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On-the-fly data reduction for the Cherenkov Telescope Array

The Cherenkov Telescope Array (CTA) is the next-generation ground-based gamma-ray observatory, currently in the prototyping and testing phase. CTA will consist of two arrays of imaging atmospheric Cherenkov telescopes, one in the Northern and one in the Southern hemisphere, reaching a sensitivity roughly five to ten times higher than existing instruments and covering an energy range from 20 GeV to 300 TeV. These design features will allow CTA to probe transient and time-variable gamma-ray phenomena with unprecedented precision.

Owing to the large number of telescopes (more than 100) with roughly 2000 pixels per camera, array trigger rates of the order of 10 kHz and nanosecond sampling, CTA will produce tremendous data rates and volumes posing a significant challenge to the on-site and real-time analyses. A critical aspect of these analyses is the on-the-fly data reduction to allow for an efficient handling of the data stream without significant impact on sensitivity. While there are several approaches to data reduction, we focus on the identification of signal- and background-containing pixels in a particular event, both gamma- or hadron-induced, with the aim to suppress or even completely discard the information in background-only pixels. In this contribution we present different methods of doing so, including wavelet- and deep-learning based, and discuss their respective performances.

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