Contribution ID: **1344** Type: **Poster**

Deep-learning event reconstruction for the Cherenkov Telescope Array Observatory with CTLearn

The Cherenkov Telescope Array Observatory (CTAO) is the next-generation ground-based observatory for very-high-energy (VHE) gamma-ray astronomy. The Large-Sized Telescope prototype, LST-1, located on the Canary Island of La Palma, is responsible for observation of the low-energy range of the VHE gamma-ray spectrum. It is undergoing commissioning and has already observed the Crab Nebula as a standard reference source. Accurate and efficient reconstruction of shower parameters (e.g. energy, direction, and particle type) is crucial for achieving the scientific goals of the CTAO.

In this work, we use CTLearn to implement deep learning event reconstruction, as an alternative to the standard Random Forest method. CTLearn is built to be fully compatible with ctapipe, a framework for prototyping the low-level data processing algorithms for the CTAO, and can be seamlessly used for data analysis without changing the general framework. It implements convolution-neural-network based models that take the integrated charge and the relative peak time of calibrated pixels in cleaned images as an input, to infer the primary particle's properties.

Using Crab Nebula observations as a validation sample, we explore three different approaches. The first is to train a model with Monte-Carlo (MC) simulations covering all possible altitude-azimuth coordinates of the Crab Nebula, resulting in a single model that can be used to reconstruct events from any Crab Nebula observations. The second approach is to train 10 models along this coordinate line, each incorporating a range of ˜10° in altitude. The last method produces 10 similar models but trained using transfer learning from the single model. This drastically reduces training times and meets the demand for efficient computing.

In this contribution, we present our investigation of the performance of CTLearn models, and highlight the potential of CTLearn for future data analysis in CTAO.

Collaboration(s)

Author: LACAVE, Bastien

Presenter: LACAVE, Bastien

Session Classification: PO-2

Track Classification: Gamma-Ray Astrophysics