Review of the use of machine-learning methods with spectroscopy in fusion plasmas

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Artificial Intelligence (AI) tools are taking an important place in plasma science [1] and particularly in plasma physics [2-4]. In this context, there is an incrasing actitivity related to the use of Machine Learning in the field of plasma spectroscopy. Combining machine or deep learning methods with plasma spectroscopy have various purposes including real-time inference of plasma dynamics in magnetic fusion devices [5] or the prediction of the plasma parameters [6]. In this paper, we review the various applications of machine-learning and deep-learning algorithms to spectroscopic data in plasmas with a focus on magnetic fusion plasmas without excluding other types of plasmas. We also present our own work related to the use of neural networks such as Convolutional Neural Network (CNN) to theoretical Balmer-α line spectra emitted by hydrogen isotopes for the hydrogen isotopic ratio prediction for Tokamak plasmas [7-8]. The paper will also be an opportunity to discuss the advantages and the drawbacks of the introduction of AI in plasma physics.

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