Fire Radiative Power Prediction Using Ensemble and Deep Learning Models With Explainable AI Integration

Taghizada, Nijat (School: European Azerbaijan School)
Abdinli, Tural (School: School Number 143)

Recent events have once again proven how big and pressing of an issue wildfires are. In our approach to wildfire predictiveness, rather than focusing on a single model, we branch into different ML subfields: Deep and Ensemble Learning. A dataset acquired from NASA's public website was utilized to train the models. Essential preprocessing steps like variable scaling and target transformation were conducted. Then, pair-plots, scatter charts and correlation matrices were constructed to understand the underlying relationships between the variables. Afterwards, the data was split into test and training sets. Two different types of models were utilized: Random Forest Regressor and TabNet Regressor. Before fitting the data into the models, hyperparameter tuning was implemented. For Random Forest, Grid Search CV (Cross Validation) was implemented, with 5 folds. For TabNet, a different approach was taken. The data was first reshaped to a format that can be inputted to TabNet. Then, instead of using Grid Search CV, K-Folds CV was employed, with 5 splits. After the CVs were completed, the dataset was fitted to both of the tuned models. For each of them, a low value of MSE and MAE proved their precision and accuracy in providing predictions for FRP. An r^2 score of greater than 60 for both cases confirms the relationship between predicted and actual FRP values, which, once again, verifies our models' effectiveness. However, it should be pointed out that TabNet had better results, with a lower error, and higher r^2 value. SHAP analysis was conducted for both models and it was revealed that parameters with largest impact for both models were "brightness" and "bright_t31", but the third largest differing: "latitude" for TabNet and "confidence" for Random Forest.

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