Fast image drift compensation in scanning electron microscope using image registration

Research framework

It is a well-known fact that scanning electron microscopic (SEM) image acquisition is mainly affected by nonlinearities and instabilities of the column and probe-specimen interaction; in turn, producing a shift in the image points with respect to many parameters and time, in particular. The compensation of this phenomenon is an important issue if one wants to use a SEM for measurements involved in material characterization or for complex micro-nano-robotics tasks.
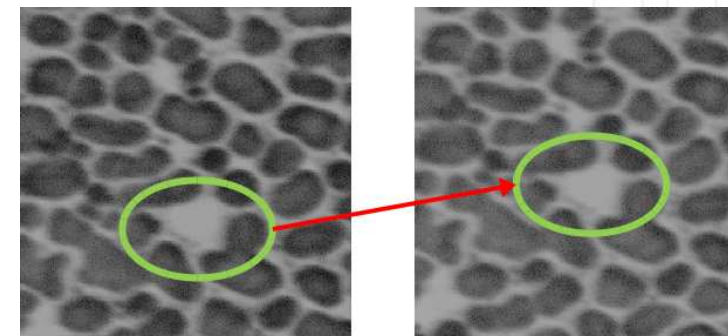
Proposed approach

In these works, image registration-based drift compensation methods have been developed. The homography between the reference image and the current one is computed using two approaches.

- In the first approach, phase correlation of the pair of images is used to compute the homography between both images.

- In the second approach, keypoint points detection and matching are used to compute the homography between the pair of images. Four algorithms have been tested: SURF, FAST, ORB and dense matching.

The results of all methods are consistent: the images tested show no rotation or shear, or scaling. However, ORB detector provides the best compromise between accuracy of drift compensation and computation time.

Major article: Malti, A. C.; Dembélé, S.; Piat, N.; Arnoult, C. & Marturi, N. Toward fast calibration of global drift in scanning electron microscopes with respect to time and magnification, International Journal of Optomechatronics, 2012, 6(1).
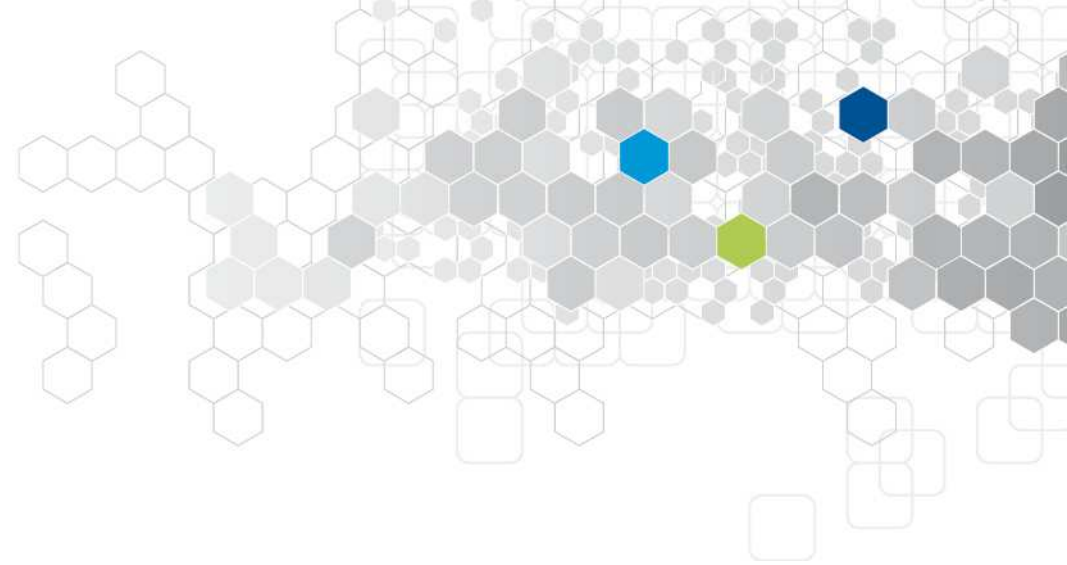

Drift between two images of the area acquired at a 30s interval (JEOL-JSM 820 SEM)
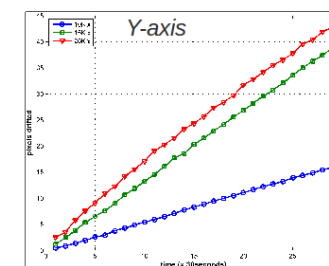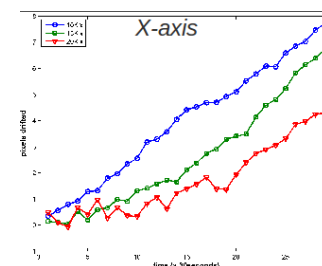
Evolution of the drift with respect to time for 10 kx, 15kx and 20 kx magnifications (JEOL-JSM 820 SEM)

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