Monitoring Earth Surface Dynamics with Optical Imagery

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Despite the increasing availability of high-quality optical satellite images, continuous monitoring of Earth’s surface changes is still of limited use due to technical constraints.

To overcome these limitations, we propose a processing chain, the Cosi-Corr, that provides sub-pixel orthocorrelation and sub-pixel correlation of optical satellite images. By accurately orthocorrelating and co-registering pairs of satellite images, we are able to monitor small-scale surface changes with sub-pixel precision.

The Cosi-Corr Flowchart and Methodology

(a) Inputs
- Raw Images
- Orbit, platform attitude, camera model
- Digital Elevation Model

(b) Orthocorrelation
- Images must be superresolved accurately
- Orthocorrelation

(c) Outputs
- Orthocorrelation
- Image correlation
- Image correlation

The Cosi-Corr procedure relies on the automated generation of ground control points (GCPs). They are generated such that the deformation field lies on the viewing geometry of the sensing platform allows for efficient orthocorrelation and co-registration of the images. The generated set of GCPs forms an already ortho-rectified image mosaic, by locally applying a rough sub-pixel extraction of GCPs image positions from reference image. Orthocorrelation and their registration with the master orthoimage are estimated from correlation.

La Valette landslide (French Alps) monitoring using SPOT5

(c) Ice-flow monitoring using SPOT5: the Mer de Glace glacier

[Diagram showing ice-flow monitoring using SPOT5]