V224b   Data driven phase and PSF reconstruction from Shack-Hartmann wavefront sensor measurements.

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Recently, there has been substantial development in deep learning applications for wavefront sensing focused on pyramid wavefront sensors in Adaptive Optics (AO). However, the performance of these techniques has not been studied at length in conventional AO systems using Shack-Hartmann wavefront sensors (SHWFS) with advanced architectures such as Vision Transformers (ViT). This research aims to develop an innovative AO control system by applying ViT models directly to raw SHWFS outputs, leveraging the capabilities of the AO3K and ULTIMATE-START systems at the Subaru Telescope to generate robust training datasets. The core hypothesis is that this approach will outperform previous methods and convolutional models by using attention-based mechanisms and exploiting otherwise lost information from centroiding, enabling more accurate atmospheric turbulence correction and improved angular resolution in astronomical imaging. Furthermore, this research will benchmark on-sky performance in the Subaru telescope.