EGU21-13729, updated on 24 Oct 2021
https://doi.org/10.5194/egusphere-egu21-13729
EGU General Assembly 2021

Towards machine learning for the estimation of wildfire risk from weather and sociological data

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Estimating the probability of a wildfire occurring at a specific location on a given day comes with the challenge that it not only depends to a high degree on weather conditions and soil moisture, but also on the presence of an ignition source [1]. A commonly used index to assess wildfire risks is the Canadian Fire Weather Index [2], which does, however, not model the presence of an ignition source.

We develop a machine learning model which discriminates between (1) the probability of a wildfire occurring given an ignition source, and (2) the probability of an ignition source being present, and inferences both. We first demonstrate the performance of our approach by estimating these probabilities on simulated data. With these simulations, we also assess the robustness of our model to machine learning-related challenges that arise with wildfire data, such as extreme class imbalance and label uncertainty. We then show the performance of our model trained on satellite-derived global wildfire occurrences between 2001 and 2017. The dataset FireTracks, which includes a comprehensive record of wildfire occurrences [3], is used as ground truth. Input features include weather data (ERA5 [4]) and population densities (GPW4 [5]). Finally we compare wildfire risk ratings computed with the Canadian Fire Weather Index to the probabilities estimated by our model.

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