Predicting Wildfires with Convolutional Neural Networks

By - Galactic Geeks

Introduction

Wildfires pose a significant threat to ecosystems, wildlife, and human lives, making early detection and prediction crucial for effective wildfire management.

Convolutional Neural Networks (CNNs) have emerged as a powerful tool for predicting wildfires due to their ability to extract complex patterns from spatial data, such as satellite images and weather data.

What are we solving?

The primary problems this project seeks to solve include:

1.Early Detection of Wildfires: By harnessing the power of CNNs and satellite imagery, this project enables the early detection of wildfires, allowing for proactive intervention measures to be implemented before they escalate.

2.Improving Prediction Accuracy: Predicting the likelihood of wildfires is a complex task that requires analyzing various environmental factors, including vegetation density, temperature, humidity, and wind speed. CNNs excel in extracting patterns and features from spatial data, leading to more accurate predictions of wildfire risk areas compared to conventional modeling approaches.

Why CNNs?

CNNs can analyze various factors that contribute to wildfire risk, including vegetation density, temperature, humidity, and wind speed. By training CNNs on historical wildfire data and environmental factors, these models can learn to identify patterns indicative of potential wildfire outbreaks. One of the key advantages of using CNNs for wildfire prediction is their ability to process large-scale, high-resolution satellite imagery quickly. This allows for real-time monitoring of wildfire-prone areas, enabling early detection and timely deployment of firefighting resources.

Additionally, CNNs can improve the accuracy of wildfire prediction models by integrating data from multiple sources, such as satellite imagery, weather stations, and historical fire records. This holistic approach provides a comprehensive view of wildfire risk factors, leading to more reliable predictions.

Dataset Overview

Source

Canada's website for the original wildfires data:
Forest Fires - Open Government Portal

About Dataset

This dataset contains satellite images (350x350px) in 2 classes :

- Wildfire : 22710 images
- No wildfire : 20140 images

Distribution

The data was divided into train, test and validation with these percentages

- Train : ~70%
- Test : ~15%
- Validation : ~15%

How

Using longitude and latitude coordinates for each wildfire spot found on the dataset, we extracted satellite images of those areas using MapBox API to create a more convenient format of the dataset for deep learning and building a model that can predict whether an area is at risk of a wildfire or not

OBJECTIVES

Using longitude and latitude coordinates for each wildfire spot (> 0.01 acres burned) found on the dataset above we extracted satellite images of those areas using MapBox API to create a more convenient format of the dataset for deep learning and building a model that can predict whether an area is at risk of a wildfire or not.

Models created with this dataset predict where a fire could potentially occur. It was created on this basis by the Canadian state.

This inference was made only through RGB bands. This should be taken into account.

DEVELOPMENT

Model development is a a crucial step in leveraging CNNs for wildfire prediction. Let’s delve deeper into the process:

01. Data Visualization and Exploration

02. Model Architecture Selection

VGG-16 is utilized

03. Model Performance Evaluation

Class Activation Maps is utilized

CONCLUSION

The importance of early detection in wildfire management cannot be overstated. By accurately predicting wildfire risk areas before outbreaks occur, stakeholders can take timely preventive measures to mitigate the potential impact on ecosystems, wildlife, and human lives.

Looking ahead, there is ample room for further exploration and collaboration in improving wildfire prediction models. Continuous advancements in deep learning techniques, satellite imaging technologies, and data analytics present opportunities to enhance the accuracy and reliability of wildfire prediction systems.

By embracing the power of CNNs and prioritizing early detection efforts, we can make significant strides towards mitigating the devastating impact of wildfires on our environment and communities.