Object Detection using SURF features

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Abstract - Nowadays, computer Vision Technology is playing a very important role to understand the information present in image format. The object details those are in the form of image can be treated to find. This paper proposes the object finding method to help visually impaired people. The SIFT can extract distinctive features in an image to match different objects. The proposed recognition process begins by matching individual features of the user queried object to a database of features with different personal items which are saved database.

Key Words: SURF, Feature points, Morphological operations, matching, descriptor.

1. INTRODUCTION

The World Health Organization estimated that in year 2002 of the world’s total population was visually impaired [3]. Visually impaired people face many challenges when interacting with their surrounding environments. One challenge is finding dropped or misplaced personal items. The goal of this paper is to develop an effective algorithm to help people with visually impairments to find personal items such as keys, wallets, sunglasses, cell phones, and other objects. In this paper, a method to identify objects using feature detection is introduced. When the system finds the requested item, an audio signal will be produced. In our method, based on the blind user’s request, the time required for processing is obtained with the number of features. If matches are found the output is obtained in audio form using Microsoft text to speech software.

2. SURF OVERVIEW

In computer vision SURF is patented as local feature detector and descriptor. SURF detector has been used to locate and recognize objects. SURF was first presented by Herbert Bay at 2006 European Conference on Computer Vision [2]. Interest points are detected using SURF method in which determinant of Hessian and Blob detector approximate values are calculated. Its feature descriptor is based on sum of the Haar wavelet response around the point of interest. SURF algorithm is implemented in three divisions as Interest point detection, local neighbourhood description and matching.

2.1 Detection

Surf uses square shaped filters as an approximation of Gaussian smoothing. Filtering the image with a square is much faster when the integral image is used

\[ S(x, y) = \sum_{i=0}^{X} \sum_{j=0}^{Y} I(i, j) \]

The sum of the original image within a rectangle can be evaluated quickly using the integral image requiring evaluation at the rectangle's four corners. In SURF blob detector based on the Hessian matrix used to find points of interest. The determinant calculated from Hessian matrix is the measure of change around the point and with the maximum value of determinant points are selected.

2.2 Descriptor

Descriptor is to provide a unique and robust description of an image feature. The dimensions of the descriptor have direct impact on its computational complexity as well point-matching as well as accuracy.

The first step is to fix a reproducible orientation based on information from a circular region around the interest point. Then a square region aligned to the selected orientation is found, and the SURF descriptor from it is extracted.

2.3 Matching

Matching pairs are found using the comparison of descriptors obtained from various images.

2.4 Local Features

Local features refer to a pattern or distinct structure found in an image, such as appoint, edge, small patch. They are related to the image patch that differs from its surrounding. This difference is based upon texture, color or intensity. Blobs, corners and edge pixels give the examples of local features.
3. AUDIO TRANSLATION

The recognized text codes are recorded in script files. Then, employing the Microsoft Speech Software Development Kit to load these files and display the audio output of text information. Blind users can adjust speech rate, volume, and tone according to their preferences [9].

4. OUTPUT

5. PERFORMANCE ANALYSIS RESULT OF SURF ALGORITHM

![Fig 1: SURF Algorithm](image1)

![Fig 2: Output images obtained for SURF Algorithm](image2)

### Table 1: Performance analysis of SURF algorithm on different object images

<table>
<thead>
<tr>
<th>Input Image</th>
<th>Angular changes (Degrees)</th>
<th>Processing Time (Sec)</th>
<th>Feature Points Detected</th>
<th>Object Identified</th>
<th>Correct/Incorrect</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.png</td>
<td>0</td>
<td>7.2201</td>
<td>145</td>
<td>Bournvita</td>
<td>Correct</td>
</tr>
<tr>
<td>B.jpeg</td>
<td>0</td>
<td>7.0617</td>
<td>145</td>
<td>Bournvita</td>
<td>Correct</td>
</tr>
<tr>
<td>B36.png</td>
<td>36</td>
<td>5.3844</td>
<td>90</td>
<td>Not Detected</td>
<td>Incorrect</td>
</tr>
<tr>
<td>B36.jpeg</td>
<td>36</td>
<td>5.2735</td>
<td>90</td>
<td>Not Detected</td>
<td>Incorrect</td>
</tr>
<tr>
<td>B3d.png</td>
<td>1st rotation</td>
<td>4.5076</td>
<td>346</td>
<td>Colin</td>
<td>Incorrect</td>
</tr>
<tr>
<td>C45.png</td>
<td>130</td>
<td>5.30</td>
<td>84</td>
<td>Not Detected</td>
<td>Incorrect</td>
</tr>
</tbody>
</table>

6. CONCLUSIONS

The analysis result of SURF algorithm indicates that SURF gives good results for the images without scale variations or rotations however, for the rotated images it gives unsatisfactory result though the time required is less. The feature points found using SURF algorithm are satisfactory.

ACKNOWLEDGEMENT

I am thankful to Mrs. J. Dhande and Mr. P. Indurkar Co-Ordinator of M-Tech VLSI for guiding me. I am thankful to BDCOE, for making labs available.

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