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P3.054 Real-time waveform classification in TJ-II Scattering Thomson diagnostic using ensemble methods

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Over the years, humanity has needed energy constantly due increase both population and the technology. That's why conventional methods of energy production are not enough to cover new demands especially in environmental area because of pollution generated.

Energy generated by nuclear fusion solve both problems so achieve full control over it internal process, this implies an analysis over huge databases with different kind of signals. Of course it is impossible to do it manually and is essential automate process.

One of the multiple ways to achieve the above goal is generating machine learning models. It just needs input data and an answer for each input. We can find several algorithms to carry out classification in the literature in order to build such models. Most popular algorithm are support vector machines and neural networks, both have shown high performance in previous applications in fusion, but with an inconvenient: it's impossible to know the reason about why the algorithm decide between one class or another.

Ensemble methods provide good balance among success rate and internal information about model. Particularly, the Adaboost algorithm will allow to obtain an explicit set of rules that explains the output (the class) for each input data.

In this paper an innovative method is proposed where algorithms commonly used in image classification were used to classify waveform of nine different classes of the TJ-II stellerator fusion device located at Madrid (Spain). Average success rate of the model was 97.57%, improving the results obtained in previous works were neural networks and support vector machine techniques were used. In order to take advantage of all features of Adaboost algorithm, a sensitivity analysis were also performed to select a reduced set of features in order to classify the waveform before it actually finishes which could be very interesting for real-time applications.

Presenter: FARIAS, Gonzalo (Ingenier'a Electrica Pontificia Universidad Catolica de Valparaiso)

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