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Machine learning methods applied to meteor detection filtering

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Introduction: Recent expansions in fireball networks has lead to an increase in the number of events recorded each night. Due to the mechanism at the source of the detection procedure (i.e. tracking sources of light), the majority of the events is comprised of false meteors. These make their way in trajectory computations, and lead to erroneous orbits [e.g. 1].

Aims: For this study we explore several machine learning (ML) models for their ability to filter the false detections.

Methods: First, a supervised validation was employed on the meteor detections obtained by stations within the Meteorites Orbits Reconstruction by Optical Imaging (MOROI) network [1, 2], between 2017-2020. Next, a set of ML models suited for classification were applied to a selection of features computed from the data. Finally, each model was tuned to their optimal hyper-parameter value, to obtain the highest score.

Results: The Neural networks method was found to best filter out the false meteors, with a recall score of 96%, followed by 95% for Gradient Boost and Random Forest algorithms. The score is expected to increase when employing a spatio-temporal filter and pixel brightness information. The results entail follow-up studies on the currently expanding FRIPON network [4].

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