Interleaved Intensity Order Based Local Descriptor for Image Matching

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Introduction

- Designed an Interleaved Intensity Order based Local Descriptor (IOLD) for Local Image Matching.
- A generalization of the Local Intensity Order Pattern (LIOP) [1].
- Inherently rotation and illumination invariant.
- Solved the dimensionality problem of LIOP.

Method

The local neighborhood is divided into multiple interleaved neighboring sets as shown in Fig. 1.

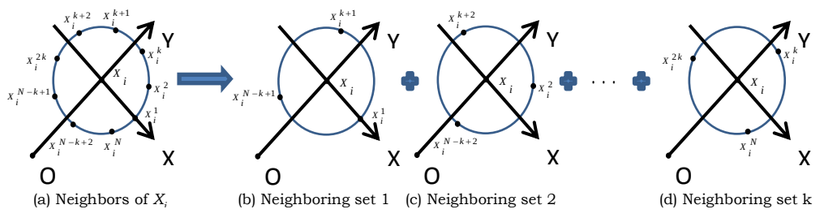

Fig.1. Considering local neighborhood as a set of different interleaved local neighborhood. The original N neighbors are divided into k neighboring sets having $d=N/k$ neighbors each.

The computation of IOLD pattern for a particular pixel is depicted in Fig. 2. The weighting factor is computed by finding the number of pairs having difference of more than 5 and biased by 1 to avoid multiplication by 0.

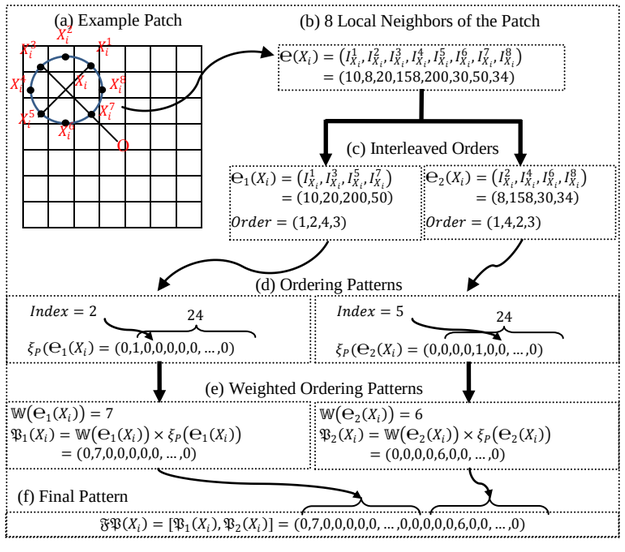

Fig.2. (a) An example patch, (b) 8 local neighbors of a pixel selected in a rotation invariant manner, (c) Interleaved orders over 2 neighboring sets, (d) Ordering patterns, (e) Ordering patterns weighted by the local dissimilarity, and (f) Final IOLD pattern.

The effect of proposed scheme over descriptor dimension is depicted in Fig. 3.

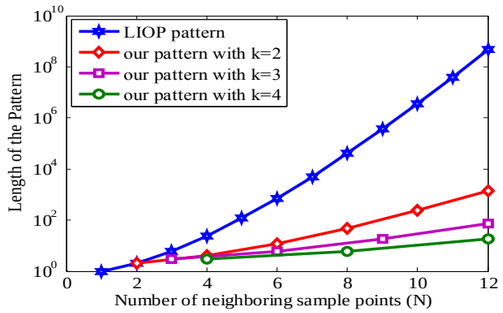

Fig.3. Comparison between the pattern dimension using LIOP [1] and proposed approach.

Datasets Used

Oxford Image Matching Dataset [2] and CASIA's Complex Illumination Change Dataset [3] are used to test the performance and robustness of the proposed descriptor.

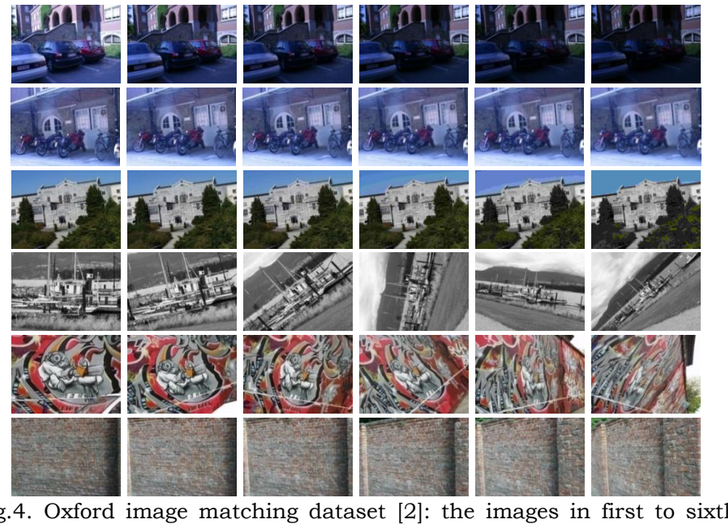

Fig.4. Oxford image matching dataset [2]: the images in first to sixth row are having the Illumination (leuven), Image Blur (bikes), JPEG Compression (ubc), Scale and Rotation (boat), Viewpoint change (graf), and Viewpoint change (wall) effects respectively.

Fig.5. Complex illumination change dataset [3].

Image Matching Results

The image matching results in terms of recall vs 1-precision are depicted in Fig.6 over each sequence of Oxford Dataset. The average result over both sequence of CASIA's Dataset is demonstrated in Fig.7. It is observed that using interleaved order the performance is improved either improved or nearly equal with a great improvement in matching time.

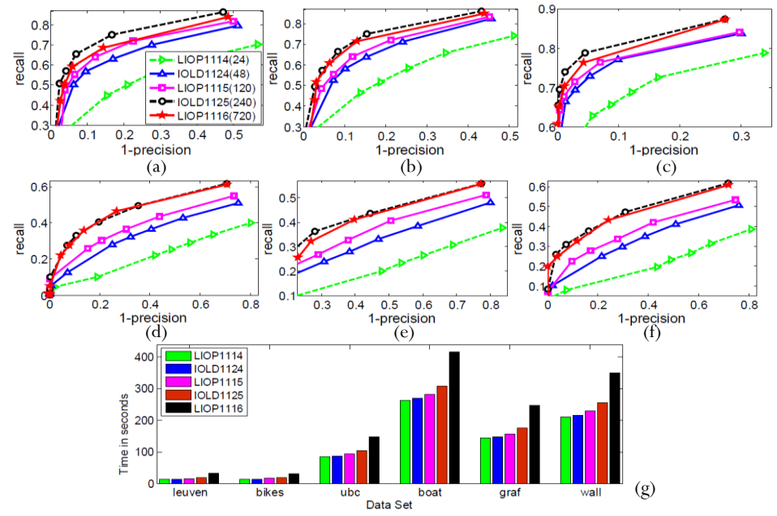

Fig.6. Descriptors performance for kd=14, 24, 15, 25 and 16 (i.e. number of interleaved set & number of neighbors in each set) when B=1 (i.e. number of multi-scale regions) and C=1 (i.e. number of sub regions) over Oxford dataset for sequence a) leuven, b) bikes, c) ubc, d) boat, e) graf, f) wall, and g) the matching time.

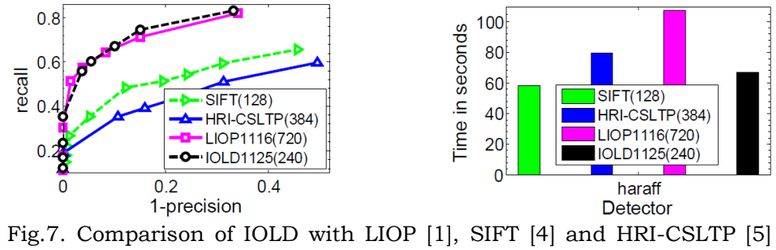

Fig.7. Comparison of IOLD with LIOP [1], SIFT [4] and HRI-CSLTP [5] over Complex illumination change dataset in terms of (a) recall-precision and (b) matching time.

References

[1]Z. Wang, B. Fan, F. Wu, Local Intensity Order Pattern for feature description, ICCV (2011) 603-610.

[2]http://www.robots.ox.ac.uk/~vgg/research/affine/.

[3]http://vision.ia.ac.cn/Students/wzh/datasets/illumination/Illumination_Datasets.zip.

[4]D.G. Lowe, Distinctive image features from scale-invariant keypoints, IJCV 60 (2) (2004) 91–110.

[5]R. Gupta, H. Patil, A. Mittal, Robust order-based methods for feature description, CVPR (2010) 334 –341.