\\_CONPEDI\\_Quantitativa.pdf](https://raphaeltinarrage.github.io/files/Paper_CONPEDI_Quantitativa.pdf)

- Ana Clara Macedo Jaccoud, Pedro Burlini de Oliveira, and Raphaël Tinarrage. Regime Progression for Heinous Crimes in Brazilian Supreme Court (STF): an Empirical Analysis of Súmula Vinculante 26. Chile, October 2022. URL: [https://raphaeltinarrage.github.io/files/Paper\\_CONPEDI\\_Empirica.pdf](https://raphaeltinarrage.github.io/files/Paper_CONPEDI_Empirica.pdf)

## OTHER/ONGOING RESEARCH PROJECTS

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All projects are in the context of the Visual Data Science Lab at Fundação Getulio Vargas.

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| 2023–present | <b>Training Data Attribution.</b> Recent project on the exploration of methods to attribute model predictions to training data. Investigation of the intersection of attribution, data-modeling, and machine unlearning. Publications are expected in 2024.   |
| 2023–present | <b>Legal Language Models and Topological Data Analysis.</b> Recent project on the exploration of the intersection between NLP and topological data analysis in legal documents.   |
| 2022–present | <b>“LegalAnalytics” Project.</b> Application of ML, NLP, XAI, and visualization methods for the creation of the LegalAnalytics system to assist judicial experts in the application of understandings from the Brazilian Supreme Court. Publications are expected in 2024.  |
| 2021–present | <b>Machine Learning and Súmulas Vinculantes.</b> Exploration of computational methods, especially ML, NLP, and topological data analysis, in legal documents that cite Brazilian binding precedents (“Súmulas Vinculantes”). The project also explored the annotation of legal documents by experts. Resulted in Contributions to Other Papers 1 and 2. Other publications, as a co-author, are expected in 2024. |

## TEACHING EXPERIENCE

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| 2023      | <b>Fundação Getulio Vargas</b><br>Professor of Introduction to Programming in a Web Systems Development course.                                       |
| 2020–2021 | <b>Fundação Getulio Vargas</b><br>Teaching assistant of Ordinary Differential Equations, Calculus in Several Variables, and Calculus in One Variable. |

## PROFESSIONAL EXPERIENCE

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|-----------------|--|
| 12/2019–02/2020 | <b>EloGroup</b><br>Summer Intern in Data Science<br>Conducted time series analysis, exploratory data analysis, sanity checks on databases, and data preprocessing.   |
| 01/2019–02/2019 | <b>PSR Power Systems Research</b><br>Summer Intern in Optimization<br>Developed and implemented optimization models for maintenance schedules and dispatch of power plants, utilizing Julia and optimization packages. |

## HONORS, AWARDS, & SCHOLARSHIPS

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| Incoming  | Cambridge Trust’s Cambridge International Scholarship. University fees and maintenance.   |
| Incoming  | PhD student at the <a href="#">ELLIS PhD &amp; Postdoc Program</a> .  |
| 2024      | <a href="#">NAACL 2024 Diversity and Inclusion</a> award. Registration and partial travel grant.  |
| 2022–2024 | MSc scholarship holder at Fundação Getulio Vargas (FGV). Tuition fee and monthly stipend.   |
| 2023      | Invited speaker at Colégio União, Três Corações, Brazil. Presentation “How the mathematics olympiads transformed my life” to motivate students, at the invitation of professor Aguinaldo Borba. |

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| 2022–2023 | Scholarship (tuition fee) holder in the Graduate Support Program for Private Education Institutions (PROSUP) of the Coordination for the Improvement of Higher Education Personnel (CAPES).   |
| 2022      | Academic distinguished undergraduate award. Ranked 1st in my undergraduate class at FGV. Recognition of academic excellence (grades and research).  |
| 2018–2021 | Scholarship holder in the Undergraduate Research and Master’s Program (PICME). This was possible because of mathematical olympiads medals before college. I had the opportunity to start research and take graduate courses during my undergraduate studies, while receiving a scholarship. |
| 2018–2021 | Selected by the Talent Selection program from the Center for the Development of Mathematics and Sciences (CDMC) of FGV. BSc scholarship holder (tuition fee and monthly stipend). I was selected based on my performance in mathematical olympiads and in the entrance exam.                |
| 2017      | 1st place at FGV’s entrance exam in Applied Mathematics (out of 24 candidates).   |
| 2017      | Scholarship holder at CEFET-MG and the National Council for Scientific and Technological Development (CNPq) in the High School Research Fellowship.   |
| 2012–2017 | Brazilian Public School Mathematics Olympiad (OBMEP). Gold (1 medal), silver (3), and bronze (1) medals, and honorable mention (1).   |
| 2012–2017 | Brazilian Astronomy and Astronautics Olympiad (OBA). Silver (2) and bronze (1) medals.  |

## LANGUAGES AND SKILLS

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**Languages:** Portuguese (native) and English (advanced). TOEFL iBT 112, 30 reading/listening, 26 speaking/writing.

**ML Frameworks:** PyTorch, scikit-learn, HuggingFace Transformers, TensorFlow, Keras.

**Programming Languages:** Python, C++, Julia, R, MATLAB/Scilab, LaTeX.

**Technologies:** Git, Pandas, NumPy, Linux.

## VOLUNTEERING

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| 2024      | Volunteer at <a href="#">FAccT 2024</a> , in Rio de Janeiro, Brazil.  |
| 2018–2019 | Treasurer at the Academic Directory of Applied Mathematics at FGV.  |
| 2018      | Support team member at the International Congress of Mathematicians 2018, in Brazil, hosted by the Brazilian Institute for Pure and Applied Mathematics (IMPA). |

## EVENTS, SCHOOLS, & WORKSHOPS ATTENDED

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| 2024 | <a href="#">NAACL 2024</a> in Mexico City, Mexico. Presentation of a poster of Conference 1.                           |
| 2024 | <a href="#">LatinX in NLP at NAACL 2024</a> workshop in Mexico City, Mexico. Presentation of a poster of Conference 1. |
| 2024 | <a href="#">Tropical Probabilistic AI School 2024</a> at FGV. Presentation of a poster of Conference 1.                |
| 2023 | Seminar for Postgraduate Students at the School of Applied Mathematics of FGV (SEPEMAp). Presentation of Conference 1. |
| 2023 | <a href="#">XLII Brazilian Congress of Applied and Computational Mathematics (CNMAC 2023)</a> in Bonito, Brazil.       |
| 2023 | <a href="#">Latin American Congress on Industrial and Applied Mathematics (LACIAM) 2023</a> at FGV.                    |
| 2023 | <a href="#">Summer School on Data Science</a> at FGV.  |

- 2022 [IEEE VIS: Visualization & Visual Analytics 2022](#) in Oklahoma City, USA. Presentation of Journal Publication 1.
- 2022 [8th Workshop on Mathematical Solutions for Industrial Problems](#) at the Research Center in Mathematics Applied to Industry (CeMEAI) at the University of São Paulo.
- 2018 International Congress of Mathematicians (ICM) 2018 in Rio de Janeiro, Brazil.
- 2016 High school research course ([Mentores](#)) in mathematics (plane analytical geometry) for medalists of OBMEP. Scholarship holder at CNPq.
- 2013–2015 [High School Research Program \(PIC-Jr\)](#) in mathematics for medalists of OBMEP. Scholarship holder at CNPq.