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FIRE PREDICTION MODELING AND RISK MAPPING USING RECENT AI TOOLS IN CLIMATE CHANGE.

Abstract

The integration of satellite technology into various domains has revolutionized our ability to monitor and predict natural disasters. One such critical area is fire prediction modeling, where satellite data plays a pivotal role in assessing fire risk, detecting active fires, and forecasting fire behavior. This article explores the recent practices of satellite data in fire prediction modeling and how it aids in mitigating the devastating impacts of wildfires. In addition, this research provides an innovative AI based mathematical model can be used both satellite constellations, cubesat swarms or single unit satellites. Existing machine learning algorithms for satellite applications are compared with the newly proposed (developed) model. The scope of the model consists of early detection (wind profiles and intensities), fire behavior prediction (chemical characteristics of the cause to fire) and fire risk assessment (uses historical data of the region and environmental factors). This research also reviews existing land monitoring techniques, analyses the sensor qualities of various satellites, and identifies the innovative AI based solutions for faster image processing. Key variables of the modeling are (i) vegetation health indices (VHI), (ii) weather and climate data such as temperature, humidity, wind speed and precipitation, (iii) land surface temperature (LST) from infrared sensors, and (iv) land cover mapping distinguishing between forests, grasslands, and urban areas. This information informs fire risk assessments by identifying areas with abundant fuel loads and those prone to rapid fire spread. VHI can signal increased vegetation stress, making areas more susceptible to fire ignition and spread. Also, sensor data helps in assessing environmental conditions conducive to fire ignition and propagation, facilitating early warning systems and evacuation planning.

Therefore, this research aims to provide In addition, developed mathematical model is compared with actions in real events in Algeria. Emergency response from United Nations, ESA Copernicus and commercial companies such as Planet Labs, Maxar technologies are evaluated to create an international awareness. Outcomes are evaluated in the scope of enhanced preparedness, improved resources management and the climate change adaptation to prevent future disasters.