ASSESSMENT OF INTEREST POINTS DETECTION ALGORITHMS IN OTB

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1. INTRODUCTION

The task of finding correspondences between images or objects in images is usually needed in remote sensing applications such as object recognition and image registration. To do this, interest points (or salient points) detectors can be used. The interest points are characteristic locations in an image, and for each characteristic point, there is a descriptor computed to describe this point and its neighborhood. The descriptors must be pertinent, robust to geometric and radiometric distortions. The ORFEO Toolbox includes innovative interest points detectors, Harris, SIFT [1] (*Scale Invariant Feature Transformation*) and the recently added SURF [2] (*Speed Up Robust Features*). The ORFEO Toolbox (*OTB*) provides a complete and efficient environment for developing elaborated applications thanks to the pipeline mechanism which ties successive processing steps and is able to deal with different image types. To make easier the assessment of the detectors, their implementation followed an unique policy in order to provide the same user interface. A complete benchmark was implemented using available functions of OTB as well as different data sets including Quickbird images and Pleiades simulations.

2. VALIDATION CHAIN

In order to evaluate the performances of the detectors and the robustness of the descriptors with respect to geometric and radiometric distortions, the following validation chain was implemented. The chain allows the user to choose the channel (R, G, B, amplitude or water index) on which the detector will run. It is also possible to change the geometrical transformation applied to the image and choose the number of iterations of the smoothing applied. After this preparation step, the detection of the intensest points and the computation of their descriptors can be performed. The last step is the matching. The matching using detectors is based on computing Euclidean or spectral angle distances. Figure 1 illustrates the whole validation chain.
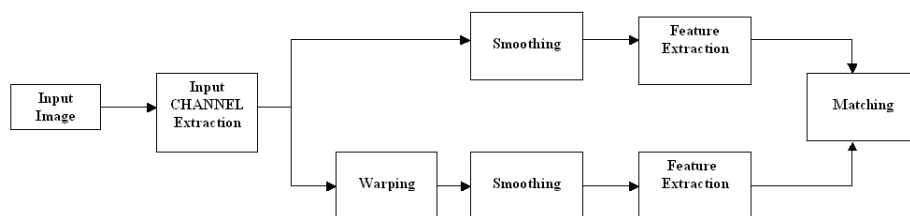

Fig. 1. Validation chain

3. EVALUATION RESULTS

We have to distinguish 2 different aspects for performances. The matching performances and the interest points detection performance. In our paper we focus on the matching aspect since it was proven that those detectors are repeatable [1, 2].

The chain 1 allow us to change the homography used to warp the image. Since we know the warp introduced, we can compute the matching performance of the detectors. The figure 2 shows the results obtained for a rotation of 10 degrees and a translation of 10.1 pixels in each axis.
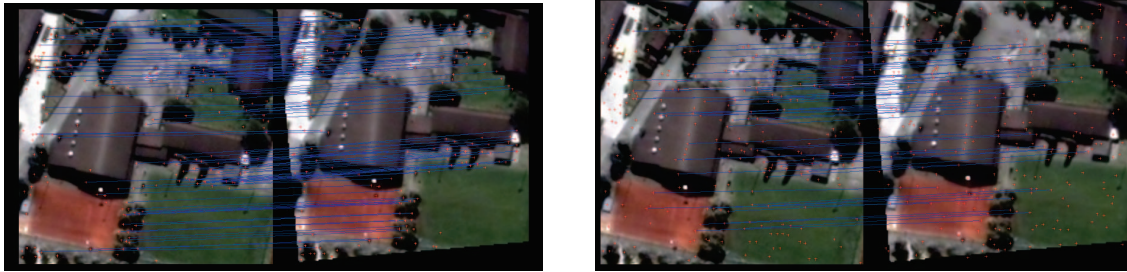
(a) SIFT Matching result : 134/269 good matches, 0 bad matches

(b) SURF Matching result : 61/282 good matches, 1 bad match

Fig. 2. SURF and SIFT matching results

We can also evaluate the behavior of the detectors in case of adding smoothing. The tests were performed with an anisotropic diffusion smoothing. The idea of smoothing images before interest point detection and matching is to deal with images of the same scene which are acquired under different illumination and noise conditions. Figure 3 shows the evolution of the detectors and the matching with respect to the number of iterations used in the smoothing.
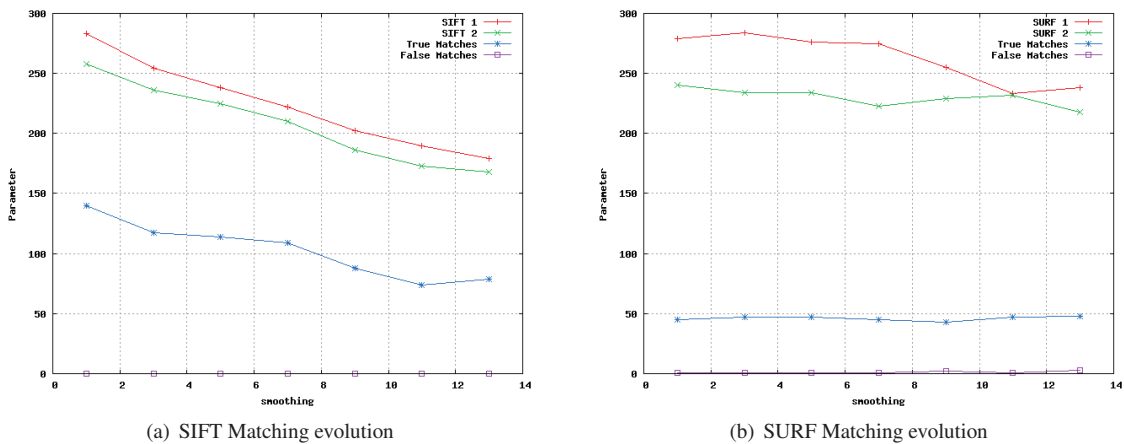

(a) SIFT Matching evolution

(b) SURF Matching evolution

Fig. 3. SURF and SIFT evolution with Angle = 5 degrees, Translation (5,3.3) and Amplitude channel

The final paper will present a detailed evaluation of the algorithms with different data sets.

4. REFERENCES

[1] D.G. Lowe, "Distinctive image features from scale-invariant keypoints," in *International Journal of Computer Vision*, February 2004, vol. 60, pp. 91–110.

[2] H. Bay, T. Tuytelaars, and L. Van Gool, "Surf speed up robust features," in *European Conference on Computer Vision*, 2006.