ROGÉRIO GUIMARÃES

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EDUCATION

California Institute of Technology — *Pasadena, CA*
Ph.D. Student in Computation and Neural Systems — *September 2021 - June 2026*
Advisor: Prof. Pietro Perona

Massachusetts Institute of Technology - *GPA 4.8/5.0* — *Cambridge, MA*
Bachelor of Science in Computer Science and Engineering — *September 2017 - June 2021*
Bachelor of Science in Linguistics and Philosophy

Graduate coursework: Human Brain Mapping: Theory and Practice, Topics in Systems Neuroscience, Networks of Relations

Selected undergraduate coursework: Machine Learning (Graduate Course), Aspects of a Computational Theory of Intelligence (Graduate Course), Advanced Natural Language Processing (Graduate Course), Advanced Data Structures (Graduate Course), Design and Analysis of Algorithms, Intro to Probability, Intro to Data Science and Statistics, Software Construction, Computer Systems Engineering, Computational Cognitive Science, Language Acquisition, Intro to Neuroscience, Intro to Psychological Science.

PROFESSIONAL EXPERIENCE & RESEARCH

Caltech Computational Vision Laboratory - *www.vision.caltech.edu* — *Pasadena, CA*
Graduate Researcher — *September 2021 - Present*

Intelligent systems need to develop *representations* and work on top of them to solve tasks. I am interested in how we can learn representations that are both robust and compositional in order to generalize to novel tasks. My research is focused on creating novel ways to learn features in artificial neural networks, but also on studying the solutions that our brains already developed so that I can *measure and bridge the gap between natural and artificial intelligence*. My public projects include:

- **Text-image Alignment for Diffusion-based Perception**
  Diffusion-pretrained vision models repurpose latent representations from the U-Net backbone of a Diffusion Model for downstream visual perception tasks. We analyzed the effects of caption-image alignment and used automatically generated captions to reach state of the art results in depth estimation and cross-domain segmentation with our diffusion-based vision model.
- **Reverse Engineering Animal Algorithms for Navigation**
  Studying the learning algorithms used by mice and humans to navigate complex mazes. The goal is reproducing, in AI models, features of animal navigation such as efficient exploration, few-shot learning, and rapid adaptation to environment changes.

Zeiss Medical Technology - *www.zeiss.com* — *Dublin, CA*
Data Science Intern — *June 2021 - September 2021*

- Upgraded the algorithms used in the automated segmentation of OCT images from UNets to Transformers. Implemented the new algorithm without hurting execution time by processing OCT images as sequences of 1D B-scans, instead of 2D input.

MIT Laboratory for Information and Decision Systems (LIDS) - *www.lids.mit.edu* — *Cambridge, MA*
Undergraduate Researcher — *January 2019 - May 2021*

- Developed models for automated optimal decision making in agricultural management in Sub-Saharan Africa based on crop yield using Deep Reinforcement Learning. Used the WOFOST model to generate simulated data to train the models.

Bridgewater Associates - *www.bridgewater.com* — *Westport, CT*
Investment Engineering Intern — *June 2020 - August 2020*

- Utilizing learned macroeconomics concepts and understanding of global markets, analyzed select case studies to develop hypotheses to explain and predict the business cycle. Used them to build a fully automated sample bond trading system.

Pegasystems - *www.pega.com* — *Cambridge, MA*
Software Engineering Intern — *June 2019 - August 2019*

- Member of a core engineering team with the task to speed up the initialization of Kubernetes nodes when running Pega Platform, the main product of the company, in the cloud.
- Collaborator in the root cause analysis that found a bottleneck caused by requests to the database for java classes. Worked in the implementation of a solution that pre-loaded such classes directly in the docker image used in the nodes.

TEACHING

California Institute of Technology - *www.caltech.edu* — *Pasadena, CA*
Head Teaching Assistant - EE 148: Large Language and Vision Models — *March 2024 - June 2024*
Teaching Assistant - EE 148: Large Language and Vision Models — *March 2023 - June 2023*

- Graduate course on how large generative models, such as ChatGPT and Dall-E, process and produce realistic text and images

Organização Educacional Farias Brito - *www.fariasbrito.com.br* — *Fortaleza, Brazil*
Competitive Programming Teacher — *November 2016 - May 2017*

- Taught competitive programming and logic to students from 6^{th} to 12^{th} grade in one of the best schools in informatics olympiads in Brazil. Two students classified to the International Olympiad in Informatics in the 2017 Team Selection Tests.

PUBLICATIONS & PATENTS

- **Text-image alignment for diffusion-based perception**
  Kondapaneni, N., Marks, M., Knott, M., **Guimaraes, R.**, & Perona, P.)
  IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR 2024)
- **Method and system for an end-to-end deep learning based optical coherence tomography (OCT) multi retinal layer segmentation**
  Nair, A., **Guimaraes, R.**, Bagherinia, H, & Salehi, A
  U.S. Patent No. 2023/0196572 A1

SELECTED POSTER PRESENTATIONS

- **Mice in the Manhattan Maze: rapid learning, flexible routing and generalization, with and without cortex**
  Zheng, J., **Guimaraes, R.**, Hu, J., Perona, P., & Meister, M.
  Cognitive Computational Neuroscience (CCN 2024)
- **Mice in Manhattan: efficient exploration and automated theory testing in a rapidly reconfigurable maze**
  Zheng, J., **Guimaraes, R.**, Perona, P., & Meister, M.
  Society for Neuroscience (SfN 2022)

SELECTED AWARDS

- **International Olympiad in Informatics (IOI) - Silver Medal** (2016, Russia), **Bronze Medal** (2017, Iran)
  The IOI was initiated by the UN and is the most prestigious computer science competition for HS students in the world. It requires knowledge on advanced data structures and algorithms and has contestants from more than 80 countries.
- **Caltech Thomas A. Tisch Prize for Graduate Teaching in Computing and Mathematical Sciences** (2024)
  Awarded to graduate students for outstanding teaching and course development in computing and mathematical sciences.
- **Caltech Tianqiao and Chrissy Chen Graduate Fellow** (2021)
  Fellowship provided to exceptional first-year graduate students in neuroscience options at Caltech
- **MIT EECS Undergraduate Research and Innovation Scholar - SuperUROP** (2019/2020)
  A year-long program for selected students in EECS that provides sponsorship and academic advise for their research projects.
- **MIT Burchard Scholar** (2019/2020)
  Selected group of students who have demonstrated outstanding abilities and academic excellence in the humanistic fields.
- **Estudar Fellow** (2017)
  Fundação Estudar awards scholarships and connects talents who want to positively impact Brazil (33 selected from 83,000).

LEADERSHIP & PERSONAL INTERESTS

- **CodCad** *(2016 - 2019)*
  Co-founded a company to provide introductory and advanced online courses in CS. The platform had more than 9,000 users and was recommended by the Brazilian Olympiad in Informatics. Finalist in Microsoft Imagine Cup Brazil 2017
- **Brazil Conference at Harvard & MIT** *(2019)*
  Conceived, managed, and mediated a panel with four successful Brazilian YouTubers about new communication media. The conference had 900 participants and 80 speakers, including the Brazilian vice president, congressmen, and entrepreneurs.
- **Ousadia** *(2018 - 2020)*
  Created and captained Ousadia, the soccer team of the Brazilian Students Association of MIT. It reached new members for the association and connected with non Brazilian members of MIT. We won two intramural competitions.

CLASS PROJECTS

- **Meta-Visualization: Investigating Rapid Learning and Feature Reuse**
  Final Project for MIT 6.867 - Machine Learning (2019)

  Investigated the nature of the meta-learning process in algorithms like MAML through the development of a visualization tool for the learning path in the loss landscape and geometric interpretations of rapid learning and feature reuse.

- **Translating Tweets from Trumpese to Sanderese with Transformers and CycleGANs**
  Final Project for MIT 6.864 - Advanced Natural Language Processing (2020)

  Used Transformers to apply Cyclic Generative Adversarial Networks to the Natural Language Processing domain, attempting to transfer styles between tweets of different users

- **Bayesian Few Shot Learning of Compositional Instructions**
  Final Project for MIT 6.804 - Computational Cognitive Science (2019)

  Developed a Bayesian Model that reproduced human behavior when given the sequence-to-sequence task of interpreting a list of instructions in an artificially generated language to generate a sequence of colors.

- **Non-adult Behavior of Children's Quantification in Logical Deduction Outside of the Language Domain**
  Final Project for MIT 24.904 - Language Acquisition (2020)

  Proposed a psycholinguistic experiment to evaluate whether exhaustive pairing, a non-adult judgement common in children in ages 4 to 6, is caused by pragmatic or semantic reasons.

- **Implementing a Fusion Tree in C++ (2017)**
  Final Project for MIT 6.851 - Advanced Data Structures (2017)

  Implemented a fully functional and well documented fusion tree that can perform predecessor queries in sets with limited capacity using only a constant number of operations in a general BigInt.

SKILLS

Computational Skills: Advanced Algorithms and Data Structures construction and analysis, Machine Learning, Computer Vision, Reinforcement Learning, Natural Language Processing, Statistics & Data Science, C & C++, Python, Java, PyTorch, Scikit-Learn
Languages: Portuguese (native), English (fluent), Spanish (advanced)