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OVERCOMING THE CHALLENGES OF AUTOMATIC IMAGE RECOGNITION IN SATELLITE GEOSPATIAL DATA

Abstract

The increasing volume of geospatial data and satellite imagery from Earth observation satellites urges the need for a mechanism to automatically analyze the accumulated geospatial data. The development of on-board storage capabilities, the improvements of the sensors' resolutions and coverage and the variety of sensors in the new space era, are all reasons for a huge increase in the amount of geospatial data accumulated by the ground station; data that needs to be resolved and analyzed.

Currently, the analysis of the images and data is primarily based on human operators and this creates a limitation in the ability to analyze the increasing amounts of data. Evidently, a new approach for analyzing the geospatial data is needed. What if we could treat all the geospatial data as structured data? Create queries, run big data algorithms and information retrieval algorithms on this data? Imagine that a query can be run on all your geospatial data and that it can retrieve images that contain certain elements or objects. This is the future of satellites' data and image handling, the main challenge in reaching this goal is the ability to automatically analyze the data and break it down into elements and objects.

Deep learning methods are becoming more common in the automatic analysis of imagery data and have shown great success in object identification and recognition. However, when it comes to geospatial data, these methods are currently less applicable because of the unique conditions and limitations of the Earth observation missions.

This manuscript reviews the satellite-specific challenges in applying deep learning methodologies to achieve geospatial image recognition and object identification. The manuscript, also, reviews how one can overcome these challenges and create AI models that automatically identify objects within geospatial image data. The manuscript starts with a short introduction of the concept of automatic image analysis, reviews the capabilities of deep learning algorithms in image recognition and then, elaborates why these methodologies are currently not as effective when applied on geospatial data. After understanding the challenges that are specific to the Earth observation imagery, it introduces methods and techniques that can bridge this gap and utilize the advantages of the Earth observation mission to improve the accuracy of the image recognition models.