Porto Alegre, RS, Brazil
efantini@inf.ufrgs.br

Eduardo Fantini

Curriculum Vitae - July 2024

github.com/edufantini
inf.ufrgs.br/~efantini

Academic Education

Bachelor in Computer Science **2019 — 2024 (expected)**
Institute of Informatics, Federal University of Rio Grande do Sul (UFRGS)

Experience

Scientific Initiation Fellow **2022 — present**
(Yet Another) AI Group | UFRGS Porto Alegre, Brazil

- Projects and research on topics related to Artificial Intelligence (AI), such as classical planning, heuristic search, and machine learning.

Member **2020 — 2022**
PET Computação UFRGS Porto Alegre, Brazil

- PET (Tutorial Education Program) Computing, created in 1988, is a group composed of undergraduate students from the Computer Science and Computer Engineering courses. Based on the Academic Triad of Teaching, Research, and Extension, it aims to provide members with the opportunity to explore areas of interest beyond their course curriculum.
- The Tutorial Education Program is a Brazilian Federal Government program to stimulate research, teaching, and university extension activities at the undergraduate level. The program is under the Secretariat of Higher Education of the Ministry of Education.

Publications

1. Fantini, E., Lermen, T. S. & Cota, É. F. **Estudo de IA baseado em projetos: implantando uma Engine para jogos de tabuleiro**. *Revista ComInG - Communications and Innovations Gazette* **5,** 1–13. https://periodicos.ufsm.br/coming/article/view/67744 (Nov. 2021).

Projects

Blocks World Generalization, (Yet Another) AI Group | UFRGS **2023 — present**
This project developed new methods based on machine learning to encompass the **generalization capability of residual neural networks** applied as state evaluators in the Blocks World planning domain.

- Ideated and implemented projection techniques between different search spaces.
- Implemented algorithms using `libtorch`, the C++ API of *PyTorch*.
- Conducted experiments comparing the accuracy and generalization capability of residual neural networks.
- Analyzed the influence of different distributions and sample sizes on the learning of residual neural networks in a regression problem.
- Wrote a scientific article reporting the findings and comparing the results with the state of the art.

NeuralFastDownward-trees, (Yet Another) AI Group | UFRGS **2022 — 2022**
This project compared the use of two machine learning models, **neural networks** and **decision trees**, as heuristic functions to guide searches in different classical planning domains.

- Studied the *XGBoost* learning model.
- Implemented an interface between *XGBoost* models and the *Fast-Downward* search framework.
- Trained *XGBoost* models and compared their performance in search tasks. Comparisons were made with the best approaches found in the literature.

RTDL-experiments, (Yet Another) AI Group | UFRGS **2022 — 2022**
This project involved studying and reproducing the article *Revisiting Deep Learning Models for Tabular Data*. The article compares and analyzes the performance of various machine learning models trained with **tabular data**. In the context of **heuristic search** in classical planning tasks, the obtained models are used to estimate the distance to the goal state of the search task, starting from any given state.

- Studied the article and its methodology.
- Evaluated different regression models.
- Studied the *Multi-Layer Perceptron*, *Residual Neural Networks*, *CatBoost*, and *XGBoost* models.

Papagaio, PET Computação UFRGS **2021 — 2022**

This machine learning project uses the EPMS package (described below) to generate musical pieces in MIDI format. The trained *bidirectional LSTM* models received a piece of music and complemented it with a new line generated for a chosen instrument. Satisfactory results were achieved with various types of musical instruments.

- Ideated, proposed, and led the project.
- Studied different types of *Recursive Neural Networks*.
- Studied web scraping and developed a *crawler* program that built a dataset with MIDI music available for free on the internet.
- Trained *bidirectional LSTM* models with different parameters and datasets to verify which produced the most satisfactory results.
- This project is open-source, and its code is available in the following git repository: **github.com/petcomputacaoufrgs/papagaio**

EPMS, PET Computação UFRGS **2021 — 2021**

This project developed and published the *Expressive Polyphonic MIDI Serializer* package, which converts MIDI files into an internal representation - and vice versa. Thus, it allows manipulating MIDI music using neural networks.

- Studied the MIDI format.
- Developed a program that performs conversion between MIDI files and Pandas DataFrames, without losing the expressiveness of the music and the metadata of the original file.
- Published the developed program as a Python package (**pypi.org/project/EPMS/**).
- This project is open-source, and its code is available in the following git repository: **github.com/petcomputacaoufrgs/EPMS**

LoBo Brain, PET Computação UFRGS **2020 — 2021**

In this project, two machine learning techniques were implemented and compared as the decision-making center of a generic board game agent. The studied techniques were **Minimax** and **Q-Learning**.

- Studied and implemented the *Minimax* and *Q-Learning* algorithms.
- Implemented the Tapatan board game.
- Wrote a paper analyzing and comparing the two implemented algorithms regarding the optimality of decisions made, performance, and data representation.
- This project is open-source, and its code is available in the following git repository: **github.com/petcomputacaoufrgs/lobo-brain**

Events

- **Salão UFRGS 2023: XXXV SALÃO DE INICIAÇÃO CIENTÍFICA DA UFRGS** **2023**
  Highlight presentation “Study of the Generalization Capability of Heuristic Functions in the BlocksWorld Classical Planning Domain through Neural Networks” in the Artificial Intelligence Session.
- **Salão UFRGS 2022: XXXIV SALÃO DE INICIAÇÃO CIENTÍFICA DA UFRGS** **2022**
  Presentation “Study of Machine Learning Models in Tabular Data for Generating Heuristic Functions for Classical Planning” in the Artificial Intelligence and Computing Theory Session.

Interests

- Artificial Intelligence
- Reinforcement Learning
- Classical Planning
- Machine Learning
- Software Engineering
- Computational Neuroscience
- Behavioral Sciences
- Music Production

Languages

Portuguese | Native
English | Fluent
Spanish | Basic

Technical Skills

Programming Languages	Python, C++, Bash
Machine Learning Frameworks	PyTorch, libtorch, XGBoost, scikit-learn
Classical Planning Systems	Fast-Downward
Data Science Packages	Pandas, NumPy, matplotlib, seaborn
Tools	LaTeX, Markdown, HTML