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On the Potential of Adaptive Predictors and their Transfer between Different Devices for both Mitigation and Prevention of Disruptions

Notwithstanding the efforts exerted over many years, disruptions remain a major impediment on the route to a magnetic confinement reactor of the Tokamak type. Machine learning predictors, relying on adaptive strategies, have recently proved to achieve unprecedented performance on JET (with misclassifications of the order of a few per thousand both in terms of missed and false alarms) [1]. Such results are particularly relevant, because this last generation of adaptive predictors, based on ensemble classifiers, implement "from scratch" learning, i.e. they start predicting after the first example of each class (safe and disruptive) [2]. In order to show their potential to profit from the experience of previous devices when new machines come on online, specific adaptive predictors have also been operated on a series of AUG campaigns and then they have been deployed on several JET campaigns with the ITER Like Wall [3]. With regard to mitigation, the overall performance is extremely positive (errors of the order of a few per cent). Very encouraging results have also been obtained for disruption prevention. Adaptive predictors, capable of capitalising on the experience of smaller devices, have therefore become a serious candidate for deployment in the next generation of machines.

[1] A. Murari et al Nuclear Fusion, Volume 58, Number 5, March 2018, https://doi.org/10.1088/1741-4326/aaaf9c
[2] A.Murari et al Nucl. Fusion 59 (2019) 086037 (11pp) https://doi.org/10.1088/1741-4326/ab1ecc
[3] Andrea Murari, Riccardo Rossi, Emmanuele Peluso, Michele Lungaroni, Pasquale Gaudio, Michela Gelfusa, G A Ratta and Jesus Vega "On the transfer of adaptive predictors between different devices for both mitigation and prevention of disruptions"accepted or publication in Nuclear Fusion.

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