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Object Recognition in a Cluttered Scene using Point Feature Matching

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Abstract: Algorithm for detecting a specific object based on finding point correspondences between the reference and the target image. It can detect objects despite a scale change or in-plane rotation. It is also robust to small amount of out-of-plane rotation and occlusion. This method of object detection works for objects that exhibit non-repeating texture patterns, which give rise to unique feature matches. This technique is also works well for uniformly-colored objects, or for objects containing repeating patterns. Note that this algorithm is designed for detecting a specific object.
Keywords: object capture, matching technique, occlude, geometric primitives.

I. INTRODUCTION

An object capturing system gets objects in the real world from an image of the world, using object models which are known a priori. This task is very difficult. People perform object capturing [1] easily and instantaneously. Algorithm for this task for implementation on machines has been very difficult. The algorithm is known as the Continuously Adaptive Mean Shift (CAMSHIFT) algorithm. CAMSHIFT is then used as an interface for games and graphics. Different steps in object capturing are discussed in this paper and point feature matching technique that was used for object capturing in plenty of applications is introduced. The different

types of capturing tasks that a vision system needs to perform are introduced and complexity is analyzed. The object capturing problem is known as a labeling problem based on models of known objects. If we give an image having one or more objects of interest (and background) and a set of labels corresponding to a set of models which are known to the system, the system should assign correct labels to regions, or a set of regions, in the image. The object capturing [2,4] problem is closely tied to the segmentation problem: without at least a partial capturing of objects, segmentation cannot be done, and without segmentation, object capturing is not possible. In this paper, basic aspects of object capturing are discussed. The architecture and main components of object capturing is presented and their role in object capturing systems of varying complexity is discussed.

To capture a target image in a cluttered scene three methods are include. There are Appearance based methods; Geometry based methods, Recognition as a Correspondence of Local Features.

Geometry-based and Appearance-based methods discussed earlier do not satisfied by the requirements, i.e. the generality, robustness, and easy learning. The methods are not robust as they are also sensitive to occlusion of the objects, and to the unknown background. As a solution for the above mentioned issues, methods on matching local features have been proposed. Objects are represented by a set of local features, which are computed from the training images. The learned features are stored in a database. When recognizing a query image, local features are extracted as in the training images. A machine learning approach for visual object detection which is capable of processing images very rapidly and getting high detection rates is described in this paper. Same kind of features [3,2] is then retrieved from the database and the presence of objects is assessed in the terms of the number of local correspondences. The approaches are robust to occlusion and cluttered background since it is not required that all local features match. To recognize objects from different views, it is necessary to handle all variations in object appearance. The scale of the local features they can be modeled by simple, e.g. affine, transformations. Thus, even for objects with complicated shapes significant viewpoint invariance is achieved by allowing simple transformations at local scale.

Point featre matching technique Feature is defined as an "interesting" part of an image and features are used as a starting point for many computer vision algorithms. The desirable property for a feature detector is *repeatability*: whether or not the same feature will be detected in

two or more different images of the same scene. In this paper, we propose a SURF algorithm for extracting, description and matching the images and algorithm for detecting a specific object based on finding point correspondences between the reference and the target image.

The rest of the paper is organized as follows. We provide details of our system's architecture and software and hardware design flow in Section II. Section III depicts the obtained results and its discussion and Conclusion is then given in Section IV.

II. SYSTEM ARCHITECTURE

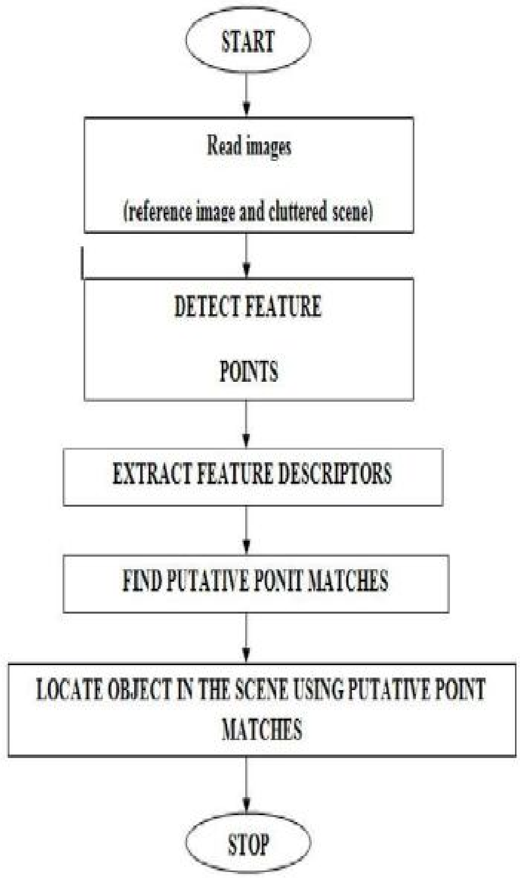

Fig.1 : Flow of the system.

The SURF Algorithm SURF is developed by Bay et al. and it stands for Speeded up Robust Features. SURF algorithm is based on the SIFT algorithm. It uses integral images and approximations for getting high speed than SIFT. These integral images are used for convolution. Like SIFT, SURF works in 3 steps: extraction, description, and matching. The difference between SIFT and SURF is that SURF extracts the

features of an image by integral images and box filters. Image filtering is used for the extraction of the key points from an image. SURF uses box filters for implementing these filters. Avery important pre-processing step is the conversion

of the original image into integral image. Integral images are easily computed by using the right pixel values. In an integral imageevery pixel is the addition of all pixels located in a rectangular window formed by that pixel and the origin, with the origin being the most top-left pixel. For approximation of the exact filter masks Box filters are used. By using integral images .with box filters a major speed up is seen. SIFT rescales the image is other difference in the extraction of key points, while SURF changes the filter

mask. These candidates are then validated if the response is above a given threshold. Both box size and location of these candidates are then refined using an iterated procedure fitting locally a quadratic function. Typically, a few hundreds of interest points are

detected in a digital image of one mega-pixel. Therefore, SURF builds a descriptor that is invariant[4][5] to view- point changes of the local neighborhood of the point of interest. Like in SIFT, the location of this point in the box- space provides invariance to scale and provides scale and translation

invariance.

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III. RESULTS

Fig. 2: Reference Images

Fig. 3: Cluttered Images

Fig 4: Extracted Features of Input Object:

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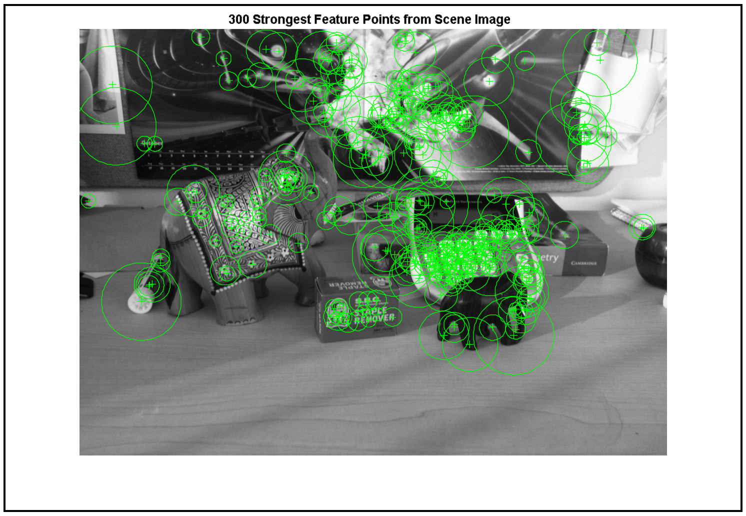

Fig. 5: Strongest feature points from reference image and cluttered image.

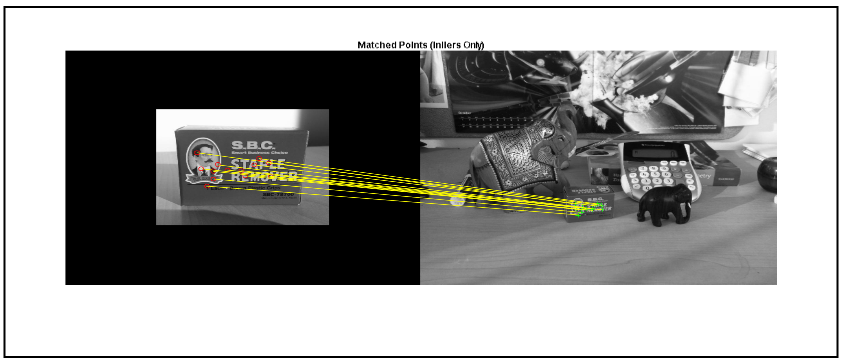

Fig. 6: Matched Points

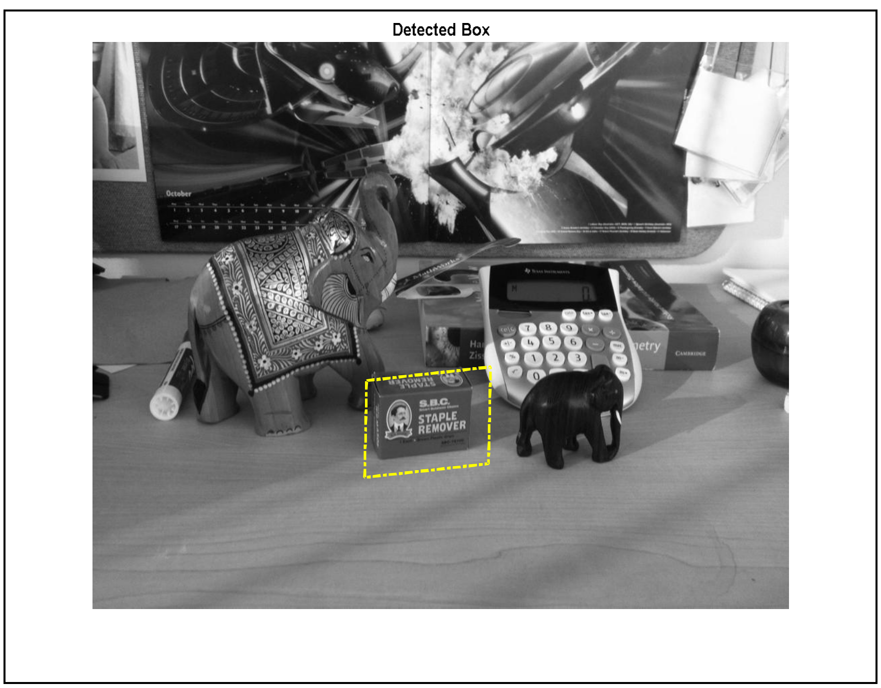

Fig 7 : captured the target image in a cluttered scene

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IV. CONCLUSION AND FUTURE SCOPE

This method of object detection works for objects that exhibit non-repeating texture patterns, which give rise to unique feature matches. This technique is also works well for uniformly-colored objects, or for objects containing repeating patterns. This method of object capturing works great for

objects that have non-repeating texture patterns, as we get unique feature matches. This algorithm is designed for finding a specific object, for example, the particular object

in the reference image, rather than any object. This method of object detection works for objects that exhibit non-repeating texture patterns, which give rise to unique feature matches. This technique is also works well for uniformly-colored objects, or for objects containing repeating patterns. Note that this algorithm is designed for detecting a specific object

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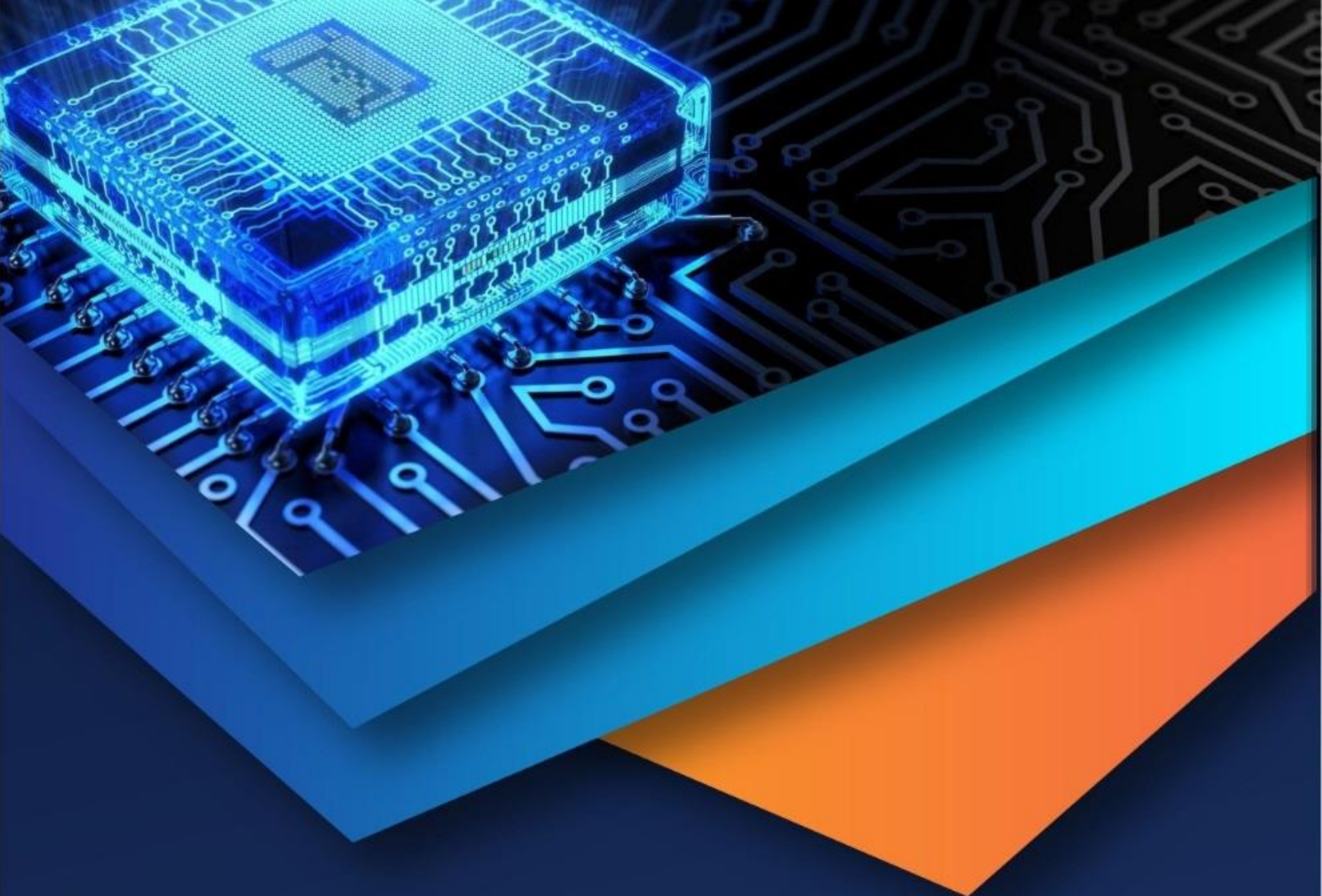

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