Predicting disruption in future tokamaks with fewer data by more physics-guided

Chengshuo Shen

Motivations

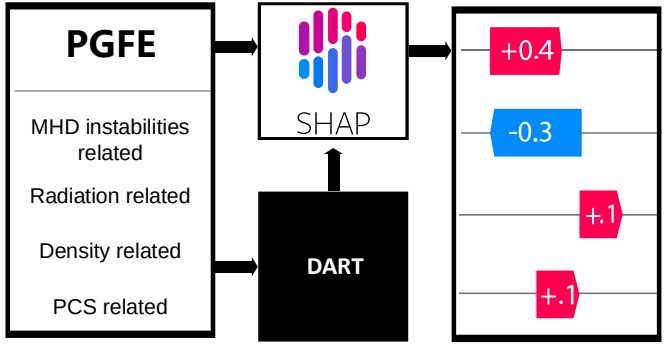
- Disruption prediction should learn from **limited data** in future tokamaks.
- **Domain adaptation** algorithm can be helpful in exploring a new cross-tokamak disruption prediction approach for future tokamaks.
- **Existing knowledge** of disruption physics and tokamak discharge could be helpful.

Results

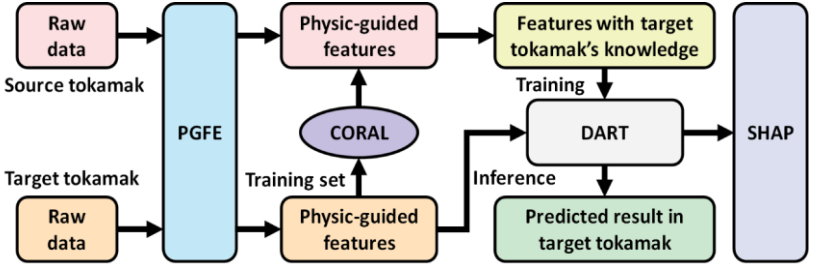
- **PGFE**: Thousands of discharges – **AUC~0.98, TPR~97.27%, FPR~5.45%** (J-TEXT)
- **PGFE**: **20dis + 120non – AUC~0.93**, TPR~90%, FPR~10% (J-TEXT)
- **PGFE + CORAL**: **10dis + 100non – AUC~0.89**, TPR~90%, FPR~25.56% (EAST)
- **PGFE-U + High data quality + normalized parameters**: **Zero-shot – AUC~0.9**, TPR~90%, FPR~30% (EAST)

Challenges

- Still need to test in more tokamaks.
- Interpretability requires further study.
- Helpless in new physics that may emerge in the future tokamaks.



CS. Shen , W. Zheng, et al. Nuclear Fusion, 63 046024, 2023



CS. Shen , W. Zheng, et al. Nuclear Fusion, under review.

https://doi.org/10.48550/arXiv.2309.05361