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Imaging hidden worlds? Exploring the SpHere INfrared survey for Exoplanets (SHINE) through deep learning

The detection of exoplanets has become one of the most active fields in astrophysics. Despite the fact that most of these discoveries have been made possible through indirect detection techniques, the direct imaging of exoplanets using 10-meter-class ground-based telescopes is now a reality. Achieving this milestone is the result of significant advances in the field of high-contrast imaging (HCI), including extreme adaptive optics systems and cutting-edge coronagraphs on the telescopes, along with dedicated post-processing techniques for image detection.

The detection capabilities of traditional post-processing techniques have been enhanced by a new family of machine learning-based methods in HCI. In the realm of deep learning, our group developed SODINN (Gomez Gonzalez et al., 2018), a binary classifier that employs a convolutional neural network to distinguish between companion signatures and residual noise in long exposures. Additionally, we have recently introduced a novel version of SODINN, known as NA-SODINN (Cantero et al., 2023), that better captures correlations in image noise, thus pushing the detection limits for fainter companions. These two algorithms have undergone testing with synthetic companion signatures, and we are now well-positioned to apply them to real HCI surveys in the search for potential companions.

In this poster, we present preliminary results from applying the SODINN and NA-SODINN algorithms to the F150 sample of the Sphere INfrared survey for Exoplanets (SHINE) survey (Langlois et al., 2021), which gathers observations of 150 stars using the SPHERE high-contrast imager at the VLT. The project aims to re-analyze this survey in an attempt to reveal yet undetected companions.

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