IAF EARTH OBSERVATION SYMPOSIUM (B1)
Earth Observation Data System Development and Management (4)

Author: Mr. Armando La Rocca
AIKO S.r.l., Italy

Mr. Luca Manca
AIKO S.r.l., Italy
Mr. Federico Fontana
AIKO S.r.l., Italy
Mr. Alessandro Aquilano
AIKO S.r.l., Italy

TOWARDS ON-BOARD SUPER RESOLUTION APPLIED TO EARTH OBSERVATION IMAGES

Abstract

Super Resolution (SR) techniques are being widely studied and applied on optical images, providing interesting results in the context of image processing. SR on Earth Observation (EO) data is a hot topic considering the vast range of applications in which remote sensing is involved and the post-processing quality enhancement that can be derived using super-resolved data.

The two main challenges in the application of SR to EO domain are the difficulties in collecting training data and the strict requirements to run SR algorithm on-board for real-time applications. The main goal of this work is the development of a framework that overcomes these drawbacks, proposing a method that does not need ground truth data and that can be employed for on-board tasks.

We implemented and tested a SR method on Sentinel-2 RGB images: starting from Sentinel images with 10m resolution, the model performs an enhancement with a scale factor of 4 reaching RGB products at a spatial resolution of 2.5m. The core technology is represented by a Generative Adversarial Network (GAN) that represents one of the most cutting-edge fields in the Deep Learning domain. Being the SR problem a supervised learning (SL) task, it requires couples of Low Resolution (LR) images and their corresponding High Resolution (HR) ones to be trained.

The availability of this genre of data represents one of the main challenges in SR algorithms development which becomes almost prohibitive when applied to EO data. However, our method does not require couples of data as for every SL algorithm, since we exploit a robust and bias-aware method to generate LR data from a given reference image.

Furthermore, a value added by the study performed is the assessment of the model to be run on-board of the satellite platform. This reduces the gap toward the implementation of SR algorithms on-board the satellite and it opens up to real-time application scenarios, where the resolution of the image product makes the difference. Our optimization pipeline provides significant improvements with a negligible loss in the quality of the produced image. This result is encouraging and will be crucial to enable future real-time applications.

In addition, further studies are undergoing to demonstrate the added value given by the on-board availability of a super-resolved image product and to test the model on different scenarios including: i) different spectral bands of Sentinel-2 data, ii) other satellite imaging sensors.