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## Advancing environmental monitoring through deep learning: wildfire segmentation using time-series of images from the Sentinel constellation

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The integration of remote sensing and deep learning has revolutionized environmental monitoring, leveraging cutting-edge technologies to assist the decision-making processes in resource management and offering advanced tools for rapid disaster response. Our work employs satellite imagery to address pressing challenges in Earth observation, integrating multi-sensor, multi-resolution, and multi-temporal data for studying the aftermath of disastrous events by means of deep learning models, capable of handling such diverse data modalities.

We focused on the segmentation of wildfire-affected areas, using multispectral images from the Sentinel-2 satellites combined with the information from the Copernicus Emergency Management Service, in particular the geolocation and impact assessments, for more than 100 events occurred mostly in the European Mediterranean region. This dataset is further enriched with the observations from the Sentinel-1 and Sentinel-3 satellites, ensuring a comprehensive representation of the effects of each wildfire event by integrating measurements from multiple sensors with varying resolutions and revisit time. To streamline the workflow, a custom library based on the SentinelHub API has been developed, facilitating the download, preprocessing, and combination of data from different sources.

The study is performed on time-series of images, incorporating pre-event and post-event data, processed with a deep learning approach that combines Convolutional Long Short-Term Memory (ConvLSTM) layers in a UNet-like architecture. The results demonstrate the effectiveness of our model in accurately segmenting the affected areas, thus providing actionable insights for emergency management and recovery. Furthermore, the varied dataset, which comprises wildfire events occurring in diverse geographical conditions, enhances the robustness and generalizability of the described methodology.

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### Supplementary materials

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