Internship in ESA's Advanced Concepts Team

on

Super-resolution algorithms for PROBA-V imagery competition

Topic description

Due to theoretical, practical and cost constraints, every satellite imaging system produces images with limited spatial resolution. Nevertheless, it is possible to enhance the resolution of the images acquired by means of image post-processing algorithms. Super-resolution image reconstruction has been a very active research area in the past couple of decades [1]. One approach often used is the "multi-frame super-resolution", where a set of low-resolution images of the same scene are combined in order to create a single higher-resolution image [2]. Super-resolution algorithms also benefit greatly from advances made in machine learning.

PROBA-V is a vegetation observation satellite that covers most of the Earth's surface every day [3]. Assuming that Earth's vegetation does not change considerably on a daily basis, multiple consecutive images of the same area can be fused to produce imagery with higher spatial detail. Hence studying the feasibility and performance of various multi-frame super-resolution techniques for PROBA-V is of interest.

Candidate's tasks

The specific project tasks include:

- Implement and test the performance of various off-the-shelf super-resolution image reconstruction algorithms on PROBA-V images.
- Try different metrics for evaluating the performance of the super-resolution methods.
- Set up a competition on the Kelvins platform to encourage the development of advanced super-resolution algorithms suitable for PROBA-V imagery.

The ideal candidate

Mandatory:

- Strong programming skills in Python or equivalent;
- Experience with image processing.

Desirable:

- Experience with machine learning.

References

[1] S. C. Park, M. K. Park, M. G. Kang, "Super-Resolution Image Reconstruction: A Technical Overview", IEEE Signal Processing Magazine, Vol. 20(3), 2003.

[2] S. Farsiu, D. Robinson, M. Elad, P. Milanfar, "Fast and Robust Multiframe Super Resolution", IEEE Transactions on Image Processing, Vol. 13(10), 2004.

[3] https://earth.esa.int/web/guest/missions/esa-operational-eo-missions/proba-v