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P3.046 Towards an automatic filament detector with a Faster R-CNN on MAST-U

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Plasma behavior in the SOL of tokamaks is driven by turbulence in the edge region where density and temperature gradients are large. This generates intermittent structures of increased density and temperature known as filaments, which extend along the magnetic field lines. The protection of plasma facing components in the next step devices is a primary concern. In this context, the identification of the filaments, for the understanding of their generation and propagation schemes, is a main issue.
The goal of this work is to develop an automatic detector for filaments arising in the MAST-U plasma. The identification of the filaments must be done starting from the 2D images acquired with a fast camera. To this end, the potentiality of the Faster R-CNN, which are suitable for image classification and object recognition, was investigated in [1].
In the present paper, a database of several thousand of images generated by a synthetic diagnostic, which reproduces the statistical properties of experimental filaments in terms of position and intensity, has been used. The synthetic images have been pre-processed by approximately mapping them onto the toroidal midplane of the machine. Preliminary results show a high detection rate (more than 0.85) for filaments with high pixel intensity and large area. Indeed, a more suitable definition of the training target box is needed to improve the capability of the detector in identifying filaments with low pixels intensity, small area or located on the edges of the frames. Therefore, to enhance the detector performance, a new definition of the target box has been deeply investigated, by considering the intensity and the size of the filament.
[1] B. CANNAS, et al. (2017). Convolutional Neural Networks for the identification of Filaments from Fast Visual Imaging Cameras in Tokamak Reactors. In Neural Advances in Processing Nonlinear Dynamic Signals, Springer.

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