

Machine learning: Modeling the risk of forest fires ignition in the Mediterranean region (North-West Morocco)

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ABSTRACT – This scientific paper explores the spatial predictability of forest fire ignitions in the mediterranean region (North-west of Morocco). The geographic information system was used to locate 704 forest fires recorded between 2002 and 2018. Using 20 human and biophysical variables, the building of dichotomous prediction model (Fire or No Fire) was developed using 3 classification models namely: the binary logistic regression, the random forest and XG-Boost. Data analysis provide relevant information to understand the human factors, climate, topography and vegetation type, affecting forest fire ignitions processes in the study area. A random sample of observations (60%) was used to build the model and external observations (40%) have been reserved for testing the ability of the model to predict forest fire ignitions. The explanatory variables included in the model, report on the impact of factors related to (1) human action represented by localities with high frequency of fires and accessibility (roads and trails), (2) topoclimatic, including, temperature, relative air humidity and slopes and (3) biological, namely the type of fuel, (pine and cork oak trees, Matorral, ...). The 3 types of machine learning models (binary logistic regression, random forest and XG Boost) have shown very interesting results in terms of forest fire predictability by correctly classifying an average of 85% of the sample reserved for the model training and data validation. The forest fire ignitions probability maps produced could operationally improve the alerts processes, the lookout posts positioning and the early intervention against fires by the units in charge of initial attacks.

Keywords: Forest fire; ignition probability; machine learning; logistic regression; random forest; XG Boost; Spatial modeling

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