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SYSTEMATIC STUDY ON OBJECT DETECTION IN CLUTTERED ENVIRONMENT USING SIFT ALGORITHM

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ABSTRACT

Detection of objects in cluttered scenes is a basic challenge that has only recently been widely undertaken by computer vision systems. This paper proposes a novel method how to detect a particular object in cluttered scenes, given a reference image of the object. This paper presents an 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. The detailed procedures are implemented using MATLAB.

KEYWORDS: Detection, Feature Extraction, Target Image, Reference Image, SIFT Operations.

INTRODUCTION

Object detection is the significant way of detecting the objects from images, videos etc. It is the most challenging way to obtain the query image from the target image. Object detection helps us to detect the any physical entity from cluttered environment. Cluttered environment means group of different images framed in one.

In an image or a frame in the video, the goal of object detection is to determine whether there are any defined objects in the image and return their locations and extents (from a long time and whole viewed observer). The object detection should know how to differentiate the specific object from everything else in the view. Object detection usually is a binary classification problem however, additional context information from background helps building a strong detector, such as co-occurrence of objects and geometric location prior. Its application include object recognition, robotic mapping, video tracking, identification of wildlife, match moving and many more. SIFT key points of objects are first extracted from a set of reference images.

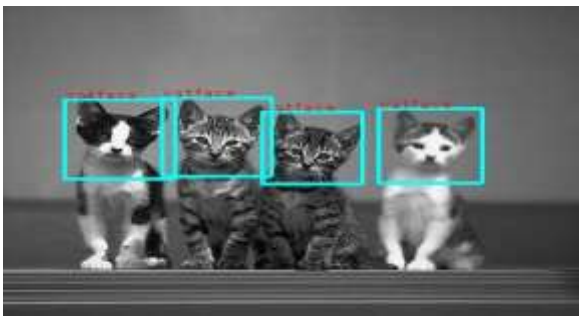

Fig. 1 Object Detection in Images

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COMPONENTS OF OBJECT DETECTION

1. Feature Extraction

For any tracking algorithm extracting characteristic is the important step which is allowing us to highlight the information of the interested object from the video frames or target image plane.

2. Target Representation

The model that can be used by any tracking algorithm to represent the interested object is known as target representation. That model includes the information of interested object about the shape, size and appearance in an image.

3. Descriptors

A descriptor is computed on an image region defined by a detector. The descriptor is a representation of the intensity (color) function on the region.

Flow Chart:

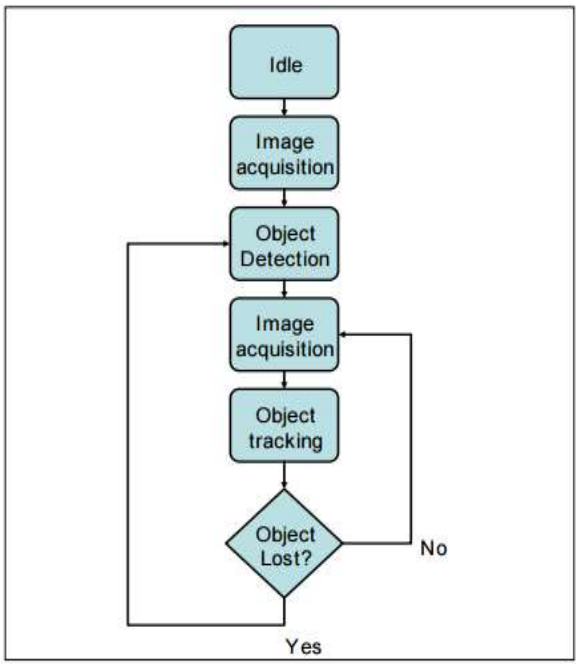

Fig. 2 Flow Chart of Object Detection

ALGORITHM IMPLEMENTATION

SIFT detection algorithm is one of the technique to detect the object from the given environment. It is faster technique for detecting the objects. SIFT means Scale-invariant feature transform, it is used to detect or find out the object and describe the local features from the target image. The following is the flow graph to be proceeded step by step for detecting the object from SIFT algorithm.

METHODOLOGY

1. Feature Extraction

The execution of a characteristic tracker relies on upon the nature of the data we can extricate from the pictures. To see how to improved adventure picture data, characteristic extraction is the one of the critical step in the object detection and tracking algorithm. It permits us to show information from image. By extracting the features of both the target and reference image it will be easy for detection of objects.

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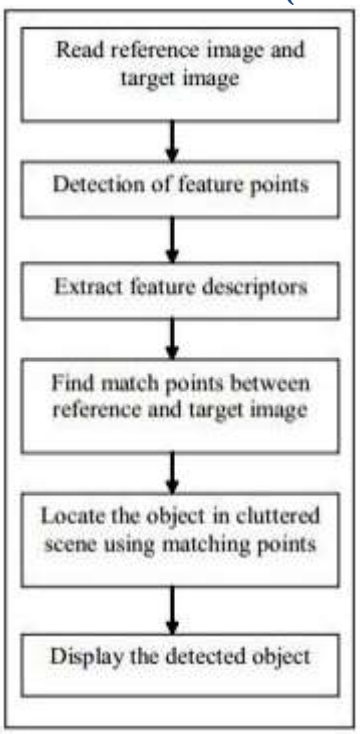

Fig. 3 SIFT Implementation

2. Scale Invariant Feature Transform

Scale Invariant Feature Transform (SIFT) is a methodology for identifying and concentrating local characteristic descriptors that are sensibly invariant to changes in enlightenment, scaling, pivot, image noise and little changes in perspective.

SIFT characteristics have numerous preferences, for examples are follows-

• SIFT Features are natural feature of pictures. They are positively invariant.
• To picture interpretation, scaling, revolution, brightening, perspective, commotion and so on.
• Great strength, rich in data, suitable for quick and precise matching in a mass of characteristic database.
• Richness- Heaps of SIFT characteristic will be investigated regardless of the possibility that there are just a couple of objects.

3. Scale-space extreme detection

SIFT uses DOG (difference of guassian) i.e used for detecting the interesting points in the target and reference image. The primary phase of estimate inquiries over all scales and image areas. It is actualized productively by technique for a difference of- Gaussian capacity to recognize potential investment point that are invariant to scale and orientation. Interest point for SIFT characteristics relate to neighborhood extreme of difference of- Gaussian channels at diverse scales [5]. Given a Gaussian-blurred image described as the formula

$L(x, y, \sigma) = G(x, y, \sigma) * I(x, y)$

Where $G(x,y,\sigma)= 1/ 2\pi\sigma 2$

Filter is given by - $D(x, y, \sigma) = L(x, y, k\sigma) - L(x, y, \sigma)$ which is just be different from the Gaussian-blurred images at scales σ and $k\sigma$.

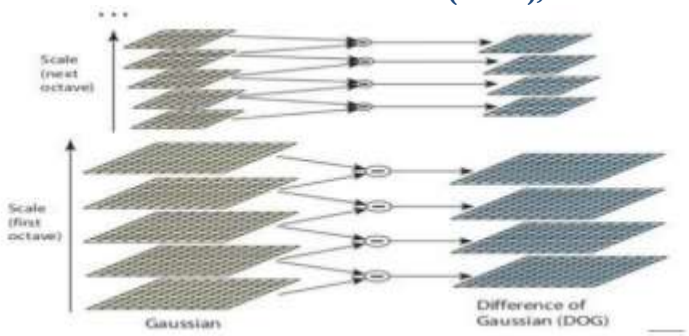

Fig. 4 Frame at different scales, and the Difference-of Gaussian

Once this DoG are discovered, image are hunt down neighborhood extreme over scale and space. For e.g one pixel in a picture is contrasted and its 8 neighbors and also 9 pixels in next scale and 9 pixels in past scales. In the event that it is a nearby extreme, it is a potential key point. It essentially implies that key point is best spoken to in that scale Interest points (called key points in the SIFT framework) are identified as local maxima or minima of the DoG images across scales. Each pixel in the DoG images is compared to its 8 neighbors at the same scale, plus the 9 corresponding neighbors at neighboring scales. If the pixel is a local maximum or minimum, it is selected as a candidate key point.

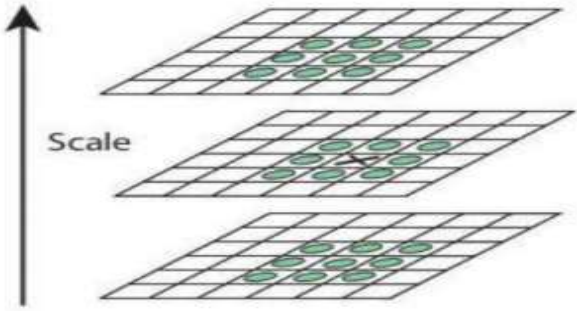

Figure 5. Local extreme detection in a 3 × 3 × 3 area that compasses contiguous DoG Image.

4. Locating Key point

The key step, additionally is the first venture in object recognition utilizing SIFT method is to produce the stable feature point [2]. At every competitor area, a definite model is fit to focus scale and area. Key points are chosen on premise of measures of their strength. The information of key points allows that points will be rejected that have low or poor contrast or are poorly localized along an edge. It highlights the features in terms of color ,edge ,area etc.

5. Orientation Assignment

This is the last step for detection of image. After the difference of guassian (DOG), we get the extreme of the image. As we are working in MATLAB everything is in matrix form the image is in array format. Now we have the target image from the reference image by locating the points from both images.

EXPERIMENTAL RESULTS

These are the result of the object detection from cluttered environment using SIFT algorithm.

Steps:-

1. Select query image
2. Select target image
3. Feature descriptions of the target image as well as query image.
4. Object detected

First select the detected image and query image .This detected image must present in the query image otherwise it will show error.

Fig. 5 Query image and detected image

After that it will highlight the features that can be edge, color, area, of the detected image. This will easily and faster detect the image.

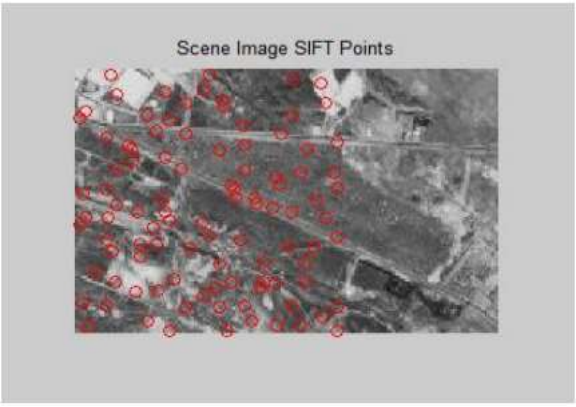

Fig. 6 Extracting feature points

This image shows that the detected object has been detected from the query image.

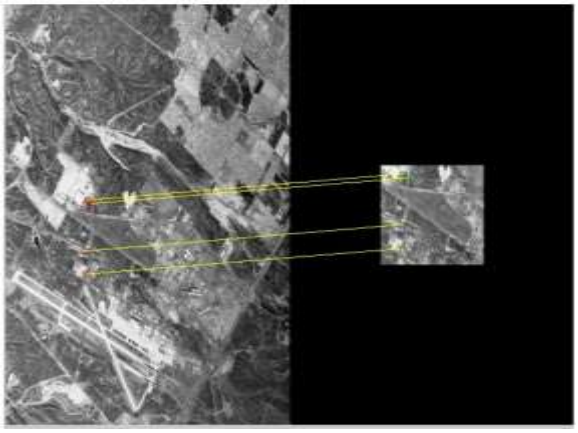

Fig. 7 Detected Object

CONCLUSION

SIFT algorithm is one of the best technique to detect the objects. This method searches the query image from the target image within a few seconds. We can detect the object from image, video, 2D images, 3D reconstruction, motion tracking and segmentation, robot localization, image panorama stitching and epipolar calibration. It has following features-

• Correct object identification

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• Reduce Noise
• Faster detection
• Low probability of mismatch

FUTURE SCOPE

It is not possible to consider a single method for the detection of all type of images, nor can all methods perform well for particular types of image. The Problem occurs during identification of object when any obstacles come before the object. If the position of camera is not proper and object in image is not captured properly then it cannot be identified .Our future scope is make this algorithm work for any image and also for the detection of objects in videos.

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