Position Offered: POSTDOCTORAL RESEARCHER
Project: *MOTHER: iMage classificatiOn in THe Extreme univeRse*

Technological and scientific fields: Artificial intelligence - Image analysis and computer vision - Edge Computing

Location: Granada, Andalucía, IAA-CSIC, https://www.iaa.csic.es/

Research Group/PI: VHEGA, Rubén López Coto, https://vhega.iaa.es/

PROJECT SUMMARY

The project aims to apply advanced deep learning (DL) techniques to data from Imaging Atmospheric Cherenkov Telescopes (IACTs), particularly focusing on the Large-Sized Telescopes (LSTs) in La Palma. Using Convolutional Neural Networks (CNNs), Graph Neural Networks (GNNs), and Transformers, the project seeks to enhance data analysis, optimizing event separation and achieving precise energy and direction reconstruction. A key innovation is combining DL with edge computing, processing data at the source to reduce latency, conserve bandwidth, and improve real-time analysis. This approach is especially beneficial for applications like autonomous vehicles and smart cities, as well as for the efficient operation of LSTs. The project targets very high-energy (VHE) gamma-ray astronomy, exploring high-energy radiation from cosmic events like black holes and stellar explosions. The LSTs detect Cherenkov light from these energetic particles, and improved data analysis via DL will significantly enhance their performance. Initially focusing on LST-1, a prototype for the Cherenkov Telescope Array Observatory (CTAO), the project aims to scale DL analysis for multiple telescopes, establishing it as a standard method. A comprehensive CNN-based pipeline will be optimized with real data, aiding in the detection and analysis of phenomena like pulsars, which could answer key questions about particle acceleration and cosmic rays. The project also emphasizes enhancing digital skills by training researchers and students in advanced machine learning and data analysis techniques, boosting their employability. In summary, the project promises technological advancements in astrophysical data analysis and improvement in digital skills, positioning CSIC as a leader in DL and edge computing applications in VHE gamma-ray astronomy.

PROFESSIONAL PROFILE

Minimum requirements:

- Academic qualification(s) required: PhD in Informatics or similar
- Proficiency in Spanish and English.
- Knowledge of very high-energy gamma-ray analysis using Cherenkov telescopes and especially the analysis using the CTLearn library for CNN analysis of Cherenkov telescopes.

Merits to be considered:

- Knowledge of Python
- Experience with libraries such as PyTorch and TensorFlow

WHAT IS OFFERED

Implement the latest CNN techniques for the analysis of Cherenkov telescope data. Short training stays at leading centers for very high energy gamma rays. Attendance at machine learning courses, software schools, and in-person meetings.

Contract conditions:

Indefinite contract for a Postdoctoral Researcher associated to the Momentum Project of 4 years' duration according to Spanish science law. Gross annual salary (41.000 € - 52.000 €).

Start of contract: before 31 December 2024

PRINCIPAL INVESTIGATOR CONTACT

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