Leveraging Machine Learning for a Wildfire Ignition Prediction Model in California

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INTRODUCTION

In western United States, the peak of wildfire season occurs between the end of summer and the beginning of the fall. The effects of climate change and the resulting alterations of environmental conditions, such as an increase in aridity, pose a big threat in increasing the time frame of this fire season. In anticipation of wildfires, many utility companies cut off power to neighborhoods, known as Public Safety Power Shutoffs (PSPS), out of fear of contributing to the ignition and spread of wildfires. Currently, there are many models for understanding the spread of wildfires but not much on predicting ignition sites. Creating a Wildfire Ignition Model (WIM) will aid in bridging this gap in research.

The goal of this research is to:

- Leverage machine learning techniques to predict the location of possible wildfires on a daily basis.
- Identify contributing variables to the prediction of wildfire ignition spots.

UCONN WIM FRAMEWORK

Machine learning (ML) based wildfire ignition model capable of predicting daily ignitions at various scales (town, county, etc.).
Utilizes high resolution weather reanalysis & variables built on 20+ years ignition data at 10km spatial resolution to capture:

1.fuel risk
2.human risk
3.convective risk
4.utility risk via proxy data

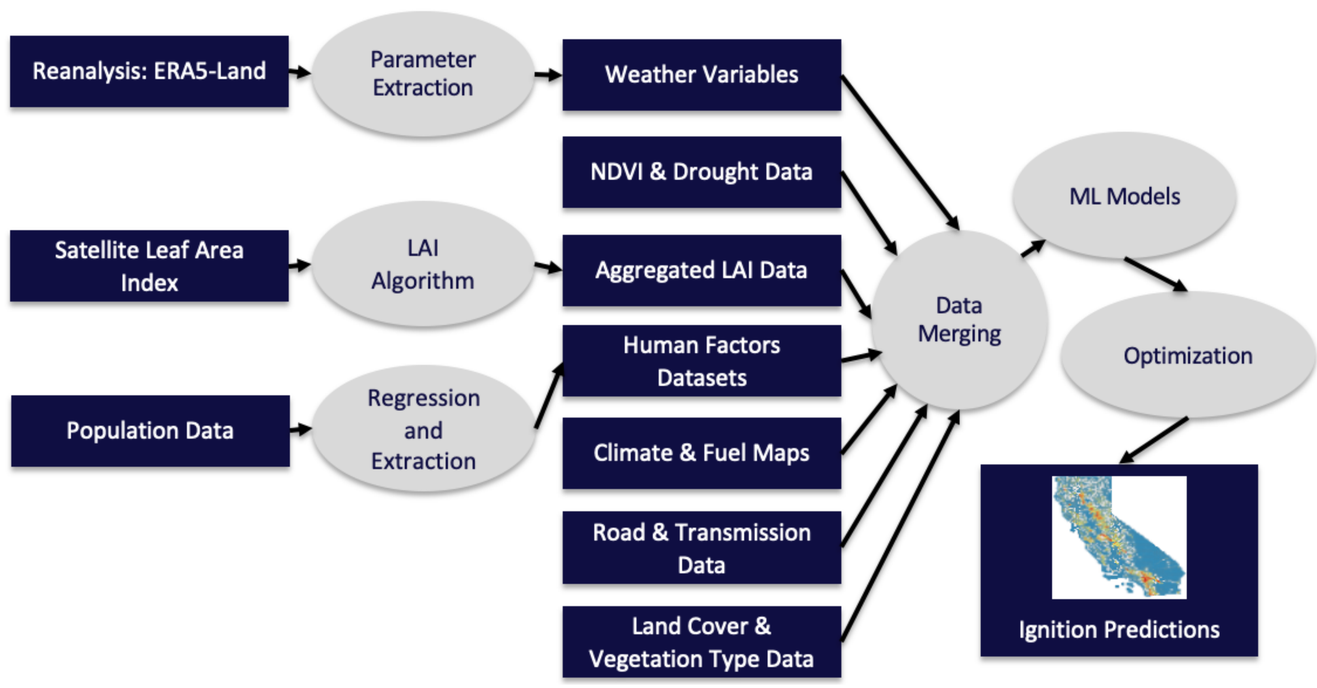

Fig. 1: Wildfire Ignition Model Architecture

WILDFIRE TRENDS AND CAUSES

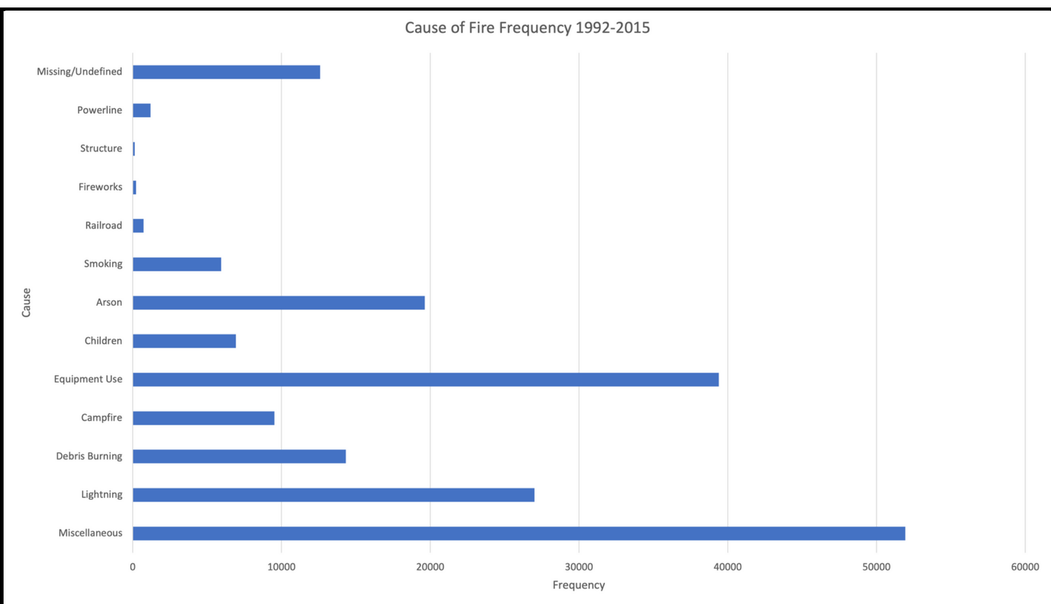

Fig. 2: Reported cause of fires in California from 1992-2015

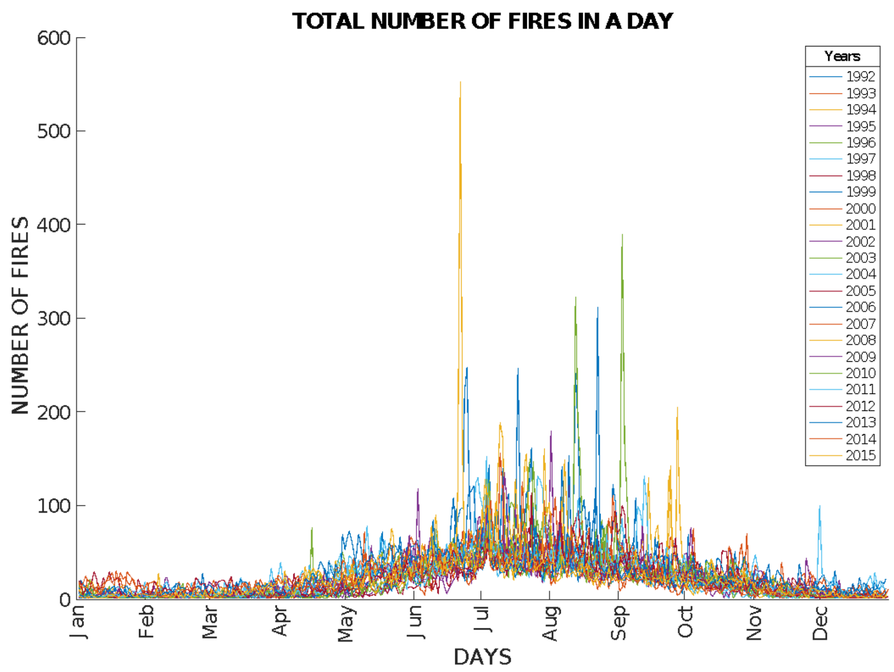

Fig. 3: Total number of fires in a day for all months from Jan 1992 - Dec 2015

MODEL PRELIMINARY RESULTS

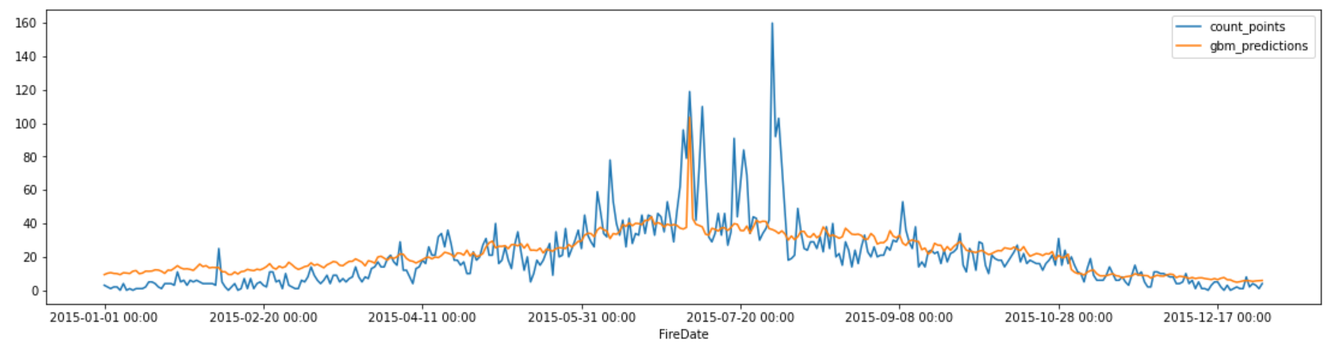

Fig. 4: Gradient Boosting ML Model (GBM) used to predict total fires in a day for the year 2015

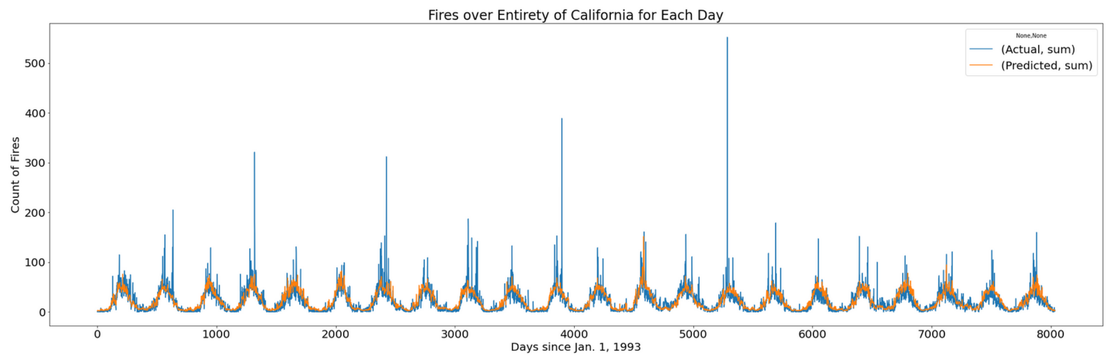

Fig. 5: Rolling average + anomalies predictions from Jan 1992 - Dec 2015

FUTURE WORKS

- Include a Wildfire Threat Index with a historical weather database into existing wildfire prediction framework.
- Improve framework through state-of-the-art machine learning model and artificial intelligence techniques.
- Extend the model to predict ignition spots in proximity to power lines to reduce PSPS.
- Adapt WIM to other states.

Patent Pending: Cerrai D., Nyame, S., Taylor, W. O., Spaulding, A., Koukoula, M., Yang, F., & Anagnostou, E. (2023). SYSTEM AND METHOD FOR WILDFIRE IGNITION MODELING (U.S. Patent Application No. 63/603,311). U.S. Patent and Trade-mark Office.

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