
Neural Networks for Turbulence Prediction and Characterization in Adaptive Optics

Alejandro Buendía*¹, Saúl Pérez¹, Carlos González-Gutiérrez¹, Santiago Iglesias-Álvarez¹, Javier Rodríguez-Rodríguez¹, Julia María Fernández¹, Fernando Sanchez Lasheras¹, and Francisco Javier De Cos²

¹Instituto Universitario de Ciencias y Tecnologías Espaciales de Asturias (ICTEA) – Spain

²ICTEA / University of Oviedo – C/ Independencia 13, Oviedo, 33005, Spain

Abstract

Neural networks have become a very relevant tool in the field of adaptive optics. From prediction to reconstruction to control, this type of network is establishing itself in all aspects, facilitating research tasks. The present studies focus on the study of atmospheric turbulence, on one hand in the prediction of its evolution and on the other in its characterization. Predictive control in adaptive optics aims to improve the performance of adaptive optics systems by anticipating and compensating for atmospheric disturbances before they affect the light path. This behavior can be emulated and studied by Recurrent Neural Networks (RNN), allowing for processes that require high speed. As for turbulence reconstruction, we present the Wavefronts Obtained from Measurements from laser-Beams from Atmospheric Turbulences (WOMBAT) technique, which presents an alternative to the use of laser guide stars, avoiding the cone effect. In this case, Convolutional Neural Networks (CNN) have demonstrated their efficiency at using images from a wide laser to study the shape of the turbulences.

Keywords: Neural Networks, atmospheric turbulence, prediction, characterization

*Speaker