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Usage of keypoint descriptors based algorithms for real-time objects localization

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In order to achieve high level of security in our everyday life we produce huge amount of data. Significant part of information is presented by videos, sounds or images. A computer is used to extract useful information from raw data [1]. Pattern recognition is branch of computer vision, which allows us to get information from images [2] and videos. Information extraction is crucial problem of pattern recognition. This problem is divided into next branches: object presence; object localization; object classification.

There are a lot of algorithms for object localization. The youngest and the most perspective group of algorithms - algorithms based on keypoints detection and descriptors building [3]. Keypoint is circular region with orientation. Keypoints describe contrast differences, edges, corners in image. Descriptor - histogram of keypoint gradients. Each keypoint characterizes by its descriptor. As an example, you can see Fig 1 where bunch of keypoints describe the places where corners and brightness changes dramatically.

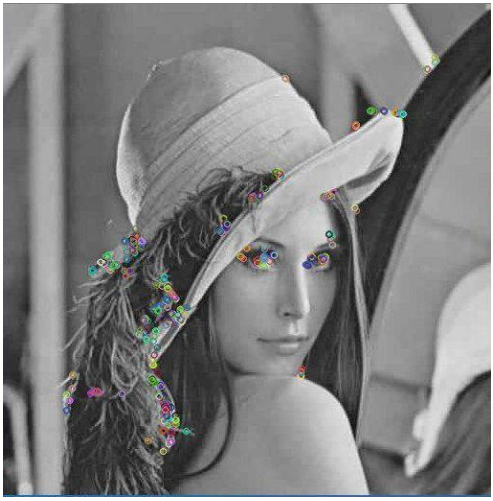

Fig. 1 – Keypoints locations in image

Object localization algorithm describes by next steps: build object

keypoints and descriptors; build scene keypoints and descriptors; matching between object and scene descriptors.

Descriptors can be matched using kNN classifier [4], which finds two nearest neighbors for every object descriptor. If both neighbors are similar, algorithm will discard both of them. These descriptors can be discarded due to the fact that they cannot belong to the object. Resultant descriptors set builds from remaining descriptor pairs by selection only the first occurrence in each pair. On the next stage, the algorithm builds vector of distances between object and scene descriptors [5]. After that this set will be divided into two classes with Otsu's method [6]. Class which has less distances describes the object.

Proposed algorithms were tested on real-time video. We used implementation of SIFT, SURF, ORB, BRIEF, FAST, AKAZE, BRISK algorithms from OpenCV library.

We have tested three of proposed algorithms no dataset, which consist of 4 different companies logo. For each logo the following number of keypoints was found:

	Nike	Adidas	Coca-Cola	Twitter
ORB	84	562	713	184
FAST	17	207	1835	259
BRISK	31	301	454	120

As the result we found that all algorithms had built similar descriptors. Only FAST, ORB and BRISK algorithms have perfect performance, so they can work in real-time mode. We divided set of descriptors into two classes, but they intersected. So we cannot locate descriptors, which belong to the object. That's why there is no possibility to divide set of descriptors into two independent classes with high reliability. From this point of view, "out of the box" implementations of these algorithms cannot be used to solve applied problems.

References

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