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SUPER RESOLUTION OF EARTH OBSERVATION IMAGERY BEYOND THE VISUAL SPECTRUM USING STATE-OF-THE-ART DEEP LEARNING MODELS WITH AERIAL IMAGERY

Abstract

In recent years, extensive research has been performed to improve super resolution algorithm performance based on deep learning methods focusing on images from the visible portion of the spectrum. However, upscaling for images that capture radiation other than visible, such as thermal infrared and radar, remains a relatively immature field of study. In this paper, we investigate the possibilities of augmented resolution for non-visible spectrum imagery.

The aim of this study is to investigate the super resolution of high resolution aerial imagery in the visible spectrum with satellite imagery from other regions of the electromagnetic spectrum. Two types of satellite imagery are explored: Synthetic Aperture Radar (SAR) and Thermal Infrared. The SAR use case includes the study of L-band, C-band and X-band imagery. Landsat 8-9 Band 10/11 Thermal Infrared Sensor (TIRS) imagery is used for the Thermal Infrared imagery.

Combinations of state-of-the-art Deep Learning models and loss functions are investigated for this application. In particular, different loss functions are considered to measure the reconstruction image quality including Peak Signal to Noise Ratio (PSNR), Structural Similarity (SSIM), and Feature Similarity Index (FSIM) metrics.

This study introduces new ideas and approaches for super resolution combining both aerial imagery and satellite data beyond the visual spectrum, highlighting the necessary considerations in different conditions of the studied scenarios.