IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

SURVEY ON TEXT IDENTIFY, EXTRACTION AND RECOGNITION FROM NATURAL IMAGES

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Abstract: Images carries important information that should be extracted whenever we need to extract. Number of algorithms and methods are proposed to extract text from the given image, and by using that user will be able to access the text from any image. Variations in text may occur because of differences in size, style, orientation, alignment of text, and low image contrast, composite backgrounds make the problem during extraction of text. If we develop an application that extracts and recognizes those texts accurately in real time, then it can be applied to many important applications like document analysis, vehicle license plate extraction, text- based image indexing, etc and many applications have become realities in recent years. To overcome the above problems we develop such application that will convert the image into text by using algorithms, such as bounding box, HSV model, blob analysis, template matching, template generation**.**

Index Terms **- Text Detection, Text extraction and Text Recognition.**

I. INTRODUCTION

Text is born as an explicit carrier of high level semantics. This unique property makes text different from other generic visual cues, such as contour, color and texture. Therefore, detecting and recognizing texts in natural scenes have become important and vibrant research areas in computer vision. Text extraction is the task of automatically extracting structured information from unstructured and/or semi-structured machine-readable documents (text).The problem is challenging in nature due to variations in text properties and reflections. Text appearing in images is classified into three categories: document text, caption text, and scene text [6]. In contrast to caption text, scene text can have any orientation and may be distorted by the perspective projection therefore it is more difficult to detect scene text.

- Document text: A document image (Fig. 1) usually contains text and few graphic components. It is acquired by scanning journal, printed document, handwritten historical document, and book cover etc.
- Caption text: It is also known as overlay text or artificial text (Fig. 2). It is artificially superimposed on the image at the time of editing, like subtitles and it usually describes the subject of the image content.
- Scene text: It occurs naturally as a part of the scene image and contains important semantic information such as advertisements, names of streets, institutes, shops, road signs, traffic information, board signs, nameplates, food containers, street signs, bill boards, banners, and text on vehicle etc (Fig. 3).

(a) (b) (c)

Fig. 1: Document Images (a) Gray-scale (b) Handwritten (c) Multi-color

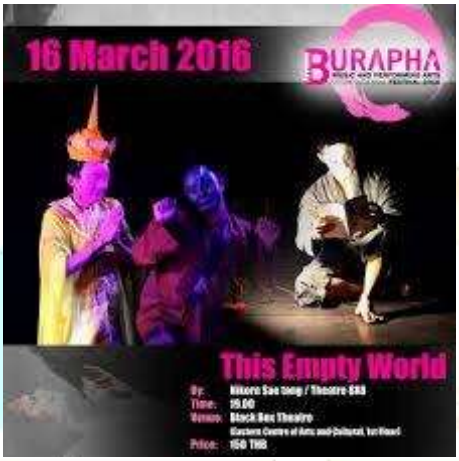

Fig. 2: Caption text images

Fig. 3: Scene text images

A. Properties of Text in Images:

Texts usually have different appearance due to changes in font, size, style, orientation, alignment, texture, color, contrast, and background. These changes will make the problem of automatic text extraction complicated and difficult. Text in images exhibit variations due to the difference in the following properties:

- **Size:** The size of text may vary a lot.
- **Alignment:** Scene text may be aligned in any direction and have geometric distortions while caption text usually aligned horizontally and sometimes may appear as non-planar text.
- **Color:** The characters tend to have same or similar color but low contrast between text and background makes text extraction difficult.
- **Edge:** Most caption and scene texts are designed to be easily read, hence resulting in strong edges at the boundaries of text and background.
- **Compression:** Many images are recorded, transferred, and processed in compressed format. Th us, a faster text extraction system can be achieved if one can extract text without decompression.
- **Distortion:** Due to changes in camera angles, some text may carry perspective distortions that affect extraction performance.

II. LITERATURE SURVEY ON TEXT EXTRACTION TECHNIQUES

In the past two decades, researchers have proposed numerous methods for detecting texts in natural images or videos. There are mainly three types of methods: Region based methods, texture based methods and morphological based methods. The various text extraction techniques are as follow:

A. Region based Method:

Region-based method uses the properties of the color or gray scale in the text region or their differences to the corresponding properties of the background. They are based on the fact that there is very little variation of color with in text and this color is sufficiently distinct from text's immediate background [20]. Text can be obtained by thresholding the image at intensity level in between the text color and that of its immediate background. This method is not robust to complex background. This method is further divided into two sub-approaches: connected component (CC) and edge based.

i.) Connected Component (CC) based Method:

CC-based methods use a bottom-up approach by grouping small components into successively larger components until all regions are identified in the image. A geometrical analysis is required to merge the text components using the spatial arrangement of those components so as to filter out non-text components and the boundaries of the text regions are marked. This method locate locates text quickly but fails for complex background.

ii.) Edge based Method:

Edges are a reliable feature of text regardless of color/intensity, layout, orientations, etc. Edge based method is focused on high contrast between the text and the background [5]. The three distinguishing characteristics of text embedded in images that can be used for detecting text are edge strength, density and the orientation variance. Edge based text extraction algorithm is a general-purpose method, which can quickly and effectively localize and extract the text from both document and indoor/ outdoor images. This method is not robust for handling large size text.

B.Texture based Method

This method uses the fact that texts in images have discrete textural properties that distinguish them from the background. The techniques based on Gabor filters, Wavelet, Fast Fourier Transform (FFT), spatial variance, SVM classifier and etc are used to detect the textual properties of the text region in the image [16]. This method is able to detect the text in the complex background. The only drawback of this method is large computational complexity in texture classification stage.

C. Morphological based Method:

Mathematical morphology is a topological and geometrical based method for image analysis. Morphological feature extraction techniques have been efficiently applied to character recognition and document analysis. It is used to extract important text contrast features from the processed images. These features are invariant against various geometrical image changes like translation, rotation, and scaling. Even after the lightning condition or text color is changed, the feature still can be maintained. This method works robustly under different image alterations.

D. Other approaches:

Epstein et al. [8] proposed SWT, an image operator that allows for direct extraction of character strokes from edge map. Binarization techniques, which use global, local, or adaptive thresholding, are the simplest methods for text localization. These methods are widely used for document image segmentation, as these images usually include black characters on a white background, thereby enabling successful segmentation based on thresholding. This approach has been adopted for many specific applications such as address location on postal mail, courtesy amount on checks, etc., due to its simplicity in implementation [11].

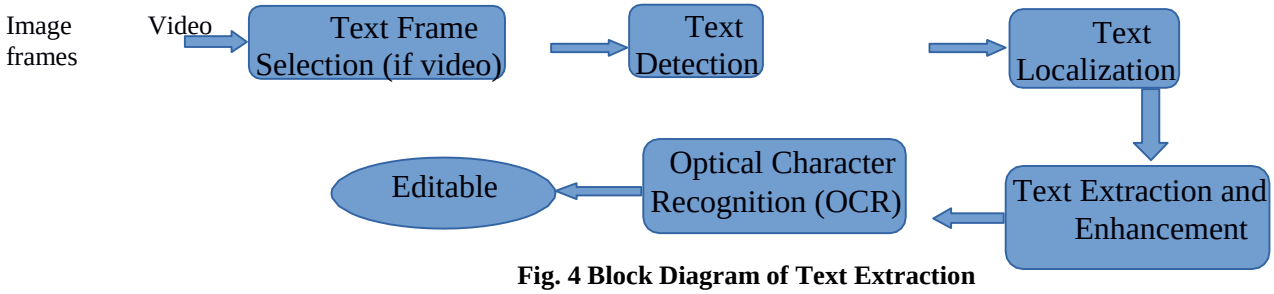

Fig. 4 Block Diagram of Text Extraction

III. METHODOLOGY OF TEXT EXTRACTION

The input image may be gray scale or color, compressed on uncompressed format. Text detection refers to the determination of the presence of text in the image while text localization is the process of determining the location of text and generating bounding boxes around it. After that, text is extracted i.e. segmented from the background. Enhancement of the extracted text is required as the text region usually has low-resolution and is prone to noise. Thereafter, the extracted text can be recognized using OCR. The block diagram of text extraction is shown in Fig. 4.

A. Applications of Text Extraction

Text extraction can be used for:

- Data entry for business documents, e.g. check, passport, invoice, bank statement and receipt.
- Automatic number plate recognition.
- Automatic insurance documents key information extraction.
- Extracting business card information into a contact list.
- More quickly make textual versions of printed documents, e.g. book scanning.
- Make electronic images of printed documents searchable.
- Converting handwriting in real time to control a computer.
- Assistive technology for blind and visually impaired users.

IV. DISCUSSION ABOUT PERFORMANCE EVALUATION

There are several difficulties related to performance evaluation in nearly all research areas in computer vision and pattern recognition (CVPR). The empirical evaluation of CVPR algorithms is a major endeavor as a means of measuring the ability of algorithms to meet a given set of requirements. Although various studies in CVPR have investigated the issue of objective performance evaluation, there has been very little focus on the problem of TIE in images and video. This section reviews the current evaluation methods used for TIE and highlights several issues in these evaluation methods.

The performance measure used for text detection , which is easier to define than for localization and extraction , is the detection rate , defined as the ratio between the number of detected text frames and all the given frames containing text. Measuring the performance of text extraction is extremely difficult and until now there has been no comparison of the different extraction methods. Instead, the performance is merely inferred from the OCR results, as the text extraction performance is closely related to the OCR output Performance evaluation of text extraction is not simple. Some of the issues related to the evaluation of text localization methods have been summarized by Antani et al. [2].

(i) Ground truth data: Unlike evaluating the automatic detection of other video events, such as video shot changes, vehicle detection, or face detection, the degree of preciseness of TIE is difficult to define. This problem is related to the Construction of the ground truth data. The ground truth data for text localization is usually marked by bounded rectangles that include gaps between characters, words, and text lines. However, if an algorithm is very accurate and detects text at the character level, it will not include the above gaps and thus will not have a good recall rate [1].

(ii) Performance measure: After determining the ground truth data, a decision has to be made on which measures to use in the matching process between localized results and ground truth data. Normally, the recall and precision rates are used. Additionally, a method is also needed for comparing the ground truth data and the algorithm output: pixel-by- pixel, character-by-character, or rectangle-by-rectangle comparison.

(iii) Application dependence: The aim of each text localization system can differ. Some applications require that all the text in the input image must be located, while others only focus on extracting important text. In addition, the performance also depends on the weights assigned to false alarm or false dismissal.

(iv) Public database: Although many researchers seek to compare their methods with others, there are no domain-specific or general comprehensive databases of images or videos containing text. Therefore, researchers use their own databases for evaluating the performance of the algorithms. Further, since many algorithms include specific assumptions and are usually optimized on a particular database, it is hard to conduct a comprehensive objective comparison.

Table 1 shows performance of various approaches in text detection and extraction.

Table 1: Various Text Extraction Techniques

Author, year	Technique Used	Images	Parameters	Remarks
Yao et al.[17], 2007	CC and Support Vector Machine (SVM)	Complex background images	PR=64% RR=60%	Pixels of each character assumed to have similar color.
Lai et al. [13], 2008	Edge detection and K-means Clustering	Signboard Images		Efficient for uneven illumination.
Zhang et al. [20], 2008	Discrete Wavelet Transform (DWT), k-means clustering, Morphology Operations	Background images with different languages, fonts and sizes	DR= 94.5%, FAR= 13.6%	Text character Color independent.
Song et al. [16], 2008	Histogram Projection and color based K-means clustering	Chinese text	PR=77.05% RR=75.63%	K=3 gives performance
Dinh et al. [7], 2008	Edge detection and Histogram Projection	Signboard Texts		Low complexity algorithm
Fan et al.[9], 2009	Stroke features and connected component	Caption text images	PR=95.2% RR= 94.5%	Color information is not fully used
Audithan et al.[5], 2009	Haar DWT, Morphological Dilation operator, logical AND operator, Dynamic Thresholding	Document images	DR =94.8 %	Independent of contrast
Anoualet al.[3], 2010	Edge detection, texture features, connected component analysis	Complex background images	PR=95% RR=89%	Robust and effective.
Kumar et al [12], 2010	CC Analysis	ICDAR 2003 scene images	PR=90% RR=89%	Capable of Multilingual Text extraction
Hassanzadeh et al.[10], 2011	Morphological operator, Decision classifier	Logo detection in document images	PR=95.6% Accuracy=86.9 %	A novel and fast method for logo detection
Zaravi et al.	DWT, Dynamic	Colored book and	DR=91.20%	Robust to noise

[18], 2011	thresholding, Region of Interest (ROI)	journal cover sheets		
Zhang et al. [19], 2012	Edge Enhancement and CC	Web images and caption text Images	DR=92.4%	Not sensitive to various types of background noises
Seeri et al. [15], 2012	Median filter, Sobel edge detect or econnected component labeling, order static filter	Kannada text images	PR=84.21% RR=83.16% Accuracy = 75.77%	Fails to extract very small characters
Azadboni et al. [6], 2012	FFT Domain Filtering , SVM Classification, K-means clustering	Scene text images	DR= 98.10%	Text characters having uniform colour
Anupama et al.[4], 2013	Morphology operators, Histogram Projection (X and Y histogram)	Handwritten Telugu document images	DR=98.54%, Accuracy =98.29%	Fail in case of touching characters and over- lapping lines
Raj et al. [14], 2014	CC based	Natural Scene Images (Devanagari text)	PR= 72.8%, RR=74.2 %	Fails for small slanted/curved text

V. CONCLUSION

This paper provided a survey of text information extraction from natural images. As a result a text- image-analysis is needed to enable a text information extraction system to be used for any type of image, including scanned document images, real scene images through a video camera, caption text images and video images. This review shows that, most of the procedures fall into any one of the above methods and also that there is a limitation in each technique to give a better detection rate with fewer false alarms without any constraints for text region extraction in different type of images. But still, to need a completely robust and generalized technique for text segmentation, it is difficult to provide appropriate input to the OCR system. So, a combined method has been proposed for automatic text content extraction.

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