Predicting Large Wildfires Using Machine Learning Approach Towards Environmental Justice via Remote Sensing

Agrawal, Nikita (School: Whitney M. Young Magnet High School)

Wildfires pose severe health and ecological consequences. In 2021 alone, 58,968 wildfires burned 7.1 million acres across the United States. Large wildfires (> 300 acres) in the United States, account for more than 95% of the burned area in a given year. Predicting large wildfires is imperative, however, current wildfire predictive models are localized and computationally demanding. This research aims to accurately predict large wildfires across the United States based on easily available environmental data and using a scalable model. USDA data for a subset of wildfire occurrences over 20 years, representing over 35 million acres burned, and NASA MODIS remote sensing data consisting of 925 million satellite observations were used. First, six key environmental variables were identified and annual averages over three years leading up to each wildfire occurrence was computed. Next, the resulting dataset of 18 environmental variables was tested on six different machine learning classification models (Logistic Regression, Decision Tree, Random Forest, XGBoost, KNN, and SVM) to determine their accuracy in predicting large wildfires. Finally, model validation tests and permutation feature importance analysis to identify important variables was performed. XGBoost Classification model performed the best in predicting large wildfires, with an accuracy of over 85%. Furthermore, towards environmental justice (Justice40), an analysis was performed to identify disadvantaged communities that are also vulnerable to large wildfire occurrences. This analysis combined with the machine learning model developed to predict large wildfires can be used as indicators for prioritization of federal resource and aid allocation, resulting in a significant step towards environmental justice.

Awards Won:
Third Award of $1,000
National Geographic Society: Excellence in Geography and Geospatial Science Award
University of Texas at Arlington College of Science: Scholarship of $10,000
Arizona State University: Arizona State University ISEF Scholarship (valued at up to $52,000 each)