

# Explainable AI in Predicting Anthropogenic Forest Fire Risk in Austria: A Multi-Criteria Approach

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## Abstract

Forest fires are becoming more frequent due to climate change and its effects, with increasingly devastating consequences for nature and society. Therefore, predictive modeling of forest fire ignition risk is a crucial step for forest management toward implementing mitigation measures.

Our work introduces a high-resolution modeling approach for predicting anthropogenic forest fire ignition risk in Austria, enabling a precise risk estimation for each specific geographical coordinate. We analyzed a decade of fire data from Austria (2012-2021) and generated an equivalent amount of no-fire data points to create a balanced data set and validate the results. For the first time, human movement patterns, as well as features such as slope, FFMC mean, vegetation, and socio-economic indicators (e.g., the amount and type of infrastructure in proximity) have been combined with state-of-the-art machine learning models to increase prediction accuracy. A cross-validated accuracy of 78% was achieved by a random forest classifier, followed closely by CatBoost with an accuracy of 77%. By deploying interpretable models, a feature importance analysis was conducted to investigate relevant drivers of fire risk. The predictive probabilities obtained from the model will be presented within a forest fire susceptibility map at the municipality level (LAU 2) to pinpoint high-risk areas.

**Keywords:** Climate Change, Forest Fire Prediction, Explainable AI, Susceptibility Map, Human Movement Patterns

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