CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

John Gerving

Project Number

J0908

Project Title

Predicting Wildfires with Neural Networks: An Approach to Preventing California Wildfires

Abstract

Objectives
In recent years, wildfires have caused billions of dollars worth of damage across the state of California. An increase in frequency and intensity of these wildfires has made it difficult for emergency managers and fire officials to plan for them. Scientists are currently looking for new ways to predict the occurrence of wildfires. The objective of this project was to develop a machine learning algorithm to predict the risk of a wildfire occurring within a given area.

Methods
Data of temperature, vegetation, evapotranspiration, and historical wildfire incidence was obtained from the MODIS satellite using the Google Earth Engine API. A deep neural network programmed using the Keras library in Python was trained on the data. The neural network consisted of three hidden layers, each with 128 neurons. The output layer had a sigmoid activation function.

Results
The neural network achieved up to 77.87% accuracy after 16 epochs (or passes over the dataset while training), and 65.99% validation accuracy after 20 epochs. The accuracy stayed approximately the same throughout the experiment, and the validation accuracy stayed in the range of about 55-65%.

Conclusions
The neural network showed signs of overfitting, a phenomenon where the neural network fits the training dataset too well. The difference in accuracy and validation accuracy is evidence that overfitting occurred. The overfitting was most likely caused by a lack of factors in the dataset. In a future experiment, if more factors were used than just temperature, vegetation, and evapotranspiration data, the accuracy and validation accuracy of the network might be closer to each other.

Summary Statement

I developed and trained a neural network on environmental variables from a satellite, and it predicted wildfires with moderate accuracy.

Help Received

I collected the satellite data and built the neural network myself. Nick Nauslar, a fire weather forecaster with NOAA, guided me on the MODIS satellite and the data it provides. Canyon Robins, a computer science major at Stanford University, told me about Google Earth Engine and gave me advice on how I