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# Event reconstruction using pattern spectra and convolutional neural networks for the Cherenkov Telescope Array

The Cherenkov Telescope Array (CTA) is the future observatory for ground-based imaging atmospheric Cherenkov telescopes. Each telescope will provide a snapshot of gamma-ray induced particle showers by capturing the induced Cherenkov emission at ground level. The simulation of such events provides camera images that can be used as training data for convolutional neural networks (CNNs) to differentiate signals from background events and to determine the energy of the initial gamma-ray events. Pattern spectra are commonly used tools for image classification and provide the distributions of the sizes and shapes of features comprising an image. The application of pattern spectra on a CNN allows the selection of relevant combinations of features within an image.

In this work, we generate pattern spectra from simulated gamma-ray images to train a CNN for signal-background separation and energy reconstruction for CTA. We compare our results to a CNN trained with CTA images and find that the pattern spectra based analysis is computationally less expensive but not competitive with the purely CTA images based analysis. Thus, we conclude that the CNN must rely on additional features in the CTA images not captured by the pattern spectra.

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