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Towards Automated Tracking of Wildfires and Smoke Plumes Across Multi-Sensor Scenes

Abstract

NASA's Earth observing instruments have provided comprehensive observations of wildfires and aerosol plumes from wildfires. At present, JPL's Segmentation, Instance Tracking, and Data Fusion Using multi-SEnsor imagery (SIT-FUSE), utilizes an unsupervised machine learning (ML) framework that allows users to segment instances of objects like wildfires and smoke plumes in single and multi-sensor scenes from NASA's satellite instruments with minimal human intervention, in low and no label environments. The output of the ML framework also facilitates the tracking of smoke plumes, allowing users to more easily, but still manually, track plumes across multiple scenes over time. Here, we discuss the approaches and progress being made towards the automation of tracking instances across scenes from the same instrument sets as well as the exploration of techniques like contrastive learning (CL), enhanced by the topological features of the object instances detected, to augment SIT-FUSE with the capability to automatically track wildfire and smoke plume instances across datasets from like and disparate instrument sets.

Keywords: Wildfires, Instance Tracking, Unsupervised Machine Learning, Contrastive Learning

Biography



Nicholas LaHaye earned his PhD. in Computational and Data Sciences from Chapman University while working as a Data Scientist with the Processing Algorithms and Calibration Engineering group at JPL, where he has been since 2013. His research focuses include applying unsupervised deep learning to large multi-sensor datasets, to segment and track objects in low and no label environments (smoke plumes, algal blooms, burn scars, etc.). He is also currently working on fast retrievals of physical parameters and associated uncertainties in the domains of water quality and cloud remote sensing and uncertainties using DL. He is generally passionate about applying machine-learning-based solutions to help better understand and mitigate the climate crisis, natural hazards, and biodiversity loss. Email: nicholas.j.lahaye@jpl.nasa.gov