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The application of the Stack-CNN algorithm for the analysis of Mini-EUSO data

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Machine learning algorithms are widely recognized as powerful and highly efficient methods in a broad range of classification tasks. In particular, Convolutional Neural Networks (CNN) are specifically suitable for the classification of images. In this work, a novel methodology that makes use of a CNN was tested on data from Mini-EUSO, a space telescope currently on board the International Space Station (ISS). Pointing towards the Earth, Mini-EUSO uses photomultiplier tubes to search for Extreme Energy Cosmic Rays (EECR, E>10^21 eV). In parallel, the instrument is able to detect a wide variety of other atmospheric phenomena, such as meteors. Leveraging this latter capability, the presented method, called Stack-CNN, is applied for the detection of meteor events. Already employed in previous studies, it makes use of a Stacking procedure according to a trial velocity vector, before applying a CNN to distinguish the signal from the background. An optimization study on the trial velocity vector pool is conducted, aimed at reducing the computational time of the algorithm. Results indicate that our algorithm performs better than the standard meteor detection algorithm, also retrieving with good accuracy the velocity vector associated with the moving meteor. In addition, being able to detect moving luminous objects, this methodology could also be used to detect space debris illuminated by solar albedo. In this presentation we will report the methodology and the results obtained using the Stack-CNN algorithm.

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