An Enhanced Approach for Extraction of Text from an Image using Fuzzy Logic

K. Chandra Sekhar[1], MD. Mehar Naaz[2], K. Haritha[3], N. Roshitha Varma[4], T. Sivajee[5], P. Sri Ram Naidu[6]

[1]Professor, Dept. of Computer Science and Engineering, Anil Neerukonda Institute of Technology and Sciences, Andhra Pradesh, India

[2,3,4,5,6]Student, Dept. of Computer Science and Engineering, Anil Neerukonda Institute of Technology and Sciences, Andhra Pradesh, India

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Abstract – *This paper represents the approach for extracting the text from an image with the method called "Fuzzy Logic. The role of text recognition is to recognize the text from an image and then to extract the text in the editable format, so that people can use the text for their future purpose. People capture lot of useful information which may have essential textual data to store and may also edit this data. Fuzzy logic identifies whether the character or the text present in an image matches with the trained data or not. The image captured by the user undergoes pre-processing and then converted into binary image. The text in an image is localized, segmentation process takes place to extract each character from image and then characters are identified which are matching the trained data using Fuzzy Logic.*

Key Words: **Text Recognition, Text Extraction, Fuzzy Logic, Pre-processing, Segmentation, Feature extraction.**

1. INTRODUCTION

Textual data present in the images contain useful information for indexing and automatic annotations. Extraction of this useful information involves text detection, localization of text, classification, and then recognition of text. Fuzzy logic determines the degree of truth values. This logic helps to identify and match the characters accurately with trained data.

1.1 Image Processing

Image processing is analysis and manipulation of a digitized image, so as to enhance its quality with the help of mathematical operations by using any kind of signal processing where the input is a picture or an image or a video frame. The output of image processing will be either a picture or set of characters or parameters associated with the given input image. This is a set of computational techniques for analyzing, enhancing, compressing and reconstructing image. There are different techniques for processing an image like optical methods, fuzzy techniques, digital processing, linear scaling.

Image processing generally involves three steps:

- Importing and Loading the image by using image acquisition tools.

- Analyzing and manipulating image to extract the information.

- Output the result. The result might be the image or a picture altered in some way or it may be a report based on analysis of the image.

1.2 Text Recognition and Extraction Model

The method of text extraction involves mainly two processes, namely- Text Detection and Text Recognition. Text detection is a way of localizing various regions from an image which contains text in it. This helps in removal of non-text regions which behave as noise while extraction of desired text. Whereas, Text recognition is a process of converting pixel-based text i.e. image text to readable code. This recognizes the text from an image by undergoing several steps such as, pre-processing, segmentation, feature extraction, classification and post-processing. Later, the text extraction is done by comparing the segmented characters with the trained data with the help of fuzzy logic.

2. FUZZY LOGIC

Fuzzy logic is a form of logic that is used in some expert systems and in various applications of Artificial Intelligence. This was originated in 1965 by "Lofti Zadeh". Fuzzy logic is a branch of logic which uses degrees of membership in the form of sets rather than the strict true/false memberships. The classical logic depends only on the Boolean values 0 or 1 and this depends upon a lot of relationships, while there are various relationships where the position that it can be considered as partly true or as partly wrong at the same time. Therefore, Fuzzy logic determines the degree of affiliation, which is extent of grades between right and wrong. This can manage the vagueness and ambiguity very efficiently. It has the power to perform reasonable and meaningful operations. In the process of extraction of text this logic plays a vital role by taking the segmented character and comparing this segmented character with the trained

character datasets. After comparing, it finds the accurate matching value of the character. If character matches accurately with trained data then the character is extracted and displayed on the digital screen. If the segmented character matches with the trained dataset character then the status becomes '1' and the character is printed, otherwise status becomes '0' and the process continues till it finds the matching character.

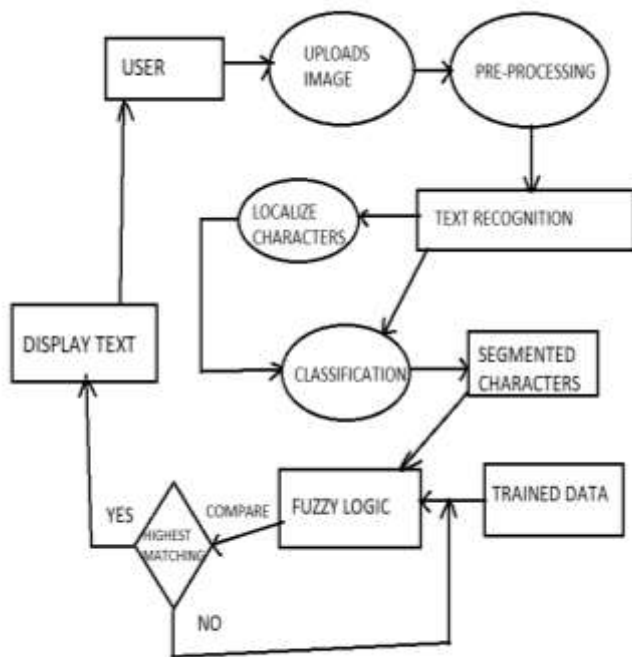## 3. DESIGN AND IMPLEMENTATION

Fig -1: Architecture of the proposed system.

The algorithm involves few steps:

1. Load the original (RGB) image and convert it into grayscale image.
2. The image undergoes pre-processing to enhance and remove the noise from an image.
3. The words in the image are classified and localized and then they are segmented according to the boundary values.
4. The segmented characters are compared with the trained dataset with the help of fuzzy logic to find the highest matching criteria.
5. If the segmented character has highest matching value with trained data then the character is displayed or else the same process continues till it finds the highest matching value i.e. nearer to 1.
6. The characters are displayed in an editable format.

3.1 Pre-processing

The main purpose of pre-processing is to enhance the visual look of the image. People generally take the picture of the required document to be extracted as text, but they might contain some noise. The image captured by the user might be blurry, noisy, and may be of low resolution. Thus, this process is used to remove the clamor or noise, stabilize the intensity of the image and to clear the artifacts. So as to improve or enhance the quality of the input image given by the user, few operations are performed in this stage. They are noise removal, normalization, binarization etc.

3.1.1 Noise Removal

The sources of noise arise in an image due to image acquisition i.e. digitization and transmission. There are generally four types of noises, namely: Gaussian noise, Salt and pepper noise, Speckle noise, Uniform noise. When the images are sent over different channels, they are prone to corruption with noise because of the noisy channels. Thus, filters are required to remove the noise from the images captured by the user before processing. There are many kinds of filtering such as linear smoothing filter, median filter, wiener filter and Fuzzy filter. The three primaries (R, G and B) are done separately in the filtering. The three R, G, B filters are followed by the gain to compensate the reduction of noise resulting from the filter. These filtered primaries are combined to form a filtered colored image. This process is shown as below:
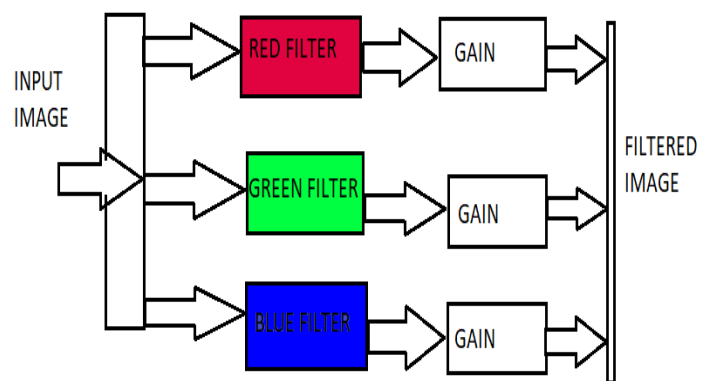

Fig-2: Filtering

Median filter is utilized for enhancing the image, Filtered_Image= Median _Filter(Original_Image, Filter_Size)

3.12 Normalization

The range of pixel intensity values are changed in the process of normalization. In general, normalization means a mechanism to bring something to normal condition. The normalized image has mean =0 and variance =1. The range

of values of the image represented between 0 and 255. The normalization of an image is performed as,

Output_channel = 255 * (Input_channel - min) / (max-min)

If a grayscale image is used then only one channel needs to be normalized. However, if we are normalizing an RGB (3 channels) we should normalize for each channel using the same criteria.

3.2 Segmentation

The process of partitioning a digital image into several multiple segments or image objects is known as segmentation and sometimes also referred as object detection. This process simplifies and changes the features or representation of an image so that analysis becomes easy and also to make it more meaningful. This segmentation is done in three ways, they are line segmentation, word segmentation, character segmentation. Some of the deep learning architectures are used for segmentation, one of the architectures is CNN i.e. Convolution Neural Network. Segmentation of image using CNN involves feeding segments of an image as input to a convolution neural network, which indicates the pixels. The entire image in CNN can't be processed. It scans the image or picture, looking at a small "filter" of several pixels each time until it has mapped the entire image.

Step-by-step process of how this works:

• Take the weight matrix.
• On top of the image put the weight matrix.
• Element-wise multiplication is performed and output is considered.
• The weight matrix is moved as per the chosen stride.
• Convolve until all the pixels of the input are used.

Each and every segmented character is placed in the form of matrix. These matrices are compared with the trained dataset matrix so as to identify the character.

3.3 Feature Extraction and Classification

Features are the unique signatures of an image or an image defined with unique properties. Feature extraction is basically related to dimensionality reduction and is used for extracting characteristics of an input image. This efficiently describes components of image as a compressed feature vector. This kind of approach is useful when size of image is very large. When the pre-processing and segmentation on the image is done, some feature extraction technique is applied to the segmented characters to acquire features, which is then followed by classification and post processing techniques. Some of the techniques like statistical and geometrical features are used in feature extraction process. The process of recognizing and extraction of character is divided into 2 stages: Feature selection and classification.

The main aim of features selection is to select a subset of input variables by cutout features with weakly or no predictive information while maintaining or performing classification accuracy, whereas Image classification is acceptance of the input image and the extracting characters and assigning them to correct class or a category.
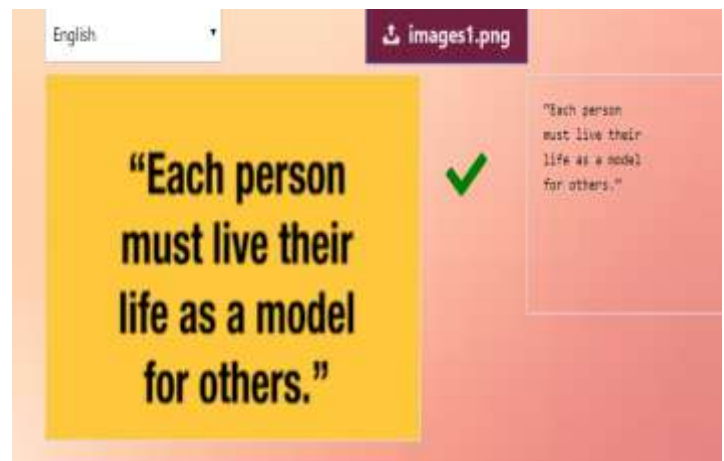
4. RESULT

Fig:3(a) Extracted text from input image

Fig:3(b) Extracted text from input image

5. CONCLUSION

Applications need several kinds of images as sources of information for elucidation and analysis. The characters which are identified are classified into meaningful word or sentence. When an image is transformed from one from to another by digitizing, scanning, processing is done through tesseract by storing the identified data and this identified fata is compared with the trained data using the Fuzzy logic. Therefore, the output image has to undergo a process called image enhancement, which has a group of methods that seek to develop the visual presence of a picture or an image. In this paper, we have successfully able to extract the text from

the image of any kind of font style and size with the help of fuzzy logic. The intend of Fuzzy rules are the attractive result to improve the quality of edges and find the accurate characters from the image. This paper will act as a good survey of researchers who have begun work in the field of fuzzy character recognition.

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