

Implications and Emerging Trends in Digital Image Processing

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Abstract -The Digital Image processing is the name referred to the techniques and methods applied on input image to transform into output image or extract information from image. With due to rapid growth in the technology, huge data is available in the form of images which need to process for multiple reasons such as automatic text extraction from images, traffic law enforcement using CCTV cameras, processing of medical images for diagnose the diseases etc. The present paper is aimed to explore commonly used techniques in fields of digital image processing. We have also explored different challenges to be faced in different digital image processing applications. The detailed literature review of OCR in Indian languages is carried out and different features are analysed to compare the efficiency of OCR. The current study is aimed to identify emerging trends in digital image processing; particularly we have included future trends in the field of OCR for Indian regional languages

Keywords: Morphological Operators, Sobel Operator, Homogeneity Operator, Canny Edge Detector, Text Extraction.

INTRODUCTION

With a rapid advancement in Digital camera technologies and availability in portable form, that gain attention of large number of researchers in the field of digital image processing. The digital image processing is name referred to the techniques and methods which applied on input image to extract meaningful information from it or transformed input image into desired manipulated image. In

the last decade, there are number of applications come into existence such as face recognition, object recognition, text extraction from image, hand written text recognition, motion recognition, etc. The present study explores commonly used digital image processing techniques along with their implications. The current study is aimed to identify emerging trends in digital image processing; particularly we have included future trends in the field of OCR for Indian regional languages and Text extraction from images.

The general procedure for Image processing techniques [1-2] can be defined as number of operations performed in a sequence to attain the desired output. There is no standardized set of procedures which may be imposed on every problem. The generalized procedure can be defined which provides flexibility to cater solution for large number of problems.

The generalized procedure is demonstrated in the figure 1 diagram

In general, digital image process is started with acquisition of input image. It may be a colored, gray or black and white image. The input image may acquire by Mobile Camera, Digital professional camera, CCTV or Scanned copy of an image. After acquiring input image, image need to be pre-processed by using pre-processing techniques.



Figure1: Generalized Procedure of Image Processing

The following is the list of pre-processing techniques:

Binarization: It is a procedure to convert colored or gray scale image into black and white image in such a way that one of the color represents background and other foreground. The well-known methods are Otsu Binarization, Niblack Binarization, Souvoal thresholding.

Denoising: It is carried out to remove unwanted signals from the image so that smooth image can be reconstructed. The well-known methods are Mean filter, Median filter, Wavelet filter.

Deskewness: It is a procedure used to align the input image into horizontal and vertical directions. It is in such a way so that original content should be preserved. The vertical and horizontal projections are well-known methods to de-skew an image.

IMAGE PROCESSING TECHNIQUES

Image processing techniques are task specific and vary according to the problem. In literature, there are n number of techniques is available and we have categorized these techniques according to the task. The following are the well-known techniques [3-4] used in different applications:

MORPHOLOGICAL IMAGE PROCESSING: The morphological operators are used to remove noise and find out edges. The following morphological operators are used to process natural scene images for detection of text.

- **Dilation:** It is a process performed by laying the structuring element B on the image A and sliding it across the image in a manner similar to convolution. If the origin of the structuring element coincides with a 'white' pixel in the image, there is no change; move to the next pixel. If the origin of the structuring element coincides with a 'black' in the image, make black all pixels from the image covered by the structuring element.
- **Erosion:** Erosion is performed in similar manner as in the case of dilation i.e. it is performed by laying the structuring element B on the image A and sliding it across the image in a manner if the origin of the structuring element coincides with a 'white' pixel in the image, there is no change, move to the next pixel. If the origin of the structuring element coincides with a 'black' pixel in the image, and at least one of the 'black' pixels in the structuring element falls over a white

pixel in the image, then change the 'black' pixel in the image from 'black' to a 'white'.

- **Opening:** It consists of an erosion followed by a dilation and can be used to eliminate all pixels in regions that are too small to contain the structuring element.
- **Closing:** It consists of a dilation followed by erosion and can be used to fill in holes and small gaps.

EDGE DETECTION TECHNIQUE: Edge can be defined as discontinuities in image intensity from one pixel to another. Edges can be used to predict the shape and size of the objects. Edge detection helps detection of text. The following are few edge detection techniques [6-7]:

- **Sobel operator:** Sobel edge detection is used to detect edges along the horizontal (180 degree) and vertical axis (90 degree). The operator is based on convolving the image using kernel.
- **Homogeneity Operator:** Homogeneity operator uses subtraction to find an edge in the image. The central pixel is replaced by the maximum result of these subtractions. The operator subtracts each of the pixels next to the center of a 3x3 area from the center pixel. Subtraction in a homogeneous region produces zero and indicates an absence of edges.
- **Difference Operator:** The difference operator for edge detection is based on difference intensity values of corners of 3 x 3 convolution mask. In this method, we compute difference of intensity of mask at Upper left - Lower right, Upper Right - Lower Left, Top - Bottom, Left - Right then we replace the center pixel with the maximum of these four values in the mask.
- **The Canny Edge Detector:** The Canny operator works in a multi-stage process. The image is smoothed by Gaussian convolution. After smoothing the image and Sobel operator performs to find out spatial gradient measurement. The Sobel operator uses a pair of 3x3 convolution masks, one estimating the gradient in the x-direction and the other estimating the gradient in the y-direction. Once the edge direction is known, the next step is to relate the edge direction to a direction that can be traced in an image after the edge directions are known, non-maximum suppression now has to be applied. Finally, hysteresis is used as a means of eliminating streaking.

EMERGING TRENDS

OCR in Indian Regional Languages

Optical character recognition [7] is the translator which recognized the text and convert into machine-editable form where text may be available in the form of handwritten or typed. OCR has number of applications like desktop publication, library cataloguing, automatic reading for sorting of postal mail, bank cheques and other documents, Bill clearance in shopping malls, stock clearance, etc. In literature, particularly in case of Indian Language OCR, a lot research is carried out on different Indian regional languages. The generalized procedure [8-9] of OCR is given below in figure 2:

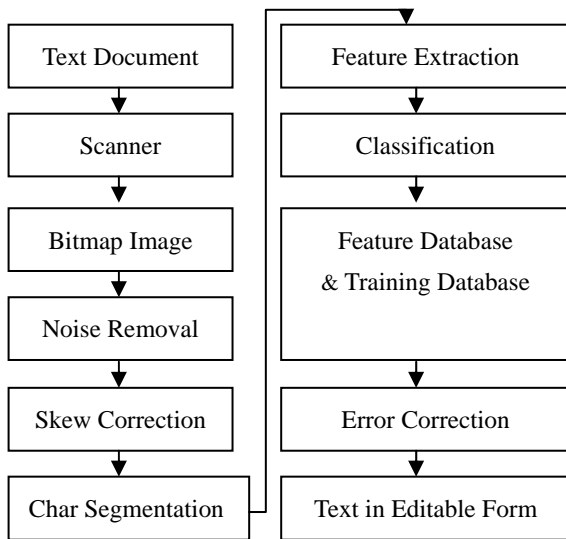


Figure 2: Procedure of General OCR

The text document is scanned into an image which is passed to an OCR. The noise detection and removal is performed to smooth the image. The skew correction is carried out to align the image. Segmentation of characters is performed to isolate the characters. Character recognition is done through features of that specific language. The following are few studies which are currently carried out in field of OCR.

K Jithesh et al.[10] have developed an Malayalam OCR recognises 50 characters per second and gives an accuracy of 97% for good quality printed documents. The results that they have obtained from the analysis show 97% Accuracy for computer printed text, 92% for Magazine, newspaper 85% and for Books 95%.

Amritha Sampath et al.[12] have proposed Neural Network based model for handwritten recognition. The direction information of the written character is recorded based on the 8 connected Freeman chain code. The back propagation Neural Network is used as a classifier for character recognition.

Raju et al.[11] have proposed wavelet based system for handwritten character recognition. The image is processed to low pass and high pass filters in different directions to extract the features. They have considered different characteristics for character recognition such as change in writing style, tilt sign etc.

Veena Bansal et al.[3] have presented a complete OCR for printed Hindi text written in Devnagri script. They have considered several features for recognition such as vertical bar feature, horizontal zero crossings, positions of vertex points, Moments, structural description etc. The different features are classified and analyzed in tree classifiers. They have claimed 93% accuracy for printed text.

Aditya Raj et al. [13] have conducted a survey on feature extraction and classification techniques used in character recognition for Indian scripts. The survey covered different approaches used in OCR for Indian scripts and the literature is represented in a tabular form. The survey has covered 17 different Indian languages along with their features and OCR accuracy.

CONCLUSION

The present paper explores commonly used digital image processing techniques along with their implications. We have also explored different challenges to be faced in different digital image processing applications. The detailed literature review of OCR in Indian languages is carried out and different features are analysed to compare the efficiency of OCR. It has been observed that text extraction from image is an emerging area and has lot of research potential. The text extractions from images, text detection from camera images, conversion of documents into editable format, traffic law enforcement are the major research area. The field of OCR is an ever green research area, particularly in Indian language OCR, the research is carried out in full swing. The regional language like Punjabi, Gujrati.

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