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Object Recognition using Point Feature Matching

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Abstract: Algorithm for detection of a particular object based on finding point correspondences between the reference and therefore the target image. It will locate objects despite a scale amendment or in-plane rotation. It is also sturdy to small amount of out-of-plane rotation and occlusion. This methodology of object recognition works for objects that exhibit non-repeating texture patterns, that produce distinctive feature matches. This method additionally works well for uniformly-coloured objects, or for objects containing repeating patterns. This algorithm is meant for detecting a specific object.

Keywords: Object capture, Matching technique, Occlude, Geometric primitives.

I. Introduction

Object models which are known as priori, are used to get objects in the real world from an image of the world, by capturing the image. This task is incredibly tough. People perform object capturing [1] easily and instantaneously. Algorithmic rule for this task for implementation on machines has been terribly tough. The algorithmic rule is called as the Continuously Adaptive Mean Shift (CAMSHIFT) algorithm. CAMSHIFT is then used as associate degree interface for games and graphics. Different steps in object capturing square measure mentioned during this paper and purpose feature matching technique that was used for object capturing in many applications is introduced. The different types of capturing tasks that a vision system needs to perform are introduced and complexity is analysed. The object capturing problem is known as a labelling 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 famed to the system, the system ought to assign correct labels to regions, or a collection of regions, within the image. The image capturing [2,4] task is closely tied to the segmentation problem while not a minimum of a partial capturing of objects, segmentation cannot be done, and while not segmentation, object capturing isn't doable. This paper deals with basic aspect of capturing image. The composition of object capturing is presented and their role in object capturing systems of varying complexity is been discussed.

To locate a target image in a cluttered scene some methods are include which are Appearance based; Geometrical methods, Recognition as a native of Local Features.

Geometrical-method and Appearance-based methods which we discussed earlier do not satisfied by the requirements, i.e. the easy learning, generality and robustness. The strategies aren't sturdy as they're conjointly sensitive to occlusion of the objects, and to the unknown background. As an answer for the preceding problems, strategies on matching local features have been proposed. Objects are shown by a set of local features, which are taken from the training pictures. The learned features are stored in a database.

When detecting a query picture, local features are taken as in the training images. A machined learning approach for visual object detection which is capable of processing pictures very rapidly and getting high resolution 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 localcorrespondences.

The methods are robust to occlusion and cluttered background since it is not necessary that all local features match. To identify objects from various views, it is compulsory to handle all variations in object look. The size of the native features they can be modelled 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 feature 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 the same feature will be detected in two or more different images of the same scene. Here a SURF algorithm for extracting, description and matching the pictures and algorithm for detecting a specific object based on finding point features between the reference and the target image.

II. RELATED WORK

A. Harris Corner Detector

This is a corner detection operator that is commonly used in computer vision algorithms to extract corners and infer features of an image, introduced by Chris Harris and Mike Stephens in 1988 upon the upgrade of Moravec's corner detector. Compared to the previous one, Harris' corner detector takes the differential of the corner score into account with reference to direction directly, instead of using shifting patches for every 45-degree angles and has been proved to be more correct in differentiating between edges and corners. Since then, it has been improved and adopted in many algorithms to preprocess images for subsequent applications.

B. Histogram Of Oriented Gradients

HOG is a feature descriptor used in computer vision and image processing for the purpose of object location. Heremethod counts occurrences of gradient orientation in localized portions of an image. This method is similar to that of edge orientation histograms, SIFT descriptors, and shape and size contexts, but differs in that it is computed on a dense grid of equally spaced cells and uses coinciding local contrast and brightness normalization for improved accuracy.

C. Template matching

This is a technique for locating small parts of an picture which match a template picture. It is a direct process. In this method template images for different objects are kept in memory. When an picture is given included to the system, it is matched with the stored template images to recognize the object in the input picture. Templates are regularly used for detection of characters, numbers, objects, size, shapes etc. It can be done on either colored or gray-scale images. Matching of template can either be pixel to pixel matching or feature based. In feature based the features of template image is compared to features of sub-images of the given input image; to determine if the template object is present in the input image. Some authors have proposed a mathematical morphological matching of template approach for object detection in inertial navigation systems (INS). The main objective of the paper is to detect and track the ground objects. Systems which can fly are equipped with camera which used to capture the photos of ground; to detect the objects. Their method is not dependent of the orientation and altitude of the object. Some steps for measuring congruency between visual images based on matching internal self-similarities. A template picture is to be compared to another picture. Measuring same across images can be difficult, the similarity within each image can be easily revealed with simple similarity measure, such as Sum of Square Differences, resulting in local self-similarity descriptors which can be matched across images. As shown in Figure1.(a), the template image of the flower is compared with all the corresponding descriptors.

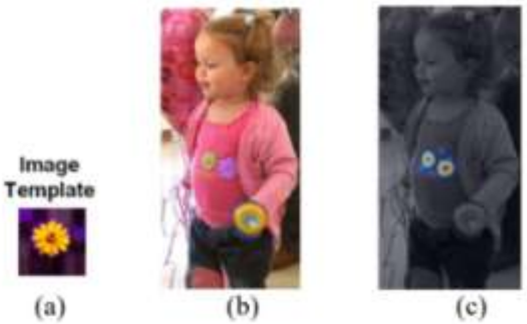

Figure1. (a)Template image (b) Reference image (c) Detected object superimposed on gray-scale image

D. SURF and SIFT

In Digital Image Processing, speeding up robust features (SURF) is a patented local feature detector and descriptor. This can be used for works such as object detection, image setup, differentiation or 3D reconstruction. This is partly inspired by SIFT descriptor. Actually, the standardized version of SURF is several times faster than SIFT and claimed by its authors to be more robust against different image transformations than SIFT.

SURF uses an integer approximation of the determinant of Hessian blob detector, which can be computed with 3 integer operations using a precomputed integral image. The feature descriptor which SIFT uses is based on the sum of the Haar wavelet response around the point of interest. SIFT can also be compare with the aid of the integral image.The SURF descriptors have been used to detect and recognize objects, people or faces, to reconstruct 3D scenes, to track objects and to extract points of interest. The image which is recognized, is transformed into coordinates, using the multi-resolution pyramid technique, to copy the original image with Pyramidal Gaussian or Laplacian Pyramid shape to obtain an image with the same size but with reduced bandwidth. This achieves a special blurring effect on the original image, called Scale-Space and ensures that the points of interest are scale invariant. SURF uses square-shaped filters as an approximation of Gaussian smoothing.

E. Color based

Color provides potent information for object recognition. A simple and efficient object detection scheme is to represent and match images on the basis of color histograms. Fahad Khan, et.al. [4] proposed the use of color attributes as an explicit color representation for object detection. The color information is extended in two existing methods for object detection, the part-based detection framework and the Efficient Sub Window Search approach. The three main criteria which should be taken into account when choosing an approach to integrating color into object detection are feature Combination, photometric invariance and compactness. The paper investigates the incorporation of color for object detection based on the above-mentioned criteria and demonstrate the advantages of combining color with shape on the two most popularly used detection frameworks, namely part-based detection with deformable part models and Efficient Sub window Search (ESS) for object localization. The resulting image representations are compact and computationally efficient and provide excellent detection performance on challenging datasets. Figure.8 provide how the extension correctly detects all Simpsons in the image; Simpsons is an American animated sitcom. The technique correctly detects challenging object classes where state-of-the-art techniques using shape information alone fail.

Figure2. On the left, the conventional part based approach fails to detect all four members of Simpsons. On the right, our extension of the part-based detection framework with color attributes can correctly classify all four Simpsons.

III. SYSTEM ARCHITECTURE

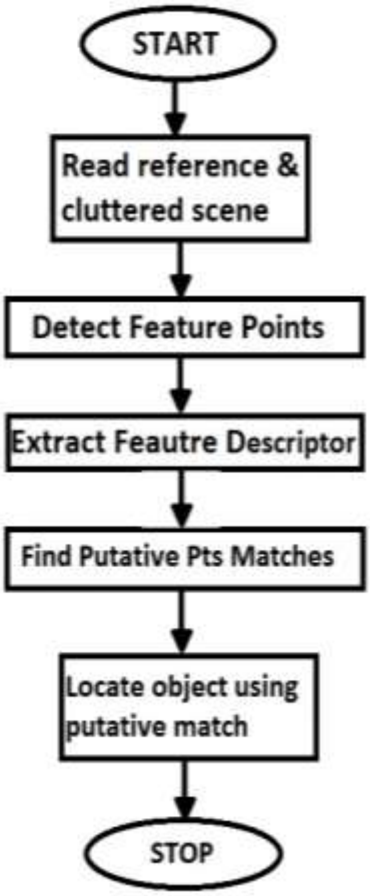

Figure3. Flow of System

The SURF Algorithm[Figure3.] SURF is developed by Bay et al. and it stands for Speeded up Robust Features. SURF algorithm is based on the SIFT algorithm.

Equation is given by:

$$S(x,y) = \sum_{i=0}^{x} \sum_{j=0}^{y} I(i,j)$$ ----------------------(a)

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 image every 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 neighbourhood 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.

IV. RESULTS

This experimentation is performed on MATLAB 2017a on i7 intel laptop. When the code is executed a sequence of matrix are generated for each image (reference image and cluttered image). [Figure5.] gives the cluttered image which has to be detected in reference image [Figure4.]. Detection of feature is done in both images. Extracted features are shown in [Figure6.]. By using putative point matching technique, the extracted features from reference images are first compare and then matched with cluttered image [Figure8.]. Get the bounding polygon of the reference image. Transform the polygon into the coordinate system of the target image. Display the detected object.

Figure4. Reference image

Figure5. Cluttered image

Figure6. Extracted features

Figure7.

Figure8. Matched points

Figure9. Captured the targeted image in clustered scene

V. Conclusion

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-coloured 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 only.

VI. Future Scope

Object recognition is a key technology behind driverless cars, enabling them to recognize a stop sign or to distinguish a pedestrian from a lamppost. It is also useful in a variety of applications such as disease identification in bioimaging, industrial inspection, and robotic vision. Object detection and object recognition are similar techniques for identifying objects, but they vary in their execution. Object detection is the process of finding instances of objects in images. In the case of deep learning, object detection is a subset of object recognition, where the object is not only identified but also located in an image. This allows for multiple objects to be identified and located within the same image.Basic approaches to object recognition may be sufficient depending on the application. Template matching – which uses a small image, or template, to find matching regions in a larger image. Image segmentation and blob analysis – which uses simple object properties, such as size, colour, or shape. Typically, if an object can be recognized using a simple approach like image segmentation, it's best to start by using the simpler approach. This can provide a robust solution that does not require hundreds or thousands of training images or an overly complicated solution.We can use a variety of approaches for object recognition. Recently, techniques in machine learning and deep learning have become popular approaches to object recognition problems. Both techniques learn to identify objects in images, but they differ in their execution.Deep learning techniques have become a popular method for doing object recognition. Deep learning models such as convolutional neural networks, or CNNs, are used to automatically learn an object's inherent features to identify that object.

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