M27a A compression method for solar spectro-polarimetry data accumulated by Hinode SOT/SP

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Analysis on solar spectra is fundamental in research of solar physics to understand about our sun and its connection with the earth. Hinode SOT/SP has accumulated spectro-polarimetry (SP) data since 2006, however, it is difficult to process such a great amount of high dimensional data with the existing computational methods. To this end, we aim to obtain a compressed representation of SP data that will be important for more detailed studies of solar spectra, such as flare prediction, automatic categorization of spectra and detection of anomalous spectra. Autoencoder, an encoder-decoder structured deep learning model, was built for compressing solar spectra containing Stokes I and V polarization parameters, where the encoder converts the input of raw SP data into a lower-dimensional compressed representation of the spectra, and then decodes it back into a reconstruction as the output. We compared performances of the model trained with different error functions, including customized loss as the sum of weighted mean absolute error of Stokes parameters, and from the true-reconstruction scatter plot the model with customized loss function resulted smaller standard deviations of 0.57–0.7% (continuum) and 2.71–3.16% (line centers) for Stokes I, and 4.79% (left line core) for Stokes V. Furthermore, we analyzed the model trained on datasets with different degree of balance—sunspots vs quiet sun regions, and the tendency of higher the data balance, better the model performance was confirmed.