Climate Adaptation in 2021: How Machine Learning and Earth Observation are Key to Extreme Event Resilience

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Abstract

The various extreme weather events that occurred globally in 2021, from Europe to China to North America, served as yet another reminder that robust strategies for climate adaptation are crucial at a time of rapid global warming. Building resilient communities and lessening the impact that natural disasters have on vulnerable infrastructure can be aided by automated systems driven by machine learning algorithms trained on Earth observation data. When deployed, computer vision models can analyze satellite imagery in real time and inform decision makers and nongovernmental organizations about the timely and targeted allocation of resources and humanitarian aid personnel to affected areas. Here, we overview several specific 2021 extreme events and the factors that caused the loss of life, damage to infrastructure, and economic loss. The events surveyed include flooding in Germany, wildfires in Greece, and Hurricane Ida in the Eastern United States. Taking this information into account, we further discuss barriers to the large-scale deployment of current machine learning technologies, especially models trained on Earth observation data. We examine the limitations of satellite imagery and big data applications in detecting damage and building collapse and how Interferometric Synthetic Aperture Radar (InSAR) can be a tool to resolve existing issues. The aim of this work is to understand why many state-of-the-art models being developed have not yet been successfully and extensively deployed in the real world and to foster discussion about optimizing the use of deep learning technology to save lives and lead effective disaster management efforts.

Climate Adaptation in 2021 and Beyond: Using Machine Learning and Earth Observation to Bolster Extreme Event Resilience

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