ABSTRACT ONLY

SYNTHESIS AND INVERSION OF STOKES PARAMETERS IN THE SOLAR CONTEXT APPLYING DEEP LEARNING TECHNIQUES

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The solar photosphere is the optical limit for which we can observe the sun at a greater depth. It is here where the structures generated by plasma convection to the solar interior are evident. The study of the phosphosphere allows us to analyze the emergency zones of magnetic fields, whose evolution can generate highly energetic phenomena such as flares, and turbulent movements that can be one of the causes of nanoflare generation. Although observations of the Sun are limited by the resolution of telescopes, during the last two decades an increasing number of realistic simulations of the configuration of the solar interior and atmosphere have been developed, which employ the equations of the magnetohydrodynamics and various other conditions, depending on the particular characteristics and activity in each zone of the sun, whereby the physical properties and details of the structure of various solar zones can be studied. In this work, the MURaM code is used to generate simulated physical parameters such as plasma density, temperature and velocity, including also the magnetic field, at different optical depths in the convective zone and the solar photosphere. The main objective, based on the simulations, is to train a 1D convolutional neural network, which takes the values of density, temperature, magnetic field and speed, the latter two in the line of sight, along a column. The trained network is capable of generating the corresponding Stokes parameters. Based on this model, another version is created which has an inverse functionality such that now having the Stokes parameters as inputs, the corresponding physical parameters of the plasma and the magnetic field in the same domain can be recovered.

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