A Machine Learning-Driven Approach for Wildfire Detection Using Hybrid-Sentinel Data: A Case Study of the 2022 Uljin Wildfire, South Korea

Linh Nguyen Van*, Min Ho Yeon**, Jin Hyeong Lee***, Gi Ha Lee****

Abstract

Detection and monitoring of wildfires are essential for limiting their harmful effects on ecosystems, human lives, and property. In this research, we propose a novel method running in the Google Earth Engine platform for identifying and characterizing burnt regions using a hybrid of Sentinel-1 (C-band synthetic aperture radar) and Sentinel-2 (multispectral photography) images. The 2022 Uljin wildfire, the severest event in South Korean history, is the primary area of our investigation. Given its documented success in remote sensing and land cover categorization applications, we select the Random Forest (RF) method as our primary classifier. Next, we evaluate the performance of our model using multiple accuracy measures, including overall accuracy (OA), Kappa coefficient, and area under the curve (AUC). The proposed method shows the accuracy and resilience of wildfire identification compared to traditional methods that depend on survey data. These results have significant implications for the development of efficient and dependable wildfire monitoring systems and add to our knowledge of how machine learning and remote sensing-based approaches may be combined to improve environmental monitoring and management applications.

Keywords: Wildfire detection, Random Forest classification, Sentinel-1, Sentinel-2, Google Earth Engine, 2022 Uljin Wildfires

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candidate

* Member · Ph.D. student, Dept.of Advanced Science and Technology Coverage, Kyungpook National University · E-mail: linhnguyen@knu.ac.kr

** Member · Ph.D. candidate, Dept.of Advanced Science and Technology Coverage, Kyungpook National University · E-mail: alsgh2620@knu.ac.kr

*** Member · Undergraduate student, Dept.of Construction and Disaster Prevention Engineering, Kyungpook National University · E-mail: jinhyung9904@naver.com

**** Member · Associate Professor, Dept.of Advanced Science and Technology Coverage, Kyungpook National University · E-mail: leegiha@knu.ac.kr