FireGuard: Fire Management with Autonomous UAV Navigation

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Principal Investigator Project Date

Team members:

Marko Beko[1], Slavisa Tomic[1], João P. Matos-Carvalho[1,2], André Mora[1], Ricardo Serra Santos[1], Afonso Fernandes-Oliveira[1]

1. Center of Technology and Systems (UNINOVA-CTS) and Associated Lab of Intelligent Systems (LASI);
2. LASIGE Computer Science and Engineering Research Centre;

Abstract:

The primary goal of this research is to develop a holistic decision support platform customized for wildfire management, prevention, and recovery. This platform, driven by data acquired from Unmanned Aerial Vehicles (UAVs) and utilizing advanced image processing techniques, specifically multispectral indices, will possess the capability to extract essential topographical, biological,

structural, and meteorological data from a designated region of interest, using new localization algorithms with obstacle avoidance. This comprehensive dataset will be employed for modeling and simulating wildfires within the same region. Currently, there is a scarcity of effective decision-making solutions for wildfire combat available in the market. The majority of these solutions heavily depend on satellite imagery, which, unfortunately, comes with limitations in terms of both temporal and spatial resolution, posing significant challenges, especially for smaller areas. Furthermore, these solutions often fail to harness the full spectrum of insights that can be derived from a wildfire simulation and lack user-friendliness, rendering them less desirable for active deployment. UAVs are swiftly gaining prominence as the primary choice for data collection across diverse application domains. Their surging popularity can be attributed to their remarkable mobility, compact dimensions, and versatile capabilities. These are opening the door to a plethora of applications, ranging from surveillance and search and rescue missions to applications in forestry, agriculture, and more. This makes them an interesting choice for rapidly and effectively collecting data for wildfire simulations. In summary, our aim is to increase our knowledge of creating a fully developed decision-making platform for wildfire management using UAVs with autonomous navigation. This involves understanding both the advantages and limitations of utilizing UAVs for data collection in real-world wildfire scenarios and develop new modeling and simulation methodologies for characterizing wildfire representation and progression.

Project Logo: