VI Conference on Active Galactic Nuclei
and Gravitational Lensing
June 02-06, 2024, Zlatibor Mt., Serbia
https://doi.org/10.69646/aob24004

X-RAY-INDUCED CHANGES IN NEAR-EARTH PLASMA: A MACHINE LEARNING PERSPECTIVE

F. Arnaut, A. Kolarski and V. A. Srećković

Institute of Physics Belgrade, University of Belgrade, Pregrevica 118, 11080 Belgrade, Serbia

E-mail: filip.arnaut@ipb.ac.rs, aleksandra.kolarski@ipb.ac.rs

We explored the feasibility of utilizing a multi-output machine learning algorithm to estimate ionospheric plasma parameters (sharpness and reflection height). The ionospheric plasma parameters are crucial for determining the properties of ionospheric plasma, such as electron density, rate coefficients, and cross sections for ionization/recombination processes. We examined the feasibility of employing two single-output algorithms, such as a combination of Random Forest (RF) and XGB, for the target variables. The findings revealed that during the in-sample testing phase, the multi-output model (XGB-XGB) consistently yielded the most favorable outcomes in terms of the RMSE. However, a close alternative was observed in the combination of RF and XGB models, where RF was employed for the sharpness parameter and the XGB algorithm was utilized for the reflection height parameter. During the out-of-sample validation, there was minimal variation observed among the four algorithm combinations. The most significant difference was observed between the RF-XGB and RF-RF combinations (7.6 percent decrease in RMSE).

The utilization of different algorithms and combinations of algorithms may yield marginal improvements, suggesting that the most significant improvement can be achieved through the expansion of the database.

Acknowledgments

The authors acknowledge the support from the Institute of Physics Belgrade which was made possible by grants from the Ministry of Science, Technological Development and Innovation of the Republic of Serbia.