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Object Detection using SIFT features

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Abstract

In computer vision, determining the presence and placement of objects inside an image is known as object detection. A popular feature extraction approach known as SIFT (Scale-Invariant Feature Transform) is invariant to changes in scale, rotation, and illumination. This method use a sliding window to scan the image at various scales and positions after extracting SIFT feature descriptors from the input image. To pinpoint the position of the object in the image, the SIFT descriptors are compared to the object's descriptors. It has been demonstrated that the SIFT feature detection method works well for object detection in a range of contexts, including robotics, surveillance, and face recognition. However, it also has several drawbacks, including a need for a sizable training dataset and high computing complexity. To get over these restrictions, a number of tweaks and enhancements have been suggested, including the use of quicker feature extraction methods, the use of deep learning-based techniques, and the combination of several features for greater accuracy.

Keywords: Scale-invariant Feature Transform (SIFT), Object Detection, Image processing,

1. Introduction

In computer vision applications, the feature extraction approach SIFT (Scale-Invariant Feature Transform) is frequently used for object detection. It is a reliable technique for object detection in photos because of its resistance to changes in illumination, rotation, and scale. For researchers and programmers working in the field of computer vision, MATLAB is a popular choice because it has a built-in function for extracting SIFT characteristics.The first step in using SIFT features to recognise things in MATLAB is to use the built-in function to extract SIFT feature descriptors from the image. The location of the object in the image is then determined by comparing these descriptors with the descriptors of the object of interest. Different methods, such as nearest-neighbor matching or clustering, might be used for the comparison.

The fact that MATLAB has a number of built-in tools and methods for image preprocessing, feature extraction, and visualisation is one benefit of utilising it for object detection using SIFT features. For instance, MATLAB has functions that can be used for preprocessing to resize and filter photos. The SIFT features can also be visualised using built-in MATLAB tools, which can help in object detection algorithm debugging and optimisation.In conclusion, MATLAB is a well-liked option for academics and developers in computer vision since it offers a strong toolset for object detection utilising SIFT features. Developers may simply extract features and visualise the outcomes by utilising the built-in functions and tools, which ultimately leads in more precise and effective object detection algorithms.

1.2. Study Objectives

- One of the main goals of a study on object recognition using SIFT characteristics is to assess how well this method performs in detecting objects in various settings.
- To examining how various parameters affect the precision of object detection Many factors, including the quantity of features, the feature matching standards, and the threshold values, can influence how well SIFT-based object detection performs.
- To another goal of a study on SIFT feature-based object detection could be to create and improve a SIFT feature-based object detection system. In order to optimise the

algorithm's performance, this may entail investigating multiple strategies for feature extraction, feature matching, and object localization.

2. Methodology

The method for Detection of Object using SIFT features

- The methods used to detect the object in a cluster image is one of the feature matching technique which is known as SURF feature extraction. SIFT(Scale-Invariant Feature Transform) is a one of the features used in a MATLAB software. In this project we use SIFT feature to extract the matching point in a template image and source image.

  INTERIOR:

- The SIFT feature use a kernel to detect based on their matching. The sample image is divided into 3X3 matrix and also template image is divided into 3X3 matrix. The entire template image matrix in place in the each 1x1 matrix of the sample image and check for a matching value. If the template image is matched with the source image it will indicate in discrete form.

  EXTERIOR:

- *Step 1:*Firstly the template image is read through the MATLAB. It can be either real-time image or object. And source image is read where the template image's object is placed somewhere in the image. In our project we give staple remover as a template image and cluster desk as a source image
- *Step 2:*In second step take strongest feature point from the template image which is an staple remover box and take same as the staple remover for cluster desk image
- *Step 2.1:* First take 25 strongest feature point from a elephant image or template image, then take 50 strongest feature point from the elephant image or template image. Then take 75 strongest feature point from the elephant image or template image. And finally take 100 feature points from the template image or box image
- *Step 2.2:* After completed the process of extraction of feature point on a elephant image or template image its time to extract feature points from cluster image or source image. From the beginning ,

take 100 feature points , its because the no .of . bits in a source image is high compare with template image. Take till 300 feature points so that the amount of accuracy will high

- *Step 3:* In next step putative matched point is taken in localized area from the template image with the source image and also in a globalized manner
- *Step 4:* As a result , the object is been detected and indicated with the coloured square shape around the border of the template image .

2.1. Object detection using SIFT feature

Figure.1. Cluster Image

In fig.1 shows the cluster image which has more than one image in a desk is will take it as a source image

Figure.2. Image of an Elephant

In fig 2 we take the Elephant as a Target image

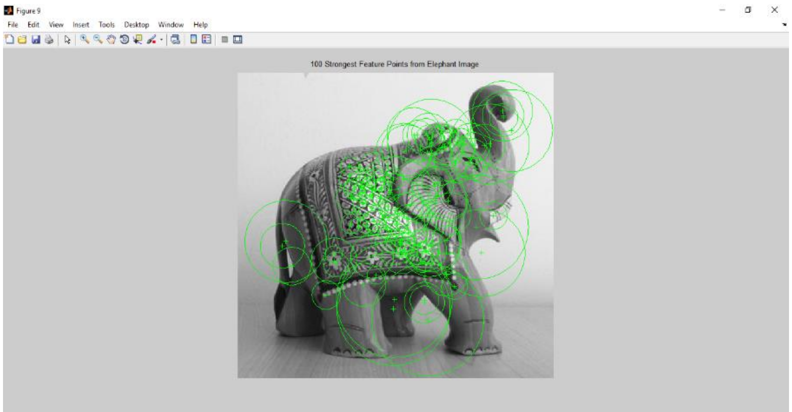

Figure.3. Taking the 100 strongest point

In fig 3 we take the 100 strongest point from the Target image by pointing out the highest point were the intensity level is maximum from the imge

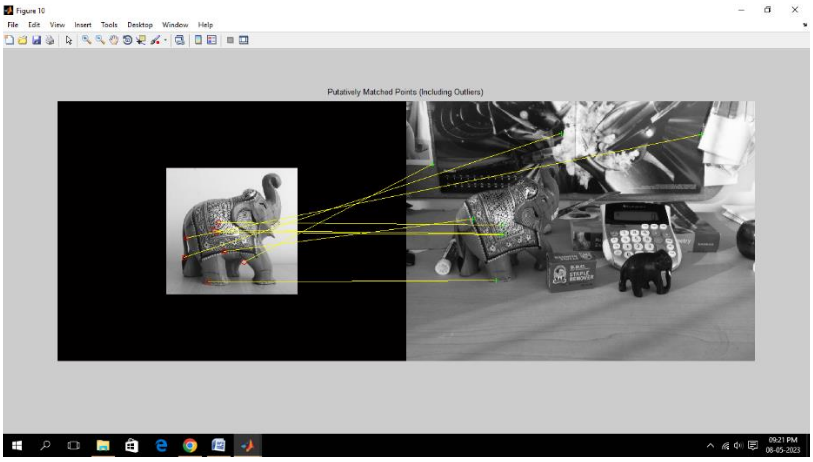

Fig 4: Taking putative points in globally

In fig 4 we take the putative point in both compare with the target image and source image

3. Future Directions

Deep learning integration: Combining SIFT features with deep learning methods is one potential future avenue for object detection utilising SIFT features. The accuracy of object detection and robustness to changes in object appearance and background can both possibly be improved by combining SIFT characteristics with deep neural networks.Real-time object detection: Creating real-time object detection systems is another future direction for object detection utilising SIFT features. This may entail building solutions that are tailored to particular hardware or speeding up the SIFT feature extraction and matching algorithms. Multi-modal object detection combines data from various sensors or modalities, such as depth maps and RGB pictures, to increase the accuracy of object detection. Future studies in object detection using SIFT features might investigate how to combine these modalities with SIFT feature-based methods.Object recognition in challenging circumstances: While SIFT features have proven to be robust to a variety of image alterations, challenging environments like crowded settings or dim lighting may still provide challenges. The creation of algorithms that can manage these complicated situations may be the subject of future research in this field.

4. Conclusion

In conclusion, the Object detection based on using machine learning techniques, such as SIFT algorithm, has shown promising results in the early detection of the object from the cluster iamge. The SIFT feature has been used effectively to detect various object based on their d features extraction point. The image's SIFT features are taken out, and a matching procedure is used to find the target object. Different post-processing methods can be used to polish the detection outcomes and get rid of false positives. Numerous applications, including face detection, pedestrian detection, and object tracking, can make use of the method.Despite its success, object detection utilising SIFT features still has certain drawbacks, such as high computing costs, occlusion susceptibility, and challenges navigating complicated settings. The goal of continuing research and development in this field is to get around these constraints and boost the potency and effectiveness of SIFT feature-based methods. In conclusion, SIFT feature-based object detection is a useful and popular computer vision technique. It has the potential to be crucial in numerous applications, including as robots, autonomous systems, and sophisticated surveillance systems, with more study and development.

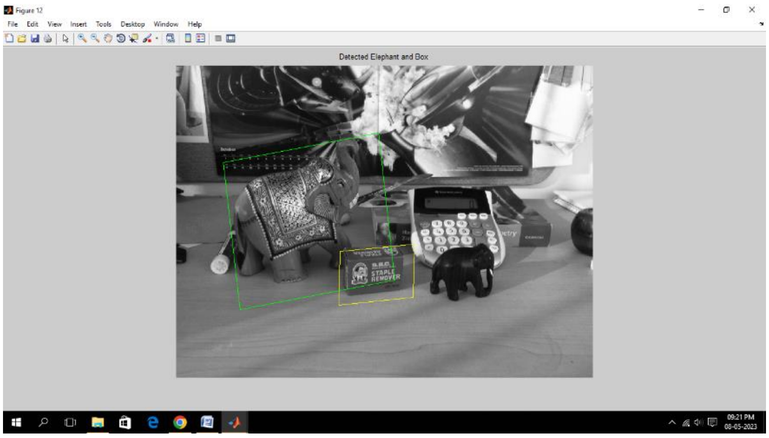

Figure.5. Final outcome

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