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Wildfire Detection Using Satellite Images

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ABSTRACT: The Intelligent Wildfire Detection System represents an innovative solution to the global challenge of wildfires. Leveraging high-resolution satellite imagery and advanced machine learning models, the system aims to enhance the early detection of wildfires, enabling prompt and targeted responses. By employing pruning algorithms, the machine learning models are optimized for accuracy and efficiency, minimizing false positives and false negatives. The system integrates seamlessly with existing emergency alert systems, providing real-time alerts to authorities and communities. Geospatial mapping enhances precise visualization of wildfire locations, aiding in resource allocation and evacuation planning. Historical data analysis contributes to the system's predictive capabilities, offering insights into past fire behavior and regional patterns. The user-friendly interface empowers emergency responders, government agencies, and residents with efficient visualization tools. The project envisions global applicability, with scalability designed to cover diverse geographic regions and adapt to various environmental conditions. It addresses non-functional requirements such as performance, scalability, reliability, and security, ensuring the system's optimal functionality. Constraints related to data availability, quality, and community engagement are acknowledged, emphasizing the need for strategic solutions. Overall, the Intelligent Wildfire Detection System stands as a comprehensive and adaptive tool, poised to revolutionize wildfire management, safeguard communities, and preserve ecosystems on a global scale.

KEYWORDS: Convolutional Neural Networks (CNNs), DeepLearning, Satellite Images, Neural Network

I. INTRODUCTION

Wildfires represent a pervasive and escalating threat, with severe environmental, social, and economic consequences. Leveraging satellite imagery for early detection and monitoring has become paramount. In this in-depth survey, we provide an expansive overview of the field of wildfire detection using satellite images. We explore the historical context of wildfire detection, the progress in remote sensing technologies, the application of machine learning and deep learning techniques, the evaluationmetrics commonly used, and the persistent challenges in wildfire detection. As wildfires continue to pose a severe global threat, thiscomprehensive survey is an essential resource for advancing the field and advocating for more proactive wildfire detection systems. Wildfires have become an increasingly significant globalchallenge due to their wide ranging impact on ecosystems ,human settlements, and economies. To address this issue effectively, the development of advanced methods for early detection and monitoring is essential. Remote sensing technologies, particularly those utilizing satellite imagery, have emerged as valuable tools inthe battle against wildfires. This survey provides an extensive exploration of the current state of wildfire detection using satelliteimages, covering the field's evolution, the application of machine learning methodologies, and the challenges faced in wildfire detection. By the end of this survey, readers will have a deep appreciation of the significance of this research in safeguarding our environment and communities.

A. MOTIVATION

The motivation behind the"Wildfire Detection Using Satellite Images" project stems from the critical need to address the escalating challenges posed by wildfires worldwide. Wildfires have become increasingly destructive, causing immense harm to ecosystems, threatening lives, and challenging the resilience of communities. The project is driven by the urgency to enhance early detection mechanisms, as timely intervention is paramount in minimizing the devastating consequences of wildfires. Leveraging satellite imagery and advanced machine learning techniques presents an opportunity to revolutionize the effectiveness of wildfire detection, providing a proactive and efficient solution. By developing a system that integrates seamlessly with existing emergency protocols, offers real-time monitoring, and incorporates historical data for improved predictive capabilities, the project aspires to significantly contribute to the preservation of ecosystems and the safety of communities. This initiative is fueled by the belief that innovative technology can play a pivotal role in safeguarding our environment and minimizing the impact of wildfires on the inhabitants.

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II. LITERATURE SURVEY

Year	Author	Title	Main Idea	Algorithm	Use	Remark
2021	MartinLanger	Wildfire Detection FromMultisensor Satelite Imagery Using Deep Semantic Segmentation	It helps identify specific objects and features in the images.	CNN	This technology can also aid in assessing the severity and extent of the fire, assisting in evacuation planning and mitigating potential damage.	It helps us detect and monitor wildfires more accurately and efficiently, aiding in early response and minimizing the damage caused.
2020	Thilanka Munasinghe	Exploring Various Applicable Techniques to Detect Smoke on the Satellite Images	To develop effective methods for identifying and monitoring smoke plumes in order to detect and track wildfires.	CNN	These techniques involve analyzing satellite imagery using algorithms to identify and track smoke plumes.	we can improve early detection and response to wildfires, ultimately helping to save lives and protect the environment.
2022	MINSOO PARK	Forest-Fire Response System Using Deep-Learning-Based Approaches With CCTV Images and Weather Data	To leverage advanced technologies to enhance early detection and response to forest fires.	Bayesianneural network,	By analyzing CCTV images and integrating them with real-time weather data, the system can identify potential fire hotspots and provide timely alerts toauthorities.	This system has the potential to make a significant impact in minimizing the damage causedby wildfires and ensuring the safety of both human lives and natural resources.
2023	Yu Zhao	Tokenized Time-Series in Satellite Image Segmentation With Transformer Network for Active Fire Detection	To improve the accuracy and efficiency of active fire detection in satellite imagery.	RNN	It can enhance early warning systems for wildfires by accurately detecting and tracking the spread of fires over time.	This can greatly enhance early warning systems and aid in effective fire response strategies.
2020	Roman Larionov	Wildfire Segmentation on Satellite Images using Deep Learning	To utilize advanced neural network architectures to automatically identify and delineate fire regions in satellite imagery.	CNN	To automatically detect and delineate fire-affected areas in the imagery.	It allows for more accurate and efficient detection of fire-affected areas, which is crucial for early warning systems and effective response strategies.

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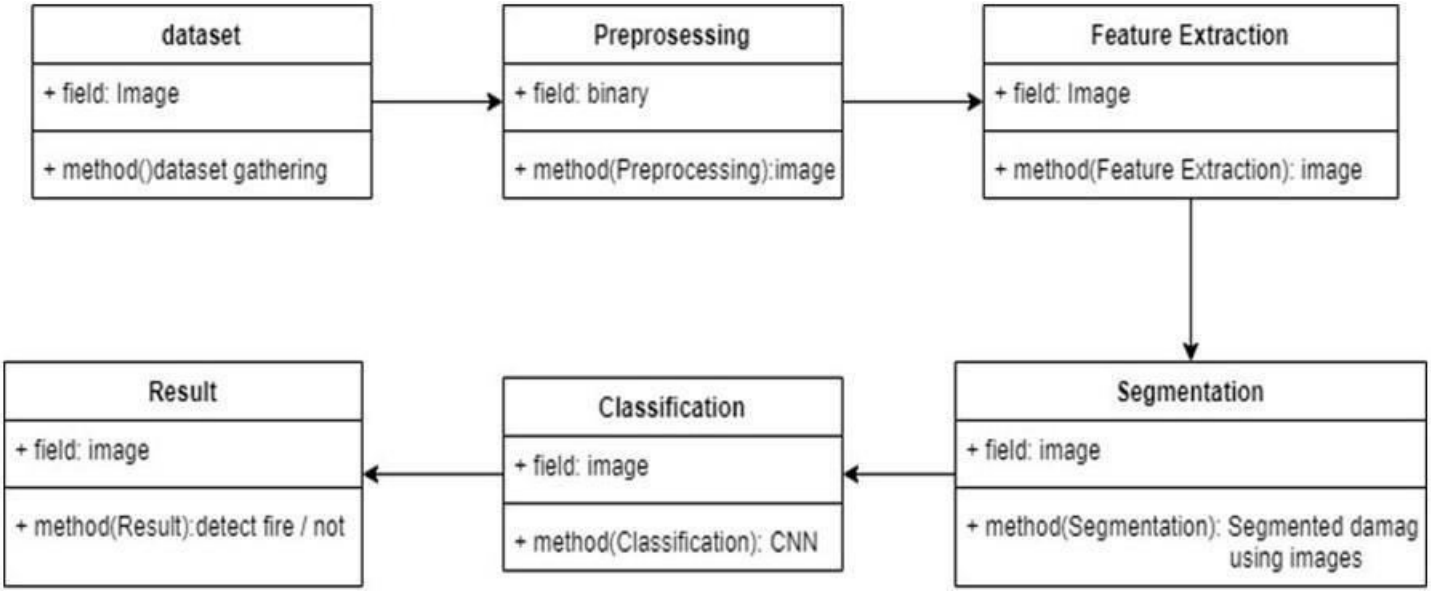
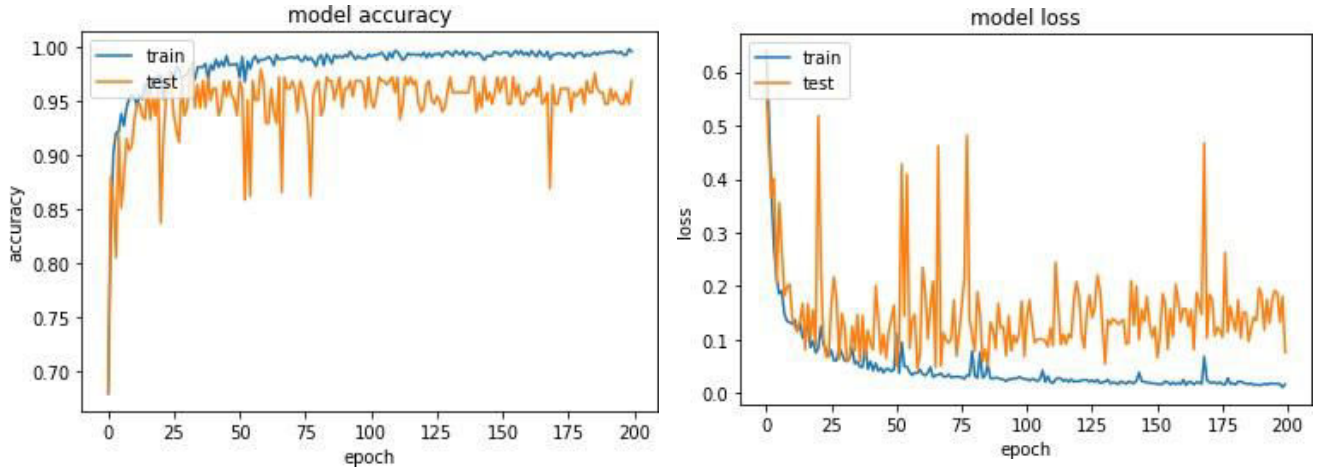
III. METHODOLOGY



IV. ACCURACY AND LOSS GRAPHS



V. CONCLUSION

This survey has provided a comprehensive overview of the state of wildfire detection using satellite images. The field has witnessed significant progress, evolving from early localized observations to the deployment of advanced remote sensing technologies and the integration of machine learning and deep learning methodologies. These advancements have significantly enhanced our capacity to detect wildfires accurately and in a timely manner. However, challenges such as false positives, cloud cover, and real-time processing persist, emphasizing the need for ongoing research. Wildfires continue to pose a significant global threat, and this survey serves as a critical resource in advancing the field, ultimately contributing to more accurate and timely wildfire detection and better protection for our environment and communities

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