Proceedings of the Sixth International Conference on Computing Methodologies and Communication (ICCMC 2022)
IEEE Xplore Part Number: CFP22K25-ART; ISBN: 978-1-6654-1028-1

2022 6th International Conference on Computing Methodologies and Communication (ICCMC) | 978-1-6654-1028-1/22/$31.00 ©2022 IEEE | DOI: 10.1109/ICCMC53470.2022.9753706

Automatic License Plate Detection using KNN and Convolutional Neural Network

[1]P Lavanya Kumari, [2]Ravoori Tharuni, [3]I V S Sai Vasanth, [4]M Vinay Kumar

[1]Associate Professor, [2,3,4] UG Scholar
Department of Computer Science and Engineering
Vignan Institute of Technology and Science
lavanya.madina@gmail.com

ABSTRACT: **License plate Recognition is a computerized machine that eventually detects a number plate from a given digital image. There are various operations that are enclosed with the detection of the number plate such as capturing images, locating the actual license plate, division of letters and the optical character recognition from those alphanumeric characters. Here, the major concept lies in developing and increasing the image transformation strategies where the algorithm locates the number plate by dividing each character with the help of OpenCV. The implemented is done with the help of K-Nearest neighbor algorithm in Python programming language. Some of the real-life applications where this system is used is security, detection of speed of vehicle at highways, violation of light and text printed identification.**

KEYWORDS**: License Plate Recognition, K Nearest Neighbor, Segmentation, OpenCV.**

1. INTRODUCTION

There are various people from their individual countries get connected as research community in a multicultural environment where they come up with efficient solutions for the human problems. Now-a-days, People are using vehicles more frequently compared to the previous years. Each vehicle has a specific unique authenticated ID as their identifier. The license is legally referred by this ID that is given to the person so that they can make use of them as unique identifiers.

The number plate recognition approach incorporate many modules for efficient recognition. They are, localizing the number pad so that the area of number plate is drawn out from the digital image [1]. Then sequential panel number detection is done [2] and later truncation of characters from the obtained panel and then detection is done [3]. The predominant step is to determine where the number pad is located exactly from the image that is being captured [4]. In the plated region, unwanted noise is

pulled out by translating components that are together [5].

License plate recognition is a controlled system that takes vehicle image as input and the output is the string of characters that are detected from the given image [6].

2. RELATED WORKS

Localization, character segmentation, and character recognition are the three most significant processes in character detection.

One of these steps [7] uses the adaptive threshold mechanism that suppresses the background and highlights the characters. To convert into binary image from colored image, Component algorithm is applied, and it also removes unwanted image spaces [8]. A special algorithm that has unique set of rules to truncate the characters from the Optical Character Reader engine Pytesseract is applied to return decoded value for each character by using Image Scissoring. This process is implemented in OpenCV [9].

Another method [10] is used to classify the characters. In preprocessing state, scaling is performed and edges are detected. The problems of fragmentation of characters are addressed by component survey [11]. This is done using Backward-propagation method.

[12] Another way wherein Localization is done using Binarization that is related to evaluation. The Point Analysis technique gets rid of unwanted factors and combines split factors and break up factors [13-15].

3. SYSTEM ARCHTECTURE

There are two types of license plates in our country. The first has black characters on a white pad, while the second has black characters on a yellow pad.

The high-level diagram that addresses these two types of number plates, is shown below.

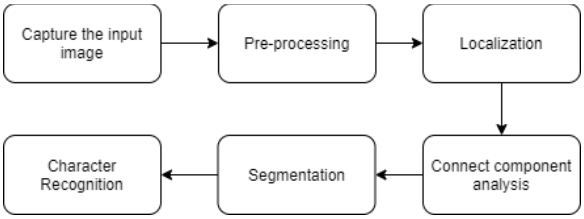

Figure 1. Proposed system architecture

4. Algorithm

The algorithm of proposed system is given below.

1. Start
2. Input: Captured image
3. Output: Alphanumeric characters
4. LP: License Plate
5. Transform RGB image to Grayscale image.
6. Removal of pixel boundaries.
7. Conversion of Grayscale image to binary image (B/W image)
8. Gaussian blurring for reduction of size of image
9. Search for all edges in image
10. Find & detect all possible characters in image

11. The LP that has highest candidate characters are cropped out.
12. Crop the license plate from obtained image.
13. Reapply the transformation from steps 6 to 11 on the cropped plate.
14. Display the characters that are detected
15. Stop

4.1. KNN Algorithm:

KNN algorithm is one of the most used algorithms in the field of computer science. Two main features of this algorithm are: It is non-parametric and lazy learning which helps in estimating the target function locally. As KNN is a non – parametric algorithm it does not make any assumptions on the underlying data distribution. It uses a database that classifies the data points into different groups to anticipate the classification of a new sample point. One such advantage of using this technique is its ability to classify multiple data points. If a need arises for the data to be classified into more than two categories, KNN is the best algorithm to use.

KNN algorithm uses feature similarity to predict the new data point values. This implies that, the value assigned to these new data points depend entirely on its closeness to the given training set.

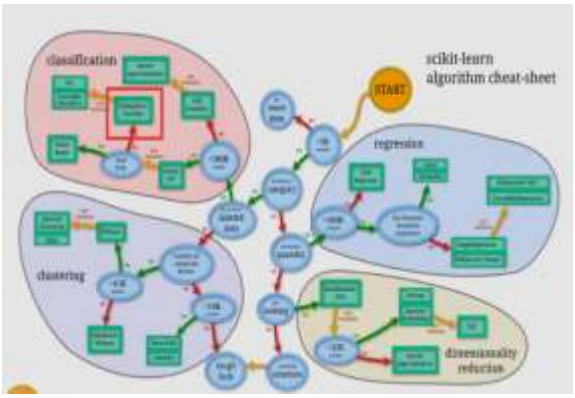

Figure 2. Classification using KNN algorithm

From the Figure 2, it is observed that KNN can be applied to classification or Regression or Dimensionality reduction or Clustering. Some of the real-time applications include handwritten text recognition using OCR, image, and video recognition.

4.1.1. Advantages and Limitations of KNN

Advantages:

- There are no particular assumptions on the data that is to be given.
- KNN is a simple algorithm. It is easy to explain and to understand and also easy in interpreting the results.
- Highly accurate — it is relatively high but not high when compared with supervised machine learning models.
- Versatile (Both classification/regression)

Limitations:

- Since it stores all training data in database, it is not cost effective.

- High memory requirement (Usage of database)
- It takes more time for the prediction.
- Sensitive to irrelevant features

5. IMAGE PROCESS FLOW

Vehicle image capturing is done by using a high-resolution camera and then it is given as input for detection of the plate.

Figure 3. Original image

Let the captured image be original scene and pre-process it. After the prepressing, The RGB image is transformed into grey image

Figure 4. Grayscale image

After the greyscale image is obtained, the possible edges are detected. From those detected edges, possible characters are found.

Figure 5. Edge detection

Figure 6. Character detection

From the detected edges, The numberplate with highest matching characters are taken out and then text is recognized from that plate.

Figure 7. Highest matching characters detection

6. TEXT RECOGNITION FROM THE PROCESSED IMAGE

The below image is obtained after prepressing and the same procedure is applied for the extracted number plate to detect each character in the plate. Here after prepressing is applied, Transformation of grey scaled image to black and white image is done. Finding the vector of possible plates is done. The highest matching character is taken out and then it is checked with the number plate pattern and then the characters are extracted. If there are any overlapping among the characters, they are removed. Hence,

the string of characters is detected and is displayed out as output[16-17].

Figure 8. Text recognition from the preprocessed image

7. FLOW DIAGRAM

The flow diagram of the proposed model is given in Figure 9.

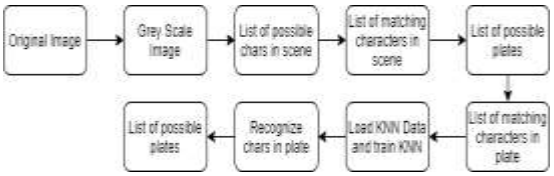

Figure 9. Flow diagram of the proposed model

8. RESULT ANALYSIS

Table 1 gives the accuracy of the operations that are performed for the image detection.

Table 1. Accuracy of the operations

Operation	Sample	Success	Fail	S_Ratio
License Plate Localization	100	92	8	92%
Character Separation	92	88	4	95.7%
Character Recognition	88	83	5	94.3%

9. PERFORMANCE ANALYSIS

Initially, it nearly took around 18 seconds for recognizing. For extracting the plate successive studies with set of rules made took 2 seconds. One of the important components that determines the performance analysis is the scale of input image.

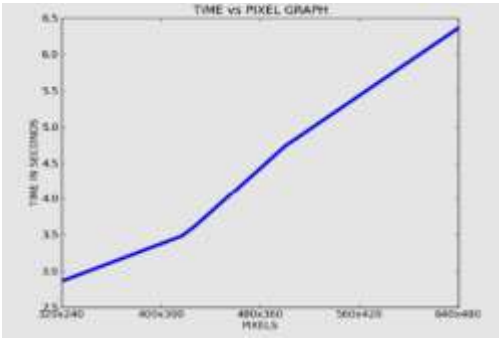

Figure 10: Performance graph

From Figure 10, it is understood that the performance can be depicted and also the performance analysis in terms of pixel and time is higher than the existing systems.

10. CONCLUSION

While scanning the number plate, shape analysis method may produce unsuccessful results to locate the region of the number plate. The work can be extended by using template matching techniques to recognize the characters. This proposed technique works well in a variety of lighting settings and with a variety of number plates often found in India. Even though there are obvious limitations, this is a viable alternative to the current system.

REFERENCES

[1]. R. Sudhashree, N. Muthukumaran, 'Analysis of Low Complexity Memory Footprint Reduction for Delay and Area Efficient Realization of 2D FIR Filters', International Journal of Applied Engineering Research, Vol. 10, No. 20, pp. 16101-16105, 2015.

[2]. Guna Sekhar Sajja, Malik Mustafa, Dr. R. Ponnusamy, Shokhjakhon Abdufattokhov, Murugesan G., Dr. P. Prabhu, "Machine Learning Algorithms in Intrusion Detection and Classification", Annals of RSCB, vol. 25, no. 6, pp. 12211–12219, Jun. 2021.

[3]. N. Muthukumaran and R. Ravi, 'The Performance Analysis of Fast Efficient Lossless Satellite Image Compression and Decompression for Wavelet Based Algorithm', Wireless Personal Communications, Volume. 81, No. 2, pp. 839-859, March 2015.

[4]. Niha, K., Amutha, S., Banu, A. , (2021), A Convolutional Neural Network based System to Detect Plant Disease, Webology, 18, pp. 944–962.

[5]. N. Muthukumaran and R. Ravi, 'Hardware Implementation of Architecture Techniques for Fast Efficient loss less Image Compression System', Wireless Personal Communications, Volume. 90, No. 3, pp. 1291-1315, October 2016.

[6]. Potluri, Sirisha, et al. "Secure Intelligent Framework for VANET: Cloud Based Transportation Model." Cloud Security: Techniques and Applications (2021): 145

[7]. N. Muthukumaran and R. Ravi, 'VLSI Implementations of Compressive Image Acquisition using Block Based Compression Algorithm', The International Arab Journal of Information Technology, vol. 12, no. 4, pp. 333-339, July 2015.

[8]. Mohanty, Sachi Nandan, et al. "Cloud Security Concepts, Threats and Solutions: Artificial Intelligence Based Approach." Cloud Security: Techniques and Applications (2021): 1.

[9]. N. Muthukumaran, N. R. G. Prasath and R. Kabilan, "Driver Sleepiness Detection Using Deep Learning Convolution Neural Network Classifier," 2019 Third International conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud), Palladam, India, 2019, pp. 386-390.

[10]. G. S. . Saiia, H. . Pallathadka, D. M. . Naved, and K. Phasinam, "Various Soft Computing Based Techniques for Developing Intrusion Detection Management System", SPAST Abs, vol. 1, no. 01, Sep. 2021.

[11]. S. Gayathri, D. C. J. W. Wise, P. B. Shamini and N. Muthukumaran, "Image Analysis and Detection of Tea Leaf Disease using Deep Learning," 2020 International Conference on Electronics and Sustainable Communication Systems (ICESC), Coimbatore, India, 2020, pp. 398-403, doi: 10.1109/ICESC48915.2020.9155850.

[12]. Patel, C., Patel, A. and Patel, D., 2012. Optical character recognition by open source OCR tool tesseract: A case study. International Journal of Computer Applications, 55(10), pp.50-56.

[13]. J. Rebekah, D. C. J. W. Wise, D. Bhavani, P. Agatha Regina and N. Muthukumaran, "Dress code Surveillance Using Deep learning," 2020 International Conference on Electronics and Sustainable Communication Systems (ICESC), Coimbatore, India, 2020, pp. 394-397, doi: 10.1109/ICESC48915.2020.9155668.

[14]. Angel, G., J. Rethna virgil Jeny, and J. Albert Simon. "ALPR for Ambiguous Character using Template Matching with Fuzzy Classifiers: a Survey." International Journal of Computing 2.6 (2013): 234-244.

[15]. R. Kabilan, N. Muthukumaran, "A Neuromorphic Model for Image Recognition using SNN", 2021 6th International Conference on Inventive Computation Technologies (ICICT), Coimbatore, India, 2021, pp. 720-725.

[16]. Jameson, J., Huda Sheikh Abdullah, S.N., Aisyah Nik Ghazali, N.N. and Zamani, N.A., 2013. Multiple Frames Combination Versus Single Frame Super Resolution Methods for CCTV Forensic Interpretation. Journal of Information Assurance & Security, 8(5).

[17]. B. Allwin Devaraj, T. Aruna, N. Muthukumaran, Andrew Roobert, "Adaptive Cluster-Based Heuristic Approach in Cognitive Radio Networks for 5G Applications", Transactions on Emerging Telecommunications Technologies, Volume 33, Issue1, January 2022.

[18]. J.Rethna Virgil Jeny, Chetan Anil Joshi, "Flexible Data Streaming In Stream Cloud" , International Journal of Innovative Research in Science, Engineering and Technology, Vol. 2, Issue 4, April 2013, ISSN: 2319-8753, pp:1127-1131

[19]. Jeeva. R, Muthukumaran. N, 'Identification of Fictitious Messages in Social Network using E-Hits and Newsapi', International Journal of Innovative Technology and Exploring Engineering, Vol. 9, Issue. 10, pp. 7- 11, August 2020.

[20]. J.Rethna Virgil Jeny,Chetan Patil, Kuldeep Yadav, Mrunalini Thorat, Varsha Wandhekar, " Real Time Production Data Monitoring System" , International Journal for Advance Research In Engineering and Technology, Volume 1, Issue II Mar. 2013 ISSN 2320-680, page:43-46.