SLM-based WFS AO Test-bench for Machine Learning; Design and Future Experiments

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Abstract

Temporal prediction is a major source of error in wide-field Adaptive Optics (AO) alongside tomographic error. The tomographic error has been improved in recent times via the use of super resolution, while temporal errors have been reduced by use of predictive reconstruction such as Linear Quadratic Gaussian (LQG). Here we also propose using artificial neural networks (ANN) to reduce errors with an emphasis on temporal, in conjunction with a purpose-built experiment for generating data: NESSIE, the New Experiment for Simulating Semi-Infinite Exposures. This experiment will generate large amounts of realistic turbulence experienced by telescopes using a laboratory-based set-up and use this to train a neural network which can predict the wavefront and thus reduce these errors. The results will then be compared with analyses on existing data from real observations, such as from the CANARY experiment.

Keywords: neural networking, ANN, spatial light modulator, turbulence

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