

# National Technical University of Athens (NTUA) team-Expertise on machine learning and data analysis

NTUA Fusion ML Team





## Dr. Fotis Bairaktaris

- Postdoctoral researcher finishing an MSc in Data Science and Machine Learning in NTUA.
- Aided in supervising of a bachelor's thesis in disruption prediction.
- Currently co-supervising an MSc Thesis in disruption prediction.
- Accepted disruption prediction participation in WPTE.

## Dr. Aristeides Papadopoulos

- Senior researcher.
- Main supervisor of a bachelor's thesis in disruption prediction.
- Activity in ML for fusion since 2019.
- Currently co-supervising an MSc Thesis in disruption prediction.
- Accepted disruption prediction participation in WPTE.



## BSc thesis in disruption prediction

- Used JET Simple Access Layer (SAL) to obtain data.
- A neural network consisting of convolutional and recurrent LSTM layers was constructed.
- Comparing results with reference paper, our method managed some improvements on accuracy, precision, recall and F1 score.
- All work has been done in Python.

Reference paper: D. R. Ferreira, P. J. Carvalho and H. Fernandes, "Deep Learning for Plasma Tomography and Disruption Prediction From Bolometer Data," in IEEE Transactions on Plasma Science, vol. 48, no. 1, pp. 36-45, Jan. 2020, doi: 10.1109/TPS.2019.2947304.



Constructing disruption prediction models that are not solely data-driven, but also physics-driven.

- PGNN: Modifying loss function to incorporate physical knowledge in the training process, penalizing deviations from laws that must not be violated (see reference).
- They have been used in applications, improving accuracy and reducing training time.
- These hybrid (data and physics driven) models bridge the gap between black box models and theoretical ones.
- Any relevant data analysis tasks can also be carried out by our team.

Reference paper: Karpatne, Anuj & Watkins, William & Read, Jordan & Kumar, Vipin. (2017). Physics-guided Neural Networks (PGNN): An Application in Lake Temperature Modeling.



- Accepted participation in WPTE to use physics-driven ML models.
- ERG proposal (F. Bairaktaris) concerning NTM control with physics guided neural networks.