Enhancing Aerial Image Georeferencing with Innovations in Pixel-Level Semantic Segmentation for Improved Precision in Mapping

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Abstract:
In the realm of aerial image georeferencing and mapping, the primary challenge is to enhance georeferencing accuracy and segmentation efficiency for precise remote sensing applications. The core obj ective is to refine georeferencing precision, ensuring heightened mapping reliability, while concurrently developing efficient segmentation methods for valuable geospatial data extraction. The incorporation of the Coco dataset validates and enhances the effectiveness of the segmentation technique devised in this paper. This paper introduces an innovative approach centered on refining pixel-level semantic segmentation for both aerial images and georeferencing processes. This proposed method marks substantial advancements in accurately categorizing and delineating objects within aerial imagery, contributing to an elevated precision in geo-referencing. The emphasis on improved pixel-level semantic segmentation underscores the commitment to enhancing the efficacy of georeferencing in the context of aerial images. The proposed approach demonstrates remarkable performance metrics, including an accuracy of 96.71 %, precision scaling to 98.75%, and a commendable recall of 90.62 %. Through comprehensive comparative analysis with established models, such as semantic segmentation, panoptic segmentation, and 3D semantic segmentation, this method emerges as a leader in the field.

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Contents

I. Introduction

In the realm of robotics, localization stands as a critical aspect across applications, be it for self-driving cars, Micro Aerial Vehicles, or collaborative multi-robot systems that rely on a shared global map [1]. Remotely Piloted Aircraft (RP A) equipped with RGB aerial imaging undergoes meticulous Object-Based Image Analysis (OBIA) for assessing sugarcane productivity, intricately considering factors like stalk numbers and average height [2], [3]. Despite strides in fire detection technology, the persistent challenge lies in reconciling instrument outputs with the nuanced requirements of modelling systems [4]. Surveillance flights conducted before and after air strikes yield images with temporal variations and diverse characteristics, posing challenges such as blurriness, errors, and uneven illumination [5]. Drones emerge as versatile tools adept at capturing intricate details of peatland microtopography and vegetation, effectively bridging the gap between field measurements and satellite remote sensing, promising continuous evolution [6], [7]. Ongoing endeavors prioritize the automated semantic interpretation of point cloud maps, contributing to the development of low-complexity, georeferenced 3D mapping, particularly beneficial for in-field operations [8]. The global utilization of high-resolution stereoscopic imagery plays a pivotal role in tracking land-cover changes. This imagery supports not only long-term environmental monitoring but also facilitates dynamic 3D change detection, marking a significant stride in comprehensive georeferencing applications [9].

Authors

Figures

References

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