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ANALYSIS OF OPTICAL CHARACTER RECOGNITION USING IMAGE PROCESSING TECHNIQUES

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ABSTRACT

Optical character recognition (OCR) includes the identification of printed characters from an image using photoelectric devices or computer software. It is the conversion of type written or printed text images into machine encoded text. The objective of this paper is to recognize text from a digital image of a vehicle number plate using digital image processing techniques in python environment. Methodology adopted in the current paper follows traditional methods of Digital Image Processing that involves various pre-processing of an image such as Gray scale conversion, bilateral filtering, canny edge detection followed by the optical character recognition using tesseract.

I. INTRODUCTION

The first part of this paper presents the overview of architecture of vehicle number plate detection in a digital image. In the later sections we will see how the major stages in the Character Recognition problem such as pre-processing and recognition is dealt by Tesseract.

The final part presents the usage and implementation of OCR in Free Software including Python and the Open Computer Vision Library. An image consisting of vehicle number plate is taken as an input into the system. The main objective here is to locate the number plate in the image and identify the characters present in it using open computer vision library and tesseract function to perform the process. In this methodology it is important to note that the output of one process would be acting as input to the successive process.

The pre-processing stage consists of image processing methodologies such as resizing of the image in to a definite width that would allow the operation to be performed in more effective manner, after resizing the image the image is gone through Gray scale conversion, bilateral filtering, canny edge detection, finding and sorting of contours in the processed image that got edges detected this image is then cropped by finding the number plate location in it.

The localization of number plate is performed by calculating the perimeter of the rectangular objects in the image. In this case It is assumed that the number plate of the vehicle is in rectangular shape. After locating the number plate, it is saved in a directory to ensure the feasibility of its performance and restrict the OCR engine to read any other information that is present in the input image. The cropped image is then once again processed to the first two methodologies that are the Gray scale conversion and bilateral to ensure the accuracy of the result. When the image is processed successfully in these stages it is read by the tesseract which would print out the characters present in the image as an output.

II. LITERATURE REVIEW

OCR is widely used to convert various types of documents, images text into an editable and searchable data format.

In paper [1] author have proposed the difficulties involved in this the font characteristics of the characters in paper documents and its quality. Due to these difficulties, the computer is unable to recognize the characters while reading them. Hence, there is a need of character recognition mechanisms to perform Document Image Analysis (DIA). This will transform the documents in paper format to electronic format.

In paper [2] author have explained that Automatic License Plate Recognition (ALPR) is a computer vision technology to extract the license number of vehicles from an image. It is an embedded system which has numerous applications and challenges. One of the important contributions of the open-source community to today's world is Python. The Intel's researches in Computer Vision bore the fruit called Open Computer Vision (OpenCV) library.

In paper [3] author have proposed about Performance rate of OCR. With help of OCR, different CAPTCHA is studied in different file formats as TIFF, GIF, BMP, PHP That gives the best file format suggestion on which human recognition error rate to be decreased.

In paper [4] author have proposed about the character recognition of LP is attempted using the KNN method that is Kohonen Neural Network. It differs from the feed forward back propagation of the artificial neural network in terms of how it is trained and it's recalling a pattern. This method does not use any kind of activation function neither it uses any kind of a bias weight. Hence, the output from the Kohonen Neural Network does not consist of the output of many neurons. This consists of only interconnected processing elements that are known as neurons. they work together in the production of LP ASCII Character as an output. The training process is important for LP OCR system learn characters.

In paper [5] author have explained the main problem of Character Recognition by introducing the pre-processing, segmentation and recognition which is dealt by Tesseract. The usage and a short demonstration of the software. A keen focus is also presented on the aspects which are at least different in Tesseract compared to many OCR engines.

Table: Existing papers have used the following techniques.

Papers	Techniques used
Automatic License Plate Recognition using Python and OpenCV	• Connected component analysis. • Segmentation. • Character recognition. • Tools used: Python, OpenCV, Tesseract.
Text Recognition from Images	• Document image Analysis (DIA) • Electronic format • Text recognition
OCR Accuracy Improvement Technique	• CAPTCHA Generation. • Image analysis. • Noise and Artifact Removal. • Error rate calculation and OCR
Indian License Plate Character Recognition using Kohonen Neural Network	• Kohonen Neural Network. • Template Matching. • Calculating each neuron's output. • Mapping to Bipolar.
An overview of Tesseract OCR Engine	• Adaptive Thresholding. • Page layout analysis. • Baseline fitting and word Detection, Recognition.

III. PROPOSED METHODOLOGY

The methodology is majorly divided to three processing segments. They are Pre-processing, Text recognition and the post processing.

PRE-PROCESSING STAGE:

At this stage we have the data in the form of image and this image can be further analysed so that the important information can be retrieved. To improve the quality of the input image and make it suitable for further analysis, we perform some operations on it such as Grayscale conversion, Bilateral filtering, canny edge detection followed by finding and counting the contours in the input image.

1) Grayscale conversion: In this the grayscale image from a color image is by instructing OpenCV if to read an image as a grayscale image.

2) Bilateral filtering: Gray scale converted image is passed as an input into this step to remove any remove noise. For this purpose, the bilateral filtering is applied on the image to decrease the unwanted information in the input image. The output of this step will give an image with blurred background and focused number plate.

3) Canny edge detection: The input of this step is the blurred image of bilateral image. To identify the edges in the image Canny edge detection to extracts edges of all the objects present in it. As an output this would display a picture with all the edges highlighted in a black background.

4) Contour detection: The Contours are drawn and counted in the edge detected image to find location of number plate. By applying contours all the edges will be outlined with magenta color by the end of this step. Top 30 contours are then sorted by specifying the count of the contours to [:30].

5) Number plate detection: This would high light the edges that top the maximum area in the input as the vehicle number plate is assumed to be a rectangular shaped object. A perimeter with width larger and height least is processed to be cropped and stored. Hence by the end of this process all the rectangle objects are identified and sorted image.

The obtained sorted image is saved in PNG format to ensure the unwanted information getting read in the further processes. Hence this step will sort and give an output as a number plate image consisting of characters in it.

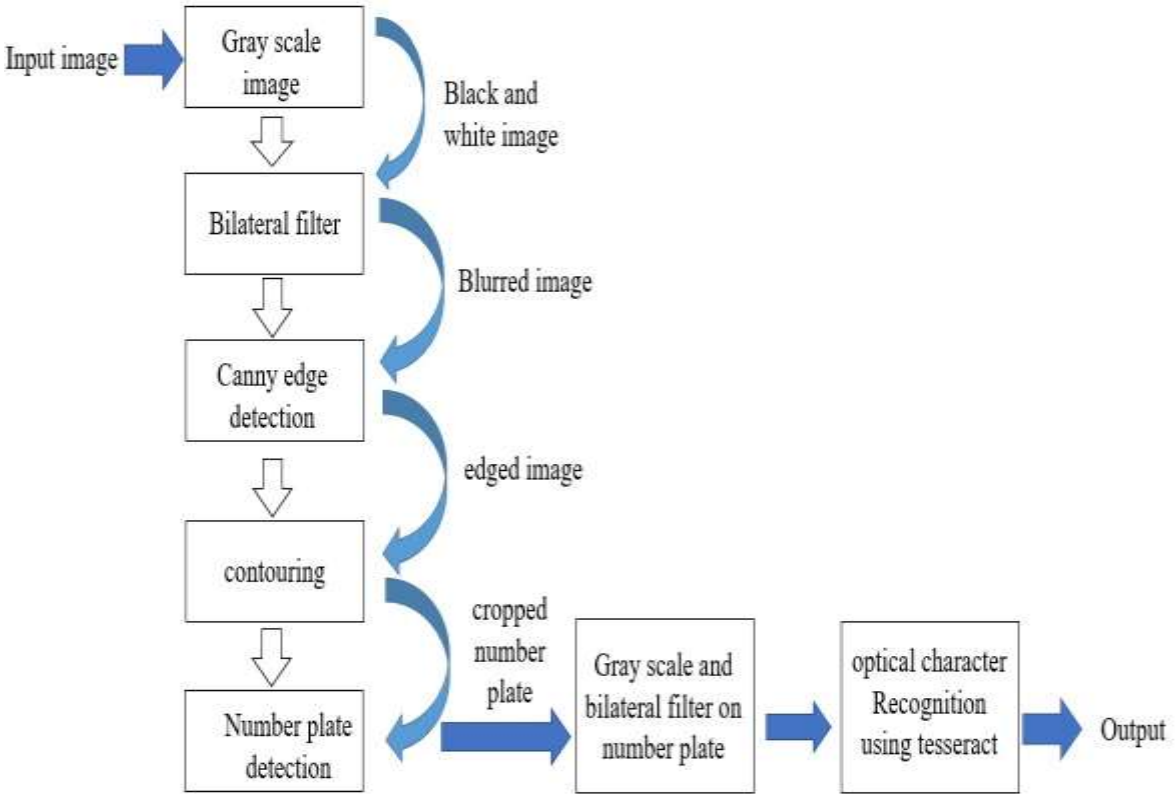
TEXT RECOGNITION STAGE USING TESSERACT:

Step 1 and step 2 are repeated on the input image of number plate as it would be returned to the original state after the cropping and saving process. This output will be served as an input to the OCR engine to detect the characters present in it. Text in the image is recognized using the tesseract engine where in would first read the input image and then identify the language that the characters are present. After identifying the language, it will match the characters with the algorithms of pre-build which will print the output of text detected. This step gives the final output. Register number of the vehicle will be obtained as a result.

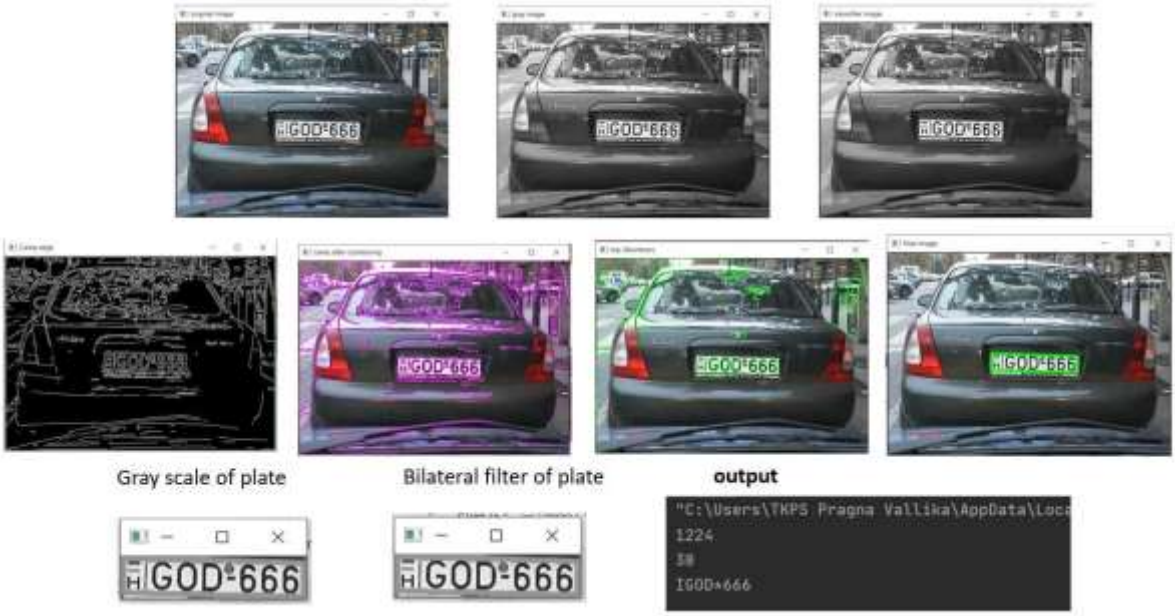
POST PROCESSING:

The Output that is obtained will be in a text format which can be stored as well as processed further for required operation.

FLOW DIAGRAM:



IV. IMPLEMENTATION



V. PERFORMANCE EVALUATION

- In the initial stage of implementation, the proposed system underwent a very decreased performance. The recognition time taken was drastically high and the performance was low too.
- A keen research with improved methodology experiments with the optimization of code brought down the time taken speed to two seconds.
- The size of input image and the steps involved in the pre processing made the key factors which eventually declared the performance rate.

VI. APPLICATIONS

- **BANKING:** The most widely uses of OCR is while handling cheques: a handwritten cheque is scanned and its contents are converted to digital text.
- The signature verification and the cheque clearance in real time all with the involvement of a human.
- **HEALTH CARE:** Having one's entire medical history on a searchable, digital store means that things like past illnesses and treatments, diagnostic tests, hospital records, insurance payments etc can be made available in one unified place.
- Rather than having to maintain unwieldy files of reports, X-rays and other papers.

VII. CONCLUSION AND FUTURE SCOPE

It gives less success rate when the image has a lot of noise or when the font of the language is one on which Tesseract OCR is not trained.

Other conditions like brightness or skewness of text will also affect the performance of Tesseract. Nevertheless, it is a good starting point for text recognition with low efforts and high outputs.

VIII. FUTURE SCOPE

Considering the success rate and execution challenge I would like to wrap the proposed methodology with machine learning technology where it would train the system to understand the pre-processing requirements of any input image and process the image accordingly.

This would make it enable for the OCR engine to recognize the text with high accuracy which in turn reduced the failure rate.

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