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Detection and Recognition of Text for Dusty Image using Long Short Term Memory

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Abstract - *Now-a-days dusty images are more common due to dust weather. Some problems like blurring, low definition, low contrast and lost or weakened features exist in the text region of dusty images which greatly affects to understanding the information from images. Text contained within these images can have a valuable information and hence the text recognition in these images has becomes one of the important topic of intelligent information processing. Due to weakened text feature in dusty images traditional algorithm cannot be apply for text recognition. To recognize the text from dusty image, new method is introduce which has two modules. First, the dusty image is enhance by enhancement algorithm and the non-text and text regions are divide by the maximally stable extremal regions (MSER). The geometric property is used for removing non-text region from images. Then text are detected and recognized in these images by Long Short Term Memory (LSTM) which is difficult but important task. The problem has been analyze and propose a coherent framework for automated text recognition in dusty image.*

Key Words: Dusty Images, Enhancement Algorithm, Detection and Recognition of text

1. INTRODUCTION

Now-a-days with the rapid growth of technology there are many camera based applications are available. Everyone is easily capture image, but the main problem in computer vision community is difficult for reading text presented in those images. Since from many years, the detection and recognition of text play valuable job in human life and in future it becomes part of so many computer applications.

Dust exists in many places, such as dirty roads, cement plants, disaster relief situations etc. According to dusty weather visibility, blowing sand, floating dust and dust storms occurs in many regions of world. Dust will be affected on scattering of light which is produced by reflection of light incident on the dust particles. Hence it causes severe degradation of images. Problems like noise, blur, contrast loss, small dynamic range, poor visibility but also serious deviation and distortion of color image. The color is changed by the attenuation of different wavelengths. In these images, many useful information in the form of text have been covered. It hinders the application of machine vision of reliance on image text recognition in dust environment. Therefore, enhance the image obtained from unconditional weather is unavoidable task.

The OCR technique are limited to scanned documents. Natural scene images and dusty images are much more complex and challenging than document images. Hence, traditional document analysis techniques generally unable to work well for text in natural scene images and dusty images.

B. Epshtein, E. Ofek, Y. Wexler in 2010 developed SWT approach [5]. This work proposed a new image operator SWT to recover the character stroke from edge map and provide the efficient technique to extract text components from complex scenes. The text is separates from other components of scene by its closely constant stroke width. The proposed SWT image operator used for finding the stroke width value for each pixel and give its use for text detection in scene images. . By using SWT the detected area can coexist text and non-text regions. So SWT is not good performs for text detection of dusty images.

Adam Coates et.al in 2011 presented unsupervised feature learning [8]. Lukas Neumann in 2013 presented a localization and recognition of text for a real time scene image [9]. Preprocessing is done with Gaussian pyramid. Limitations of this methods is that it is unable to detect one or two letters word if it is not segment of a text line and unable to detect the clutter regions at a beginning or end of text line in sequence selection stage. O. Akbani, A. Gokrani, M. Quresh, F. M. Khan, S. I. Behlim, T. Q. Syed in 2015 worked on natural scene images [10]. Stroke Width Transform (SWT) techniques is used for detection and localization of text. For character recognition step they used trained three different classifier. The trained classifier to recognize text are kNN, Random Forest and Neural Network classifier. kNN has given the best result on training set and test sets. This character classifier gave competitive result and better performance as compared to Tesseract-OCR. Xiaolong Liu, Tong Lu in 2015 proposed Markov Random Field (MRF) model by combine both local feature and global spatial structure information for scene text character [11]. Xiaoming Huang, Chenqiang Gao, Run Wang, Tao Shen in 2015 proposed method for detection and recognizing of text based MSER and SVM [12]. Sanju Sebastian, Annmaria Cherian in 2016 worked on method

for text recognition in the natural scene image which appear with perspective distorted [13]. Perspective distorted images is distracted the human readers. Perspective distortion is avoided by correct the orientation of scene image and for this Hough Transform is used. SVM classifier is used to filter non-text components. Md. Rabiul Islam, Md. Kawsar Azam, Chayan Mondal, and Abu Syed Md. Jannatul Islam in 2016 proposed enhanced MSER algorithm where MSER is filtered with canny edge and stroke width configuration [14]. Natural image contains some region which act as maximal but actually not. So there is used of preprocessing, geometry filtering, masking to detect text region from image. OCR technique with clustering by Guassian Mixture Model (GMM) is operated on detected text region for recognition the actual text of scene image. The proposed method have some limitations. When image having low quality, low resolution, blur image, strong noise, small letter then most of character candidates of text correspond as non-character and sometimes the non-character are recognized as text area. Kakade Snehal Satwashil, Prof. Dr. V. R. Pawar in 2017 proposed approach based on SVM classifier [15]. This method is not applicable on multi linguistic script. Savita Choudhary, Sanjay Chichadwani, Nikhil Kumar Singh in 2018 proposed a new methodology for text detection using MSER and for text recognition using Neural Network [17]. This paper proposed an efficient and improvised approach involves two tasks: first is text region extraction and second is character recognition by using CNN.

Hao liu, Shengze Jia, Ce Li, Dong Zhang in 2018 proposed new method to detect text from dusty image [20]. They utilized CLAHE algorithm to enhance contrast, color cast and text features of the dusty image to get clear result image. Then the text and the non-text region in enhanced image are separated by MSER which is reduced the computation complexity. Next step is used convolution Neural Network (CNN) for chooses the text region and by using Run Length Smoothing Algorithm (RLSA) text lines are obtained. Finally, boundary is smoothed and the non-text regions are removed by Guassian smoothing and area filter. The dusty image having text regions always blurred. Hence this network can achieves better detection result in the enhanced images.

2. SYSTEM METHODOLGY

On the basis of research in enhancement algorithm, detection and recognition of text algorithm, the proposed system for detection and recognition of text for dusty image consist of two module. First preprocessing and enhancement algorithm apply on dusty image and then text regions are detected and characters are recognized in these image. The proposed system overview block diagram shown in fig. 1.

2.1 Input Dusty Image

Detecting and recognizing text in the dusty images captured in dusty weather is challenging due to the variety and complexity of text's appearance, poor visibility, low definition, interference factor. In these images, many useful information in the form of text have been covered. and image enhancement to improves information in the image.

2.2 Preprocessing

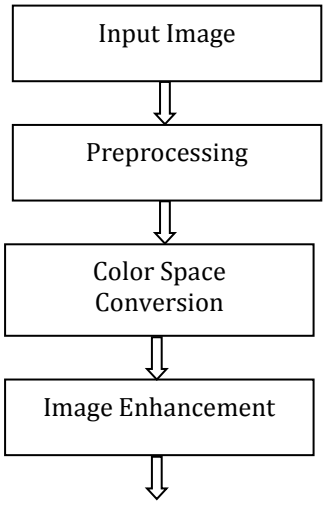
Image noise is an unwanted part of capture image that unclear the desired information. So there is need of preprocessing for removing noise from these images. The median filter is nonlinear method used for removing noise from images because it preserves edges while removing noise. First all pixel values are sorted and then replace pixels being consider with middle pixel value. Hence median is calculated.

2.3 Color Space Conversion

Lab color space expresses color as three value, L for lightness or luminance, a for green to red and b for yellow to blue components of the color dimension. Lab color space work includes spectrum of all colors and colors outside the perception of human.

2.4 Image enhancement

Image enhancement is a well-known image preprocessing technique is used for improving appearance of image and make it suitable for human visual perception or subsequent machine learning. CLAHE is an adaptive contrast enhancement method. CLAHE is advance of adaptive histogram equalization, where for contextual region of pixel, histogram is calculated. Zuierveld et al proposed CLAHE which consist of two key parameters: block size (N) and clip limit (CL). These parameters are utilized for control image quality.



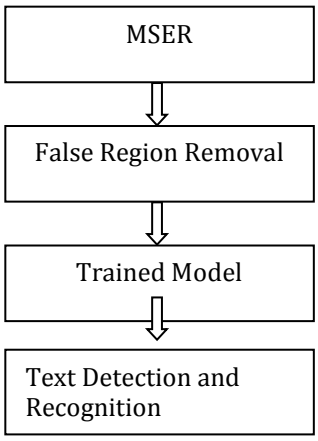


Fig -1: System Overview Block Diagram

2.5 Maximally Stable Extremal Regions (MSER)

MSER detects the objects which filled with different colors. But extra background pixels are included in many regions. Those are removed in the false region removal process. MSER algorithm used for detecting Candidate Text Region within image and plots its result. Most of text regions from image are detected by MSER but it also detects some other non-text region. Geometric Properties are apply on these image which uses important properties to remove non text regions from image. The MSER algorithm chooses alomost all text regions and many other regions which is stable in image which are not text.

3. EXPERIMENTAL RESULTS

In the experiments, MATLAB R2018b is used as the programming tool. All images that use are selected from the Internet. Randomly select five dusty images with text areas from the Internet. The first step of the work is to improve clarity of text regions. This is done by preprocessing and image enhancement algorithm. Fig. 2 is input dusty image, fig. 3 is filtered image after applying the median filter. This removes noise from images.

Fig -2: Input dusty image

Fig -3: Filtered image

Fig. 4 is enhanced images after applying CLAHE enhancement algorithm. The text region in enhanced images is obviously clearer than dusty images.

Fig -4: Enhanced image

Only using deep learning algorithm to detect and recognize the text of dusty images can reduce the detection and recognition accuracy. So our method mixs enhancement, text feature MSER and deep learning algorithm that obtain a better results for dust image text detection and recognition. MSER is search for text region which is basically a stable region and segment it with different region and show it by different color as shown in fig. 5. MSER is define the region having similar kind of properties. False region removal removed the remaining region having non uniformity and uniformity region is define as shown in fig. 6.

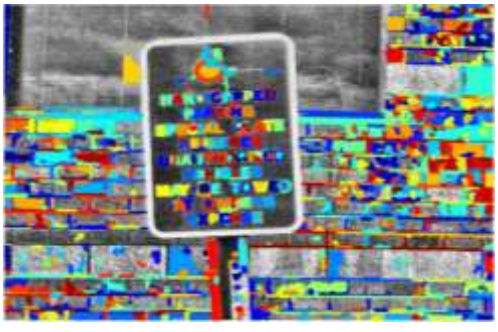


Fig -5: MSER regions

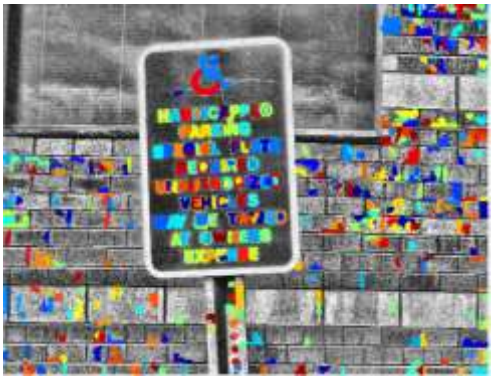


Fig -6: After removing non region based on geometric properties

Bounding box is evaluated using regionprops. It findout co-ordinate of bounding box and using insertshap instruction detected region is find. Detected region is showing by overlap the specific coordinate on input image. The detection of text output is shown in fig. 7.

Fig -7: Detected text

The text are recognized from the dusty image as shown in fig. 8. This is done by using trained network which is trained using long short term memory and save as a network. while recognition of text from dusty image, this network is uses.

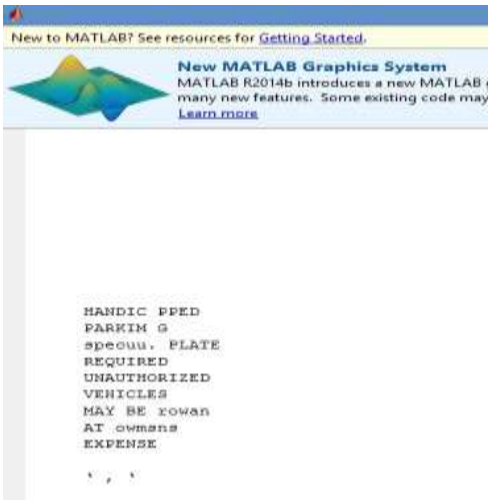


Fig -8: Recognize of text

The script of the text in the training images and test images is English. The dataset have 62 classes consisting of 10 digits and 52 English characters with both upper and lower cases. The LSTM classifier is trained using the training set which contains 27000 text images. Trained the character classifiers with varying number of features, then tested this classifier on the test set which contain 3700 text images. The classification accuracy on test set is 91.62%.

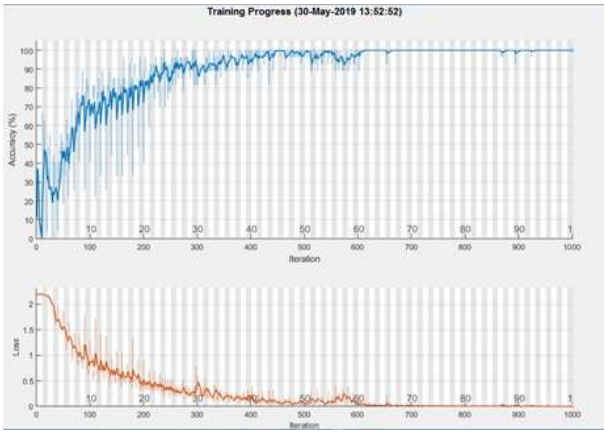


Fig -9: Training Progress

Table -1: Accuracy of text recognition with enhancement and without enhancement

Sr. no.	Images	Accuracy (%) with enhancement	Accuracy (%) without enhancement
1	Image1	87.80	69.87
2	Image2	62.16	55.26
3	Image3	89.06	89.06
4	Image4	70.37	59.25
5	Image5	100	94.11

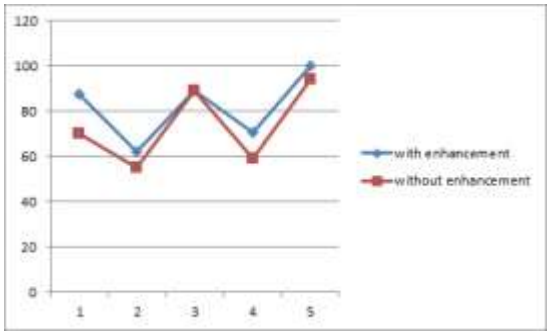


Chart -1: Comparison of accuracy

The average value for accuracy of text recognition with enhancement algorithm is 81.87% and average value for accuracy of text recognition without enhancement algorithm is 73.51%. It can be seen that the accuracy of text recognition with enhancement algorithm achieves

much better performance than only use text recognition without enhancement algorithm for dusty image.

The comparison of accuracy between text recognition with enhancement algorithm and text recognition without enhancement algorithm is represented in fig. 10 in the form of graph. From the above graph, it has been observed that the average percentage of accuracy text recognition with enhancement algorithm is more than accuracy text recognition without enhancement algorithm.

3. CONCLUSIONS

The solution for standard challenges in scene text analysis for dusty image is proposed. The problem of text detection and recognition for dusty images is address which can be used for many applications such as content-based image retrieval, sign translation and navigation aid for the visually impaired and robots, driverless car. The various detection and recognition of text techniques are reviewed. The effort of researchers, considerable progress had made in natural scene image detection and recognition of text in recent past years. Aiming at the problems that text regions in dusty images always exit some problem such as blur, text features weakened or lost, low definition, low resolution low contrast. There is need of dusty image is enhanced by enhancement algorithm and then text are detected and recognized in the enhanced image. The text and non-text regions are divided by the maximally stable extremal regions. The geometric property is used to remove non-text regions from images which greatly reduces the computational cost. Then text are detected and recognized in these images by using Long Short Term Memory (LSTM). As an overview of the results of the previous chapters, It can be conclude that 81.87% text character recognize in dusty images. The LSTM character classifier provide accuracy of around 91.52% on individual characters.

The research presented in this dissertation motivates a diversity of future research project, most of which are about improving the performance of text detection and recognition for dusty image by adding new methods or optimizing the existing methods. The proposed approach are capable of detecting and recognizing English text for dusty image with sufficient accuracy. The recognition of multi linguistic script for dusty image will be considered in future work.

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