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Early-stopping SOMs as a tool to classify SSOs in space surveys

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Self-organizing maps (SOMs) are unsupervised machine learning techniques that reduce the dimensionality of the original dataset while preserving its topological structure. Their implementation can be represented as a transformation of n data points each with p variables as clusters of similar data on a two-dimensional map. This approach is widely used in astronomy due to the simplicity of the algorithm and the capability of identifying unknown features emerging from the variable space. In particular, we present its implementation as a classifier of stars, Solar System Objects (SSOs) and galaxies in space surveys with large amounts of data such as TESS. We distinguish this approach from the previous studies on the matter by including an early-stopping method. By training the neural network on an input data set and, at the same time, testing its performance on an independent, randomly chosen, control set, it is possible to minimize the risk of falling into an over-fitting state and therefore losing the genericity which is required of this algorithm. As a number of important space surveys will begin their operations in the coming decade, adding to those launched in the last few years, an algorithm capable of swiftly handling large amounts of data and discerning SSOs from galactic or extragalactic sources will be enormously valuable, for the main scientific objectives of the surveys as well as improving our knowledge of objects in the nearest regions of the sky.

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