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Applications of Digital Image Processing Accompanied with Morphological Operations and its Limitations

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Abstract **— Now a days Digital image processing has become economical in many fields like face recognisation, in forensics, in automobile detection and in military applications. While each application has requirements unique from the others, all are concerned with faster, more accurate, cheaper and more extensive computation.**

In this paper, the image processing operations are reviewed to illustrate the basic concepts and to use them in different fields with minor changes in the methodology. we have analyzed the various algorithms used in image processing to understand the basic steps of image extraction. Also we have discussed the role of alignment of camera and the target object i.e. how the position of camera affects the accuracy of results.

Keywords**— Image processing, Adaptive image thresholding, image segmentation, morphological operations, defect detection, camera angle alignment.**

I. INTRODUCTION

The world has changed in almost every aspect in the past few decades. System development is facing rapid changes to meet the continuous evolution of its architecture. The field of digital image processing is moving toward real-time and interactive operations, where the results of the system are obtained within a very short time, so that the next decision can be made without the loss of concentration on the task at hand. There is no substitute for human vision and human processing but studies show that humans can take in only 20 different images per second before they begin to blur. Moreover remembering different images is not feasible.

Several algorithms have already been developed and the combination of image processing with morphological operations can be used to extract components of an image. This combination has been used in different applications like in vehicle detection from an image using aerial cameras [1]. One such application of this concept can be in keyboard industry where poorly manufactured keyboards can be detected at manufacturing stage[2]. In this application an input image of manufactured keyboard is fed to detect the missing key or damaged key.

Similar concept has been used in Face Recognition [3], Facial Expression Recognition. Further with the advancement of image enhancement techniques, a precise extraction of particular feature has become possible like number plate recognisation from the detected vehicle and eyes, nose, ears, lip gesture from recognized face [4].

The biggest limitation of all these algorithms is that the accuracy of these algorithms is dependent on the resolution of hardware (camera), and the alignment of camera and the target object.

So in this paper we have analyzed the different algorithms used in image processing to understand the basic steps of image extraction. Also we study the camera position with respect to object and effect of it on the accuracy of results of the algorithm. During unfavorable conditions like improper illumination, low quality hardware, results are not the same as expected.

This paper analyses various algorithms use in different applications of image processing. Next section describes the accuracy results obtained after alignment of camera at different angles with respect to the target object. Result and conclusions of the experiment is given in last section of this paper.

II. ALGORITHM ANALYSIS

After studying various application of digital image processing accompanied with morphological image processing, we observed the common movement for the detection of a particular object in the given image.

Input Image

Firstly we input an image by some sort of scanner, digital cameras or with the help of aerial cameras .This image is usually a high quality image with greater resolution.

Preprocessing

On the input image some preprocessing operations are performed. The aim of preprocessing is to improve the image data that suppresses unwanted distortions or enhances some image features. Also in case of high resolution images, the image size is reduced because processing on high resolution images will take too much time, so to avoid latencies in real time applications, this is the necessary step. After that, the color image is converted into grey scale image. The reason for differentiating such a images from any other sort of color images is that, less information is needed to be provided for each pixel. In fact grey color is the one in which the red, blue and green components have equal intensities and so it is only necessary to specify a single intensity value for each pixel.

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Image Segmentation

In image segmentation, image is portioned into multiple segments so as to simplify the representation of an image that is more meaningful and easy to analyze. Segmentation is accomplished by scanning the image pixel by pixel and then labeling each pixel as object or background, depending on whether the grey level is greater or less than the threshold value.

Edge Extraction

With the help of morphological image processing tools, some points are identified at which image brightness changes sharply or has discontinuity, to capture important changes and events in the properties of the image.

Region Filling

After edge detection it is necessary to fill the holes so as to avoid any false detection due to some unwanted objects. So for this, a series of morphological operation like dilation and erosion are performed .Dilation basically fills in holes, thicken thin parts and grows the objects where as erosion works quite the opposite. It enlarges holes, breaks thin parts and shrinks the object.

Output Image

After using various image processing techniques accompanied with morphological operation on digital image, the object of interest from the given image can be obtained.

A flow chart of the followed steps is shown in Figure 1. Next section discusses the limitations in the proposed algorithms

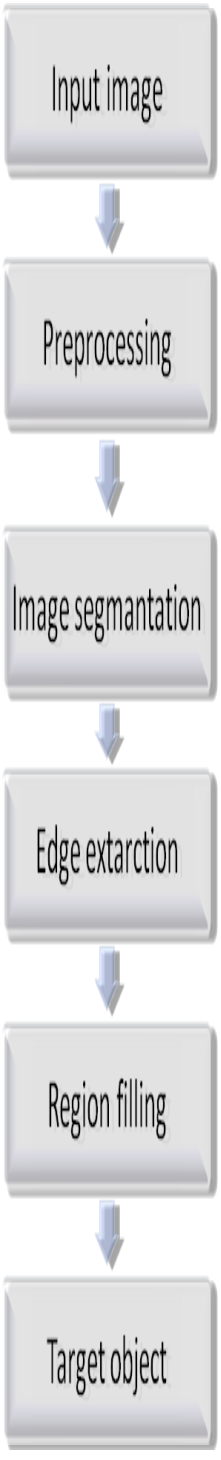

Figure 1: Flow chart of the algorithmic steps

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III. LIMITATIONS

The biggest limitation of all these algorithms is that the accuracy is dependent on the resolution of hardware and the alignment of camera and the target object. During conditions like improper illumination, night time, use of low quality hardware, results are not the same as expected.

When the defective keys were being detected it was observed that at some angles the results were not accurate. The precision was present only within a certain range of camera. So to facilitate this mostly such cameras are deployed. This happens as during image segmentation it becomes difficult to choose a single threshold value which would help to extract the object from background. The process of finding threshold value is thus cumbersome and delays the whole process thereby making it tedious. Table below shows the accuracy results with respect to different angle positions of the cameras.

S.NO	CAMERA ANGLE POSITION	ACCURACY
1	0 to 45 degree	Nil
2	45 to 80 degree	30%
3	80 to 90 degree	90%
4	At 90 degree	100%
5	90 to 100 degree	90%
6	90 to 135 degree	30%
7	Above 135 degree	Nil

IV. RESULTS

With the development of these types of methods of evaluation and by overcome these limitations of hardware, automation could be achieved to speed-up the production at industry level. Human may take time to evaluate these defects and evaluation results would not be so promising.

V. CONCLUSION

We have reviewed different types of algorithm for detection of target object in image using different types of image processing techniques accompanied with morphological image processing in different application areas. Then we focused on the importance of hardware and other environmental factors.

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