Developing a Machine Model to Predict Wildfire Risk and Identify Key Wildfire Drivers in California

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Wildfires have caused significant economic losses and human health damages in California. To minimize the losses and damages, it is imperative to understand the key drivers of wildfires and predict future wildfire risk. In this study, the relationships between wildfire burn area (BA) and precipitation, air temperature, wind, and the Standardized Precipitation-Evapotranspiration Index (SPEI) were evaluated using wavelet analysis for the seven climate divisions in California, during the time period of 1984 to 2018. The machine learning approach of random forests was utilized to identify the key drivers of wildfire. A robust machine learning model based on random forest was developed that can accurately predict the probability of a wildfire occurring in a specific climate region in California. Wavelet analysis results indicate that the wildfire areas are correlated to temperature, precipitation, wind speed, and SPEI. Wavelet coherence results concluded that the coherence between temperature and wildfire BA is more significant. Random Forests results show that the relative importance of temperature, precipitation, wind speed, and SPEI are 0.62, 0.23, 0.06, and 0.05, respectively. Therefore, temperature is concluded to be the key driver for California wildfires. Machine learning model results show that the climate divisions 2 and 6 are most vulnerable to wildfires in 2023, and can be altered to show wildfire risk predictions on a monthly scale as well. These findings provide a reference for wildfire management on improved prediction of wildfire BA and formulate future wildfire emergency plans, which is significant in the aid of damage control of wildfires in California, leading to fewer burned acres, less economic damage, and fewer casualties.

Awards Won:

Fourth Award of $500

American Meteorological Society: Honorable Mention of $125

American Statistical Association: In-Kind membership to ASA for all winners, including honorable mentions

American Statistical Association: First Award of $1,500