A SURVEY ON IMAGE PROCESSING TECHNIQUES

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Abstract— **Number recognition is the significant and crucial in identification of vehicle registration number. Unauthorized entry of vehicles, breaking traffic rules, stealing of vehicles are increasing linearly day by day. Thus to decrease these activity in our social environment Number recognition system is essential. Several methods of number recognition based on the image processing, neural network, the invariant moments have been proposed. In this paper we describe some of the recent researches carried out in the field of number recognition techniques. Discussion of these papers emphasizes the techniques that are used to extract number and alphabetic data from images. Several pre-processing techniques are used to increase the accuracy rate of extracted data. The main techniques that are used behind each research paper are stated briefly.**

Index Terms— **Image Processing, Vehicle registration number**

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I. INTRODUCTION

We are living in the world where every daily objects are automated for user convenience and advancements in technology is helping to achieve it. Entrance gate of any building or premises is manually controlled or sensor and remote controlled gates. However, this gives rise to several problems like security, user involvement etc. which are more prone to delay which will cause stacking of vehicle leading to traffic congestion. Hence, an automatic, precise and fast number recognition system is required.

Several methods of number recognition based on the image processing, neural network, the invariant moments are being used to recognize number. Image processing is extraction of digital data from image using mathematical operation. Template Matching and Optical Character Recognition are two main techniques used in image processing along with several pre-processing techniques used to extract accurate data. Some of the Pre-processing techniques are Edge detection, Gray Scale Image, enhancement Binarization, Image Segmentation etc. Edge detection for finding the boundaries of the object within the image is by sharpening the intensity of transitive regions. It works by detecting discontinuities in brightness. Enhancements include adjusting the brightness and contrast level of the images to make the pictures crispier to outline the curves and lines of the objects. Image segmentation is partitioning the digital image into multiple segments to simplify and change the representation of an image into something that is more meaningful, useful and easier to analyze.

Gray scale image is the process of converting an image in to gray scale format to reduce the color complexities; each pixel value is a single sample that carries only intensity information that ranges from black at the weakest intensity to white at the strongest. Binarization is the process of converting pixel image to binary image that is black and white. Image processing is used to authorize the vehicle by its license number thus providing complete automation of the gate with no user involvement without compromising security.

An artificial neural network is an interconnected group of nodes. It is represented as systems of interconnected group of neurons which exchange message between each other. It is used in pattern recognition, classification and function approximation fields. Neural network is used to recognize License plate from photographs of vehicle. Character segmentation is an important step in license plate recognition system. The neural networks are used in the process of segmenting characters from the license plate. The probabilistic neural network is used to identify alphanumeric characters from vehicle license plate.

The invariant moments are the extremely compressed image features, which meet the invariability of the image transformation, the ratio and the rotation to the continuous function. Therefore Hu invariant moments are widely used in the pattern recognition, the image classification, the target recognition and the scene analysis, and so on. Hu introduced seven nonlinear functions defined on regular moments which are translation, scale, and rotation invariant. This seven moment invariants were used in a number of pattern recognition problems. The characteristics of invariant includes translation, scale, and rotation, hence Hu invariant moments are employed to representation of a number recognition system through image.

II. RELATED WORK

Chen Yuan-yuan et al., [1] discuss about number plate characters recognition that uses AdaBoost algorithm. AdaBoost is based on template matching which is presented in order to improve reduce recognition time and recognition rate. The process is divided into two stages. In the first stage, Adaboost classification improved through training the classifier by template matching which is

improved through AdaBoost classification, and simultaneously classification rules are found. Number-plate classification rules are used to identify the characters and then classification results are obtained in the second stage

Tung Duy Ta et al., [2] discuss about Automatic Number Plate Recognition (ANPR). This model is designed and investigated by using a camera to capture an image. After that, the image is transmitted to a computer to process. The low pass filter is used to reduce noise and artifacts before software detects license plate. This method utilizes neural network to characters in the license are then extracted by an optical character recognition.

Yun Li'MeiXieet al., [3] discuss about An effective algorithm for number and letter character recognition. The Algorithm employs template matching, but in contrast to traditional template matching method uses the original pixel value to match. This algorithm obtains some features from the original image, and then retrieves an eigenvector of 192 dimensions. Before drawing features, the math morphologic algorithms used to dispose image. And then Euclidean distance is measured between the template vector and the sample vector. Then this can obtain the result of recognition. It can recognize characters which have high similarities characters like8 , B , R ,O and Q. This algorithm also has tolerance to the slightly tilt of the image.

Prathamesh Kulkarni et al., [4] discuss about Automatic Number Plate Recognition in which system automatically recognizes the vehicle's license number. Indian number plates varies from one to one, uniform style are not followed. The system employs algorithms like Feature based vehicle license number plate localization to locate the region of number plate, Image Scissoring is used for character segmentation and for character recognition, statistical feature extraction is used, which are designed for Indian license number plates. This system can recognize single and double line number plates.

Muhammad Tahir et al., [5] discuss about Automatic Number Plate Recognition. The system identifies the arrival of the vehicle and then captures the image of the vehicle. The region of Vehicle number plate is extracted using the image segmentation. Optical character recognition is used for recognizing characters. The resulting data is then used to compare with the records on a database.

Shoaib Rehman Soomro[6] discuss about Vehicle Number Recognition which uses efficient algorithms to detect the vehicle number from real time images. Vehicle license number plate is localized and characters are segmented. The captured image are converted to gray scale image and this system works for only gray scale images so it detects the number plate even though different color of number plates are used. Character recognized using template matching. The recognized vehicle number is then compared with the database or file store.

Sanchay Dewan et al., [7] discuss about number plate recognition system. The ant colony optimization technique is used to design the system. This system can be implemented in detecting stolen vehicles, surveillance systems and checking of vehicles at toll plazas, posts etc. Ant colony optimization technique serves better in edge detection while applying image segmentation. Ant colony optimization is introduced to give a better image edge detection. Pheromone matrix is established using Ant colony optimization which is based edge detection that represents the edge information contains each pixel position of the image, based on the movements of a number of ants which are dispatched to move on the image. The movements of these ants are driven by the local variation of the image's intensity values. This gives the number plate area extracted from the image with improved accuracy. A character recognition technique is used to produce the final vehicle's license number.

Lianwen JIN, et al., [8] discuss about Number Plate Recognition, this system can be divided into two stages: plate image processing and isolated plate number character recognition. In the field of isolated plate number character recognition, conventional methods includes template matching, MLP neural network, TDNN, SVM neural networks, mathematical morphology, image frequency analysis approach (such DFT). Plate number character recognition is in fact a typical OCR (Optical Character Recognition) problem. Many research progress have been achieved in the field of OCR, and a lots of effective methods have been developed, such as directional feature extraction method and classifier. It is interesting to notice that researchers in the field of ITS seldom used the advanced technologies developed in the field of OCR, especially on the stage of feature extraction. Many people just used original plate number image or compressed image as row feature.

Dongjin Lee et al.,[9] discuss about an efficient sequential selection from the set of External Regions (ERs) useful for end-to-end real-time scene text localization and recognition method. This algorithm is robust to blur, illumination, texture variation and color and handles low-contrast text. Zhang et al. suggested a new unsupervised text detection algorithm based on Histogram of Oriented Gradient and Graph Spectrum. This algorithm is robust to the color and size of text. Chen et al. suggested an algorithm that uses AdaBoost classifier for detecting text in unconstrained city scenes and applied commercial OCR software. The objective of this algorithm is to assist visually impaired individuals when they are walking around the city. Jose et al. introduced the Smart Vision system for detecting path borders and vanishing point for a blind person to correct their heading direction on paths and in corridors. Moving obstacles could be detected and tracked to be alerted and be informed to them.

Rajesh Kannan Megalingam et al.,[10] discuss about Automatic License Plate Recognition that is used to identify a vehicle by reading its license plates. There is a clear absence of standards for license plates in India. License plates are made of different materials and reflectivity may vary for one material to another. There are different colors of number plates which use different Character fonts, font size, line spacing and single line and double line numbers give rise to even more variability. Such difference increases complexity for automatic recognition of license plates. The extraction license number is the most challenging part in the

system. The use of Hough transform method helps to overcome the differences. Candidate rectangular regions are obtained by detecting horizontal and vertical lines. From regions, the rectangular region is chosen using the prior knowledge. Another method includes spectral analysis of the image. The license plate region, that has its characteristic frequency willrespondwhich has been filtered out from the rest of the image. In this method usage of the concept with connected elements in the image are been processed. Since the characters in the license number plate have a same size, they can be separated from the rest of the image.

LihongZheng et al.,[11] discuss about a number recognition algorithm on Spiral Architecture or a hexagonal image structure. This algorithm uses RULES-3 inductive learning method to recognize characters. This algorithm starts from collecting samples of characters from number plates. Edge detection is used to map edges of the samples based on Spiral Architecture. A rules set is extracted by these samples by RULES-3. The frequencies are described by rules of 9 different edge masks that appear in the samples. 7 hexagonal pixels form a cluster of each mask. In order to recognize a license number plate, all characters are tested one by one using the extracted rules. The number recognition can be achieved by counting these frequencies of the 9 masks.

P Vijayalakshmi, et al., [12] discuss about an algorithm for vehicle identification by recognizing the number plate which involves vehicle detection, plate localization and character recognition. In this system Genetic algorithm (GA) is used at two levels: for detecting vehicle and the license plate region from traffic image and recognizing characters from the license number plate. Detection is based on contour and shape information. GA is used to controls the window size to capture image each vehicle in a separate window. Connectivity and adjacency elements are used to locate and extract license plate and characters in it. Each character is recognized uniquely with help of a digital board with window panes added to it. GA is used at the second level to map character pixels into the window panes. For every character in the number plate, distinct feature vector is generated. A feature based matching is used for character recognition.

Dhiraj Y. Gaikwardet al., [13] discuss about the Automatic Number Plate Recognition which extracts vehicle license number from digital images. The system works accordingly, the first step is detecting the vehicle and capturing a image of the vehicle, front or back view, the second steps is the localizing the number plate and then extracting the vehicle number plate in an image. The last step is to use image segmentation, in which several methods like mathematical morphology, color analysis, and histogram analysis are carried out. Segmentation is used to recognize individual characters. Optical character recognition is to recognize the each character with the help of database stored for each alphanumeric character.

S.Kranthi et al., [14] discuss about two algorithms Edge Finding Method and Window Filtering Method for the development of the number plate detection system. In Edge Finding Method the original image is converted to gray scale image which is in high contrast, then the location of the number plate horizontally in which row its present is identified. The algorithm first determines the extent of intensity variation for each row, while in the second step it selects the adjacent rows. In window filtering method an appropriate window size is considered an appropriate window size is considered. The original image with complex Background is Filtered and the filtered image shows the High contrast regions apart from the number plate. A window is considered to exclude the surroundings from the image and concentrate on the actual image. On the basis of the expected size of the number plate the window size is estimated. The best result is obtained only if the window size equals the width of the number plate, but smaller window dimensions provide fairly good values too.

Bhupendra Moharil et al.,[15] discuss about Automatic number plate recognition system. Applications of Automatic number plate recognition system are parking management systems, border control and monitoring, and tracking vehicles. Using OCR technique number plate can be detected. Performance of OCR technique is governed by the image quality. In turn the environmental condition affecting the number plate that directly affects the image taken by the camera entirely governs the efficiency of the detection approach. With addition of QR codes, a novel method is proposed where the problems arising in the detection are reduced to a great extent.

Srbjit Kauret al.,[16] discuss about Automatic number plate recognition system The attributes of license number plate are background color, character color, character size, aspect ratio, font style, and script. The aspect ratio is very important factor. Aspect ratio is calculated as ratio of length to width. The automatic number plate recognition system consists of 4 main phases: Image Acquisition and Preprocessing phase, Number Plate Extraction, Character Segmentation and Character Recognition phase. In the first phase some preprocessing operations are performed on the image to make better quality input image. In the second phase, to extract the portion of the image, the exact location of number plate from whole vehicle image is detected. In the third phase the segmentation of characters from the extracted plate is done. The last phase is character recognition in which segmented characters are recognized and output is license plate number. In ANPR system, Number plate extraction phase is the most important phase because all others phases depend on extraction of number plate area.

Aminder Kaur et al.,[17]discuss about the License plate recognition in which First step is, Pre-Processing and Number Plate Localization, An image taken from an Infrared Camera is a gray-scale image it is an input image for pre-processing. By considering the background illumination conditions and the number plate localization algorithms Preprocessing is performed. Second step is, Character Segmentation, Various methods suggested for character segmentation are blob coloring and peak-to-valley method. Third step is, Pre-Recognition Character Enhancement, The segmented characters are extracted from input gray scale image. Using Ostu's method each character is binarized. Final step is Character Recognition using Support Vector Machine; A Support Vector Machine is a pattern recognizer that classifies the data. To separate different classes the hyper planes are used. To maximize a

measure of the margin between classes the hyper planes are constructed. An SVM corresponds to a linear method in a high dimensional feature space. The feature space to the input space is related non-linearly.

Ganesh R.Jadhavet al., [18] discuss about Automatic number plate recognition System. Automatic number plate recognition System is used to convert the pixel information of digital image into the ASCII text of the number plate. To identify the number plate of vehicle accurately, Mathematical morphological operations are applied. Mathematical morphological operations are based on operations such as image enhancement, morphological transformation, edge detection and extraction of number plate from vehicle image. After this, using template matching, segmentation is applied to recognize the characters present on number plate. The number plates must be separated from the background images prior to the character recognition. The two major methods to extract number plate are Edge Detection and Finding Rectangles in a vehicle Image.

Tuan Nguyen et al.,[19] discuss about, using neural network ANPR software on Android smart-phones is built which can be applied to support intelligent traffic monitoring. This method is divided into two main parts: i) using OpenCV and neural network ANPR software is built on mobile phone; ii) evaluating the software on real traffic. The ANPR development includes three main steps: to locate the area which contains the number plate AdaBoots classification method is used, using neural network for character recognition and to separate characters within the number plate morphology method is applied.

M. S. Mallikarjuna Swamy et al.,[20] discuss about the knee joint articular cartilage segmentation methods, validation methods, visualization, thickness measurement and volume measurement. The important biomarker for the progression of osteoarthritis (OA) is the change in cartilage morphology. The modality used to image the knee joint is Magnetic resonance imaging (MRI). For early detection and progression of the disease, Cartilage thickness measurement and visualization is used in case of OA affected patients. For knee joint image segmentation a wide variety of algorithms are available. They are classified as pixel and model based methods. Segmentation methods on the basis of human intervention required are classified as manual, semi-automatic and fully automatic methods.

BhartenduSeth et al.,[21] discuss about the mechanism for design of a marker suitable for planar motion analysis. The task of image processing is meant for marker design that is computationally less intensive so to make real time motion analysis practical. The equivalence table algorithm of Rosenfeld is used to segment the input image. The new marker facilitates automatic tracking and it provides both position and orientation information. On the basis of a text code markers are uniquely identified with respect to the marker geometry that is placed in a designated location. In this method, the text code of the bounding box is computed. Knowing the text orientation of the marker, the sub-image containing the text can be transformed, so that the text is aligned horizontally. This will permit a standard OCR routine to read the text code.

AishwaryaVisvanathan et al.,[22] discuss about Car Number Plate Recognition for Smart Building Management .The proposed method involves the below steps A. Text localization- text localization involves two phases, namely (i) template creation and (ii) image recognition. Template creation involves binarization, De-skewing the image. Hough transform is applied to estimate the skew and extracting the features. B. Feature Extraction from Test Image. C. Matching Template and Test Image.

Hongying Zhang et al.,[23] discuss about aircraft registration number recognition. This involves capturing clear image of the aircraft registration number, Image pre-processing, including interference removal, tilt correction and filtering is done. Then image processed to get images of single character. Finally extract statistical and structural features from the image segmented to identify the character. The character recognition technology has been applied in multiple areas such as IC card, and license plate recognition. Registration number positioning Registration number segmentation - This paper adopts the region growing algorithm to mark each single connected region with different color, and then extract each region which has the same marked color. Registration number identification -In order to balance the time-consuming and recognition rate, this paper adopts the most simple and the most commonly used method-template matching.

Priyanka Prabhakar et al., [24] discuss about Automatic Vehicle Number Plate detection and recognition. A technique to localize, segment and recognize the characters within the plate located is presented. Captured images from cameras are obtained and regenerated in to gray scale images. Using Hough transform, the Hough lines are determined and therefore the grey scale image segmentation is generated by finding edges for smoothing image. Finally, the single character within the registration code is detected.

Yew Cheong et al.,[25] discuss about a method using image processing to identify the edges and corners of clothes in an image. In clothes manipulation, it is important to identify the shape of clothes before spreading and folding by the GUI program. The first step in clothes manipulation, the robot needs to grab two real corners of the clothe, so that it can be spread easily. The computer vision system is an important part in finding the corner of clothes. Image processing is used to identify, the corner of the clothes so that it is easy for the robot to spread and fold the clothes. Basic morphological operations are used to filter the captured image to reduce the noise and disturbance and the data that is essential is extracted from the image for further processing. The main purpose of using this method is to identify the pixel in the image which is represented as a corner of the clothes and it becomes a starting point for the robot in clothes manipulation.

Caulfield Havlicek et al., [26] discuss about Advanced image processing techniques. using multimode IR processing the interested regions are extracted. As long format single color and multicolor sensors challenges in viewing and taking action on a much higher data volume and it also becomes challenging to end users. Reporting on processing techniques, to effectively extract targets that utilize multiple processing modes both multiple spectral and multiple pre-processed data bands from Focal Plane Array (FPA) sensors. Image processing techniques address the key pre-processing requirements, that includes scene based non-uniformity correction of pixels that are static and dynamic, multiband processing is used for object detection, reduction, management of clutter and non-targets in a cluttered environment. The motivating techniques include image pre-processing, extracting small percentage of the image set with high likelihood targets and then transmitting "active" pixel data while ignoring unchanging pixels. These techniques demonstrate significant reductions in the raw data, and allow the end user to more intelligently select data types for object identification without requiring a person in the loop.

Malik R et al., [27] discuss about Extraction of Text in Images, a text segmentation technique that is used in locating and extraction of text blocks in images. The algorithm has no prior knowledge of the text orientation, size or font. Information related to image background is eliminated and to highlight or identify the regions of the image that contain text. The algorithm is used to identify the text regions in an image by searching for several repeated instances which has uniform gray intensity of the same width. Combining this with the fact the ratio of type-face stroke width to height is fixed, this provides a useful technique for extracting text from images.

Anish Lazrus et al., [28] discuss about A Robust Method of License Plate Recognition using Artificial Neural Network. This paper is to design a system that can recognize vehicle license number plate under poor environmental conditions by using neural network. Adverse environmental condition may refer to the image has been blurred by poor lighting, rain and poor image resolution which make the image not clear. Recognition of a vehicle license plate is usually important for many security and control system. Character segmentation is an important step in license plate recognition system. The neural networks are used in the process of segmenting characters from the license plate. The probabilistic neural network is used to identify alphanumeric characters from vehicle license plate.

Zhihu Huang et al., [29] discuss about Analysis of Hu's Moment Invariants on Image Scaling and Rotation. Moment invariants have been widely applied to image pattern recognition in a variety of applications due to its invariant features on image translation, scaling and rotation. Moments and the related invariants have been extensively analyzed to characterize the patterns in images in a variety of applications. The well-known moments include geometric moments, zernike moments, rotational moments, and complex moments. In geometric moments, Hu derived six absolute orthogonal invariants and one skew orthogonal invariant based upon algebraic invariants. The moment invariants have been proved to be the adequate measures for tracing image patterns regarding the images translation, scaling and rotation under the assumption of images with continuous functions and noise-free. Moment invariants have been extensively applied to image pattern recognition, image registration and image reconstruction.

III. CONCLUSION

In this paper we have surveyed various techniques in processing the image. The raw image captured can be directly processed to extract data but Preprocessing of the image is important to increase the accuracy of the information extracted.

IV. ACKNOWLEDGMENT

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