PO4AO: XAO control with model-based reinforcement learning

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Abstract

Highest-contrast imaging with ELT-PCS requires a highly performant and robust control system. The main science case of nearby Exo-Earths calls for high contrast at very small angular separations of tens of milliarcseconds where the contrast is affected by quickly changing eXtreme AO residuals and quasi-static speckles. Reinforcement Learning (RL), a subfield of machine learning where system control is learned through interaction with the environment, holds great promise and now receives much interest in the XAO field. RL methods can handle temporal and misregistration errors and adapt to non-linear wavefront sensing. In addition, the concept of RL has a huge potential for focal plane wavefront control to tackle the quasi-static speckles. This talk discusses recent advances, motivation, and prospects of RL methods for AO wavefront sensor control and focal plane wavefront control. I will present our RL approach called Policy Optimizations for AO (PO4AO), summarize the tests with the GHOST test bench at ESO headquarters, and discuss the prospects of running PO4AO on-sky with an optimized RTC implementation.

Keywords: machine learning, high, contrast imaging, optimal control

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