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Lighting up the black box - explainable ML in Astrophysics

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The development of new all-sky and large-area astronomical surveys gives a chance for new insights in astrophysics. However, these recent generation surveys are flooding astronomers with data, giving an exponential growth - with respect to previous surveys - of data collected per night (for instance, 90 TB/night for the Thirty Meter Telescope). For some tasks, i.e. object detection, classical methods or human detection need to be faster to cover the totality of the data collected. At the same time, Machine learning (ML) keeps showing the scientific community its ability to solve astrophysical problems.
In this talk, I will show some ML applications on astrophysical data in different domains: time and frequency domain gravitational waves (GW) data, strong lenses detection (images), and astronomical text interpretation. The emphasis will be put on analysis related to Strong gravitational lensing and on the importance of having explainable Artificial Intelligence. Strong gravitational lensing is useful to constrain cosmological parameters, even though it is a rare phenomenon in astrophysics. For this reason, strong lens seekers are training their ML models on simulations. We will show how simulation-trained models behave with survey data, interpret the results and discuss techniques that might help us research new candidates. Finally, I will discuss possible applications of Interactive ML for object detection.

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