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Machine Learning Synthesis and inversion method for Stokes Parameters in the solar context

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The arrival of new and more powerful spectropolarimetric instruments such as DKIST, the development of better magnetohydrodinamic (MHD) simulation codes and the creation of newly inversion methods, are coming with the demands of increasing amounts of computational time and power. This, with increasing generation of data, will come with even years of processing that will stop the advance of scientific investigations on mid-late stages. The arrival of Machine Learning models able to replicate patterns in data come with the possibilites of them to adapt to different types of datasets, such as those for classification or for creation of sequences like the seq2seq models, that once trained, they are able to give results according to previous methods that differ on order of magnitude in time processing, being a lot faster. Some work has been done within this field for creating machine learning inversion methods using data obtained from actual inversion codes applied on observational data, and using data from radiative transfer codes for synthesis, reducing both computational demands and time processing. This work attempts to follow onto this steps, using in this case datasets obtained from simulation codes like MURaM and their correspondent Stokes parameters obtained from non-lte radiative transfer codes like NICOLE, training forward (synthesis) and backward (inversion) some neural network models to test whether or not they can learn their physical behaviours and at what accuracy, for being used in the future to process actual data obtained from newly simulation codes and for real solar observations, being another step into the future for creating a new paradigm on how to invert and sunthesize quantities in Physics in general.