DISRUPTION PREDICTION WITH ADAPTIVE NEURAL NETWORKS FOR ASDEX UPGRADE

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A disruption predictor for ASDEX Upgrade based on a Multi Layer Perceptron neural network has been presented by the authors [1]. For each pulse, six plasma diagnostic signals have been selected from numerous signals available in real-time between July 2002 and July 2004, and used to train the predictor. The system shows good performance both in terms of missed alarms and false alarms when tested on pulses occurred from June 2005 to July 2007.

The drawback of the approach is that it could produce a not reliable output when the input comes from a region of the parameters space on which the predictor was not trained. To improve the robustness and reliability of the system, a novelty detection module has to be integrated in the prediction system. In this way, samples coming from unexplored operational spaces can be reliably identified by the novelty detector and the answer of the predictor can be rejected. Thus, further knowledge has to be supplied to the predictor which has to be updated adding the new samples to the training set. This adaptive character of the predictor is crucial also to limit the system ageing.

In this paper, some algorithms, based on statistical or neural network approaches [2], to determine the 'novelty' of the input of the MLP predictor module will be tested. Moreover, retraining algorithms [3] to update the predictor in an incremental fashion will be applied, in order to supply new data without compromising performance on old data. Furthermore, it is possible that the predictor produces a wrong answer although it is fed with known samples. In this case, a retraining procedure will be performed. In particular, the optimal criterion triggering the procedure, i.e., a false alarm and/or a missed alarm, and/or a premature detection, etc., will be identified.

The on-line application of the adaptive predictor during the more recent experimental campaigns until November 2009 will be simulated.

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