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Separation of iron and proton induced air showers using convolutional neural networks

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The Cherenkov Telescope Array (CTA) will be the next-generation gamma-ray observatory offering better flux sensitivity than the current generation. (1) Each telescope will detect the Cherenkov emission from air showers initiated by gamma and cosmic rays. State-of-the-art deep learning algorithms, such as convolutional neural networks (CNNs), are used to reconstruct the energy and classify the primary particle. (2-3) CNNs are commonly used for image classification because they extract and learn from the features and patterns within an image. In this work, we proposed an architecture to separate iron and proton induced showers using the image recorded in the camera (Img), the depth of the shower maximum (Xmax), and the particle energy (E) associated with the air shower. We tested the CNN performance with three different inputs: (i) Img + E, (ii) Img + Xmax, and (iii) Img + Xmax + E. In addition, we used reconstructed and true values (for the Xmax and E) during the training and the prediction. This architecture takes advantage of the image patterns and the air showers' mass-sensitive parameters. Therefore, we aim to obtain significant efficiency in identifying iron and proton events.

Palavras-chave: Cosmic rays. Cherenkov telescope. Artifical neural network.

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