PHELIPE D'ARC

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EDUCATION

Universidade Federal do Rio de Janeiro (UFRJ)   Jan 2017 - Oct 2021
Bachelor's degree in Physics

Centro Brasileiro De Pesquisas Físicas (CBPF)   Mar 2022 - Aug 2023
Master's of science in Physics

Centro Brasileiro De Pesquisas Físicas (CBPF)   Sep 2023 - Present
Ph.D. in Physics

PUBLICATIONS

- Simulation Based Inference of BNS Kilonova Properties: A Case Study with AT2017gfo, P.Darc et al. 2023, <u>arXiv:2311.09471</u> - NeurIPS 2023

- The S-PLUS Transient Extension Program: Imaging Pipeline, Transient Identification, and Survey Optimization for Multi-Messenger Astronomy, <u>A. Santos et al. 2023</u>

- Kilonova SED Modelling Using Amortized Neural Posterior Estimation: A Case Study with AT2017gfo, Darc et al. 2024 - In preparation

RESEARCH

CBPF - LITComp-AI   Mar 2022 - Present
PhD Candidate
- Developed simulation-based inference algorithms for kilonova spectral energy distribution (SED) modeling, incorporating Amortized and Sequential Neural Posterior Estimation (NPE) techniques.
- Applied P-Cygni absorption-emission spectral feature and blackbody modeling to fit kilonova spectra.
- Employed $H\beta$ and $H\alpha$ line profile fitting in AGN spectra to estimate the mass of supermassive black holes using PyQSOFit.
- Designed and implemented a spectrum classifier to distinguish between Supernovas Type I and II. Employed interpolation and standardization techniques, integrated one-dimensional convolutional layers for feature extraction, and utilized bidirectional LSTM for enhanced performance.
- Created a Random Forest classifier for supernova identification, and built a comprehensive tutorial detailing image pre-processing, training, hyperparameter tuning, and the generalization process for a binary classification problem.
- Assisted collaborators in producing light curves of flares resulting from Binary Black Hole mergers in Active Galactic Nuclei (AGN) disk environments.
- Created a tutorial on implementing ImageNet weights on Neural Networks with more than 3 channels (TensorFlow).

FINK (Alert Broker) Brazil   Oct 2023 - Present
PhD Candidate
- Actively developing an API for the CBPF Alert Transient Search (CATS) Light Curve Broad Classifier.
- Engineered a script capable of classifying 100,000,000 LSST alerts on GPUs in less than 12 minutes for the *ELAsTiCC* dataset.

RESEARCH

NEWFIRM Infrared Survey for Transients Collaboration   **Mar 2024 - Present**
PhD Candidate
- Observed and conducted Near-Infrared transient searches at the NEWFIRM telescope.

DESGW collaboration   **Mar 2023 - Present**
PhD Candidate
- Developed a Convolutional Neural Network (CNN) model to identify optical Gravitational Wave (GW) counterparts, effectively removing artifacts generated during the difference imaging process.
- Integrated the Convolutional Neural Network (CNN) into the DESGW pipeline, uploading the scores to the website.
- Assisted the DESGW team in the real-time classification of candidates during O4 (Observing Run 4) events.

S-PLUS Collaboration   **Jun 2022 - Present**
PhD Candidate
- Developed and implemented DeepSTEP, a Deep Learning tool for identifying Astrophysical Transients in the S-PLUS Transient Extension Program (STEP). Created a robust image processing pipeline from scratch, encompassing tasks like cleaning, contrast adjustment, and normalization.
- Conducted visual inspection of transient candidates obtained from the S-PLUS Transient Extension Pipeline.
- Conducted observations using the T80s telescope.

Laboratório Nacional de Computação Científica + Lemobs   **Jan 2022 - Aug 2023**
Intern
- Designed an advanced algorithm utilizing the state-of-the-art BERTimbau model, a variant of BERT, for classifying phrases describing medical conditions. Achieved accurate identification of health issues including asthma, diabetes, and cardiovascular diseases.
- Developed a customized script employing Google APIs and the Regex library to save, process, and filter data from YouTube comments.

UFRJ   **Jan 2018 - Aug 2021**
Undergraduate Research Assistant
- Explored the utilization of Supernovae Ia as standard candles for estimating cosmological parameters through the application of Markov Chain Monte Carlo (MCMC) and SALT2.
- Investigated the application of Quasars as standard candles by exploring a non-linear relation between X-ray and UV emission. Acknowledged with the "Best Presentation" prize at the XLII Jornada Giulio Massarani de Iniciação Científica, Tecnológica, Artística e Cultural (JICTAC 2, UFRJ) for this research.
- Worked at IFFablab, the prototype manufacturing laboratory at the Institute of Physics, UFRJ. Constructed a Kater's pendulum and conducted measurements to determine the gravitational constant.

TALKS

São Paulo Advanced School on Multi-Messenger Astrophysics, May 2023
DeepSTEP: A Deep learning tool for identification of Astrophysical Transients in S-PLUS Transient Extension Program (STEP)

LNCC XVI Computational Modeling Conference, Jun 2022
Transient identification using CNNs

Dark Energy Survey Fall Collaboration Meeting (DESGW Workshop), Oct 2023
A Deep Learning approach to transient detection in DESGW search and Discovery pipeline

CBPF Artificial Intelligence workshop, Dec 2023
Simulation-Based Inference of BNS Kilonova Properties

POSTERS

XLVI Reunião Anual da Sociedade Astronômica Brasileira, Oct 2023
DeepSTEP: A Deep learning tool for identification of Astrophysical Transients in S-PLUS Transient Extension Program (STEP)

37th conference on Neural Information Processing Systems (NeurIPS), Dec 2023
Simulation-Based Inference of BNS Kilonova Properties: A Case Study with AT2017gfo

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TEACHING

Universidade Federal do Rio de Janeiro, UFRJ   **2019 - 2021**
Teacher Assistant
- Laboratory of instrumentation in contemporary physics and digital processing. (Mar. 2021 - Jun. 2021)
- Taught physics classes to high school students visiting the LADIF (Laboratório Didático do Instituto de Física da UFRJ), and visited schools introducing to the students science experiments (Mar. 2019 - Mar.2021)

ADDITIONAL SKILLS

- **Deep Learning:**

Keras-Tensorflow, Pytorch, CNN, LSTM, GPU- Paralellism

- **Python:**

Pandas, Numpy, Regex, Matplotlib, seaborn, jupyter

- **Machine Learning:**

Sckit-Learn, Random Forest, SVM, xgboost

- **Bayesian Inference:**

MCMC, Simulation-based inference (SNPE, ANPE, NLE...)

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