PHELIPE D'ARC

PH.D. STUDENT IN ASTROPHYSICS AT CBPF

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PROFESSIONAL SUMMARY

Experienced physicist with 5 years of active research utilizing statistical tools and programming languages. Skilled in the use of tools such as Docker and Conda environments, as well as IPython notebooks. Adept at combining technical knowledge and analytical skills to drive successful research outcomes.

EDUCATION

UFRJ - Universidade Federal do Rio de Janeiro

Bachelor's Degree in Physics

2017-2021

CBPF - Centro Brasileiro de Pesquisas Físicas

Master's of science in Computational Astrophysics

2022 - 2023

CBPF - Centro Brasileiro de Pesquisas Físicas

PhD in AI applied to Astrophysics (LITCOMP-AI)

2023 - Now

PROJECTS

Finding Supernovas using Random Forest Classifier

CBPF

Created a comprehensive tutorial covering the full image pre-processing pipeline, training steps, hyperparameter tuning, and generalization of a binary classification problem using a Random Forest Classifier. Demonstrated the use of the tutorial through a Jupyter Notebook example.

Search for optical Gravitational Waves candidate using CNN

CBPF + Dark Energy Survey GW collaboration

Developed a successful Convolutional Neural Network model for identifying optical GW counterparts. Trained the model using a cluster of 8 GPUs, enhancing processing speed and addressing the big data challenge. Achieved state-of-the-art results with a multi-label classifier

Kilonova and Supernovas Spectrum Classifiers using Bidirectional LSTMs

CBPF + Dark Energy Survey SPECTRO collaboration

Designed and implemented a spectrum classifier capable of distinguishing between Supernovas and Kilonovas. Utilized interpolation and standardization techniques. Incorporated one-dimensional convolutional layers for feature extraction and bidirectional LSTM for optimal results.

More informations and Others projetcs are avaible on GitHub*

CERTIFICATION

Method to analyse BigData and Astrostatistics

Centro Brasileiro de Pesquisas Físicas - CBPF

Computer Vision - Course

Kaggle

Deep Learning applied to seismic data

Centro Brasileiro de Pesquisas Físicas - CBPF

Intermediate Machine Learning - Course

Kaggle

Workshop - Deep Learning

4ª O2I Science Deep Tech and Innovation

Poster - Academic meeting of computational modeling

Laboratório Nacional de Computação Científica - LNCC

PROJECTS

Health Symptons Classifier using Transformers
Lemobs, Prontlife and LNCC + CBPF

In the field of Natural Language Processing (NLP), I have developed an advanced algorithm that utilizes the cutting-edge BERTimbau model, which is a variant of the BERT (Bidirectional Encoder Representations from Transformers) model, which was specifically trained on a large corpus of Portuguese language data.This algorithm is designed to classify phrases that describe medical conditions, and it can accurately identify various health issues such as asthma, diabetes, cardiovascular diseases, and more.Additionally, I created a custom script that uses Google APIs and Regex library to save and process/filtering data from YouTube comments effectively.

Search for Supernovas using Deep Learning
CBPF + Southern Photometric Local Universe Survey (SPLUS) collaboration

Developed and implemented a successful Deep learning model for identifying images that contains supernovas and other astronomical transients. I designed and created a robust image processing pipeline from scratch, which included tasks such as cleaning, contrast adjustment, and normalization. The deep learning model was trained using a powerful cluster of 8 GPUs, and I leveraged transfer learning to improve the model's performance by utilizing a family of CNN models known as Mobilenet (Howard et al. 2017), which are based on depthwise separable convolutions. Which significantly enhanced the processing speed and allowed me to address the big data challenge effectively.

Simulation Based Inference of BNS Kilonova Properties: A Case Study with AT2017gfo
CBPF + NeurIPS Event

Combining statistical inference and machine learning to make a bayesian inference using Simulation-Based Inference (SBI) method. This involved using computer simulations and normalizing flows to approximate the posterior distribution of a model, enabling me to estimate model parameters and uncertainties more accurately and efficiently than traditional inference methods. We propose here to use a Simulation-based Inference (SBI) technique to infer the physical parameters of BNS kilonovae from their spectra, using simulations produced with KilonovaNet (Simulator). We further test our model with real observations from AT 2017gfo, the only kilonova with multi-messenger data
Article: https://arxiv.org/abs/2311.09471

CERTIFICATION

Workshop - Machine Learning and the Physical Sciences
37th conference on Neural Information Processing Systems (NeurIPS) + Poster presentation

Workshop - LITComp-IA
Centro Brasileiro de Pesquisas Físicas - CBPF + Oral talk

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