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Spectral Inpainting with Diffusion Models: A Novel Approach for Continuum Removal in Euclid Data

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The accurate characterization of galaxy spectra is essential for extracting reliable physical properties of galaxies. However, overlapping of spectra inherent to Euclid's slitless spectroscopy can often obscure key spectral features, complicating the detection and analysis of emission lines.
In this work, we present a novel approach for continuum removal by leveraging denoising diffusion probabilistic models (DDPMs), adapted from the RePaint inpainting framework (Lugmayr et al., CVPR 2022). By training these models directly on rectangular patches of Euclid's 2D spectral data, we reconstruct the underlying continua, enabling clean subtraction and enhanced visibility of emission lines.
This methodology directly addresses and overcomes the limitations of traditional median filtering techniques, which often suffer from oversubtraction artifacts and a strong sensitivity to image orientation. The proposed approach provides a robust and automated solution for continuum subtraction, underscoring its utility in diverse astronomical contexts and large spectroscopic surveys.

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