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Development of AI models for data cubes analysis

The rapid growth of modern data acquisition systems has intensified the need for advanced Artificial Intelligence methods capable of processing large, heterogeneous, and multidimensional datasets. This research focuses on the development of deep learning architectures tailored for the analysis of data cubes: structures integrating spatial, spectral, and temporal information.

In this work, two main projects were carried out, and their development is currently ongoing. In remote sensing, a SegFormer-based model was implemented for the automatic segmentation of high-resolution satellite imagery, enabling the detection of watercourses and other land-cover classes. In the astronomical domain, a Time-GAN model was designed to extract latent temporal representations of supernovae from time-series imaging, with the goal of predicting redshift and extinction and supporting real-time event characterization. Overall, the methodologies developed in these projects are broadly generalizable and can be readily adapted to a wide range of scientific domains, ensuring that the techniques and models produced are reusable beyond their original application contexts.

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