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Internship proposal

Deep correction of satellite vibrations for image and surface acquisition

Topic

The geometry of high-resolution images is a key driver for numerous applications which require an accurate geolocation of pixels. As an example, one can think of the design of fine Digital Surface Models (DSM) from pairs of registered images. Unfortunately, mechanical vibrations of the satellite result in image distortions which make this challenge significantly harder. The goal of this internship is to explore the feasibility of correcting those artifacts. It will be attacked both at a fundamental level and at a more practical level.

The internship will start with the design of simple analytical and numerical models to reproduce the image acquisition process and the vibrations in collaboration with experts of the field. Once minimalist models will be established, we will attempt to characterize which distortions can be corrected and which cannot, depending on the nature of the underlying surface and it photogrammetric properties.

From a theoretical perspective, this work will blend notions of sampling theory, 3D geometry and inverse problems. From a practical perspective, this problem can be attacked with deep learning architectures that will be trained to recover the true underlying image from the distorted one. Depending on the progress of the candidate, an exploration of the problem with real data will be attempted.

Practical aspects

We are looking for a highly motivated student, willing to continue with a PhD thesis, with a strong background in mathematics (e.g. optimization, statistics) and/or electrical engineering (e.g. signal processing, harmonic analysis) and/or in computer sciences (e.g. Python / Pytorch). A taste for satellite imaging/optics would be a plus.

The intern will be granted the usual stipend of ~ 600 euros/month.

If the candidate is successful, this internship will be pursued by a CNES PhD (Centre National d'Etudes Spatiales). The salary for the PhD is ~ 2045 euros/month.

This internship will take place between AGENIUM and INSA, which are both located in Toulouse at walking distance. It will be co-supervised by François Devieilleville (AGENIUM) and Pierre Weiss (CNRS Toulouse). In addition, the candidate will have access to discussions with satellite specialists in AGENIUM and CNES.

Do not hesitate to contact us for more information.