

# **Training and Deployment of Predictive Models for Space Weather Forecasting: An Application on Full-disk and Active Region-based Flare Prediction**

Chetraj Pandey<sup>1\*</sup>, Anli Ji<sup>1</sup>, Rafal A. Angryk<sup>1</sup>, Manolis K. Georgoulis<sup>2</sup>, and Berkay Aydin<sup>1</sup>

<sup>1</sup>Department of Computer Science, Georgia State University, Atlanta, GA, United States

<sup>2</sup>Research Center for Astronomy and Applied Mathematics, Academy of Athens, Athens, Greece  
contact: cpandey1@gsu.edu

## **Abstract**

Taking machine learning models from conceptualization to production is a complex and often time-consuming practice. Solar flare prediction is a central problem in space weather forecasting and has piqued the interest of many researchers in recent years. The prediction efforts have been catalyzed by the recent advancements in machine learning and deep learning methods and the experimental results show notable performance improvements. On the other hand, operationalizing these models and building well-documented, reliable cyberinfrastructure from them remains to be a challenging issue. We present an example training and deployment scenario for a solar flare prediction system prototype with two different modes of prediction: full-disk and active region-based. We demonstrate the challenges we faced during the development lifecycle including the data preprocessing and integration, model training and optimization, validation, and reporting. We also show the results from our hybrid-mode flare prediction method and factors impacting the real-life performance of our cyberinfrastructure services.

**Acknowledgements:** This project is supported in part under two NSF awards #2104004 and #1931555 jointly by the Office of Advanced Cyberinfrastructure within the Directorate for Computer and Information Science and Engineering, the Division of Astronomical Sciences within the Directorate for Mathematical and Physical Sciences, and the Solar Terrestrial Physics Program and the Division of Integrative and Collaborative Education and Research within the Directorate for Geosciences.