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Advanced Image Preprocessing and Feature Tracking for Remote CME Characterization

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Coronal Mass Ejections (CMEs) influence the interplanetary environment over vast distances in the solar system by injecting huge clouds of fast solar plasma and energetic particles (SEPs). A number of fundamental questions remain about how SEPs are produced, but current understanding points to CME-driven shocks and compressions in the solar corona. At the same time, unprecedented remote (AIA, LOFAR, MWA) and in situ (Parker Solar Probe, Solar Orbiter) solar observations are becoming available to constrain existing theories. As part of the MOSAIICS project under the VIHREN programme, we are developing a suite of Python tools to reliably analyze radio and EUV remote imaging observations of CMEs and shock. We present the method for smart characterization and tracking of solar eruptive features, based on the A-Trous wavelet decomposition technique, intensity rankings and a set of filtering techniques. We showcase its performance on a small set of CME-related phenomena observed with the SDO/AIA telescope. With the data represented hierarchically on different decomposition and intensity levels our method allows to extract certain objects and their masks from the series of initial images, in order to track their evolution in time. The method presented here is general and applicable to detecting and tracking various solar and heliospheric phenomena in imaging observations.