IAF EARTH OBSERVATION SYMPOSIUM (B1)
Interactive Presentations - IAF EARTH OBSERVATION SYMPOSIUM (IP)

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ASSESSING THE EFFECTIVENESS AND LIMITATIONS OF SUPER-RESOLUTION IN SATELLITE REMOTE SENSING

Abstract

This research aims to investigate and validate the applications of super-resolution (SR) in agriculture and urban planning sector. Since the emergence of SR topic in satellite remote sensing, it sparked various debates in the earth observation community about whether SR is just a decoration or not. In fact, SR requires a lot of computational resources, fine tuning and very high resolution imagery. That makes it very challenging to conclude SR potential and limitations from an inclusive and widened perspective. For example, for counting buildings, SR could make a difference as the visual quality of images are improved. However for agriculture use cases like crop classification or crop diseases, it's mainly dependent on pixel spectral values linked to specific crops type or disease more than just visual features. Most of research overlook the limitations and applications of SR in remote sensing and focusing instead on visual quality assessment of output images. This has motivated us to address this question by providing analytical results and in different use cases. Public satellite imagery from Sentinel-2 satellite will be used in this study as it plays a vital role in many environmental applications due to their open data policy. Sentinel-2 bands, which offer 10 and 20 meters resolution, will be improved by utilizing the VENμS (5m) and Worldview 3 (1.25m) satellite data. For the agriculture part of the research, a corn classification model will be built using original Sentinel-2 imagery. Afterwards, a second model will be built using the super-resolved data. Finally, the results will be compared to assess the impact. Actually, most farms look the same worldwide, however, in cities, man made architectures and design are quite diverse across the globe. For example, Las Vegas differs from Mumbai and Cairo, making it hard to build one model for them all. The validation approach will rely on performing experiments in different locations to reveal if training dataset geographical location diversity has an impact on the results or more the quality of training dataset with respect to correct mapping of the high/low resolution sensors data to each other. Finally, a simple building detection model will be run on a few super-resolved and original high resolution tiles to validate the impact in counting buildings. By demonstrating the feasibility and benefits of upscaling Sentinel-2 imagery, this research contributes to the broader understanding and adoption of SR technologies to support solving precision agricultural and urban planning challenges