

Automatic Number Plate Recognition System using Deep Learning Techniques

1B. Srinivasulu, Asst. Professor, Department of Information Technology, BVRIT HYDERABAD
College of Engineering for Women, Hyderabad, Telangana 500090.

2Srinivasa Rao Dhanikonda, Associate Professor, Dept of Information Technology, BVRIT
HYDERABAD College of Engineering for Women, Hyderabad, Telangana 500090.

Abstract:

One of the most significant methods utilized in the deep learning approach is text recognition. Text recognition is now a very significant activity that is utilized in many applications of current gadgets to recognize images in a detailed manner. Automatic Number Plate Recognition, for example, is an image processing approach that detects the vehicle's number (license) plate. The Automatic Number Plate Recognition system (ANPR) is a key feature that is used to manage traffic congestion. The goal of ANPR is to devise a method for automatically identifying permitted vehicles using vehicle numbers. Automatic Number Plate Recognition (ANPR) is utilized in a variety of applications, including traffic control, vehicle tracking, and automatic payment of tolls on roads and bridges, as well as monitoring systems, parking management systems, and toll collecting stations. The established approach first recognizes the vehicle before taking a picture of it. After that, the number plate region in the car is localized using a Neural Network, and the image is segmented. Using a character recognition approach, characters are retrieved from the plate. The results, together with the time stamp, are then saved in the database.

Keywords: Automatic Number Plate Recognition, OCR, Segmentation, Binarization, Identification.

I INTRODUCTION

Text recognition is one of the most important method which is used in the deep learning

technique. For example Automatic Number Plate Recognition system is used to identify the characters located on the number plate of the vehicle. In this method, it gives a good result in the recognition of the text from images captured by CC Cameras[7].

ANPR framework is utilized to beat the downsides and insufficiency of fruitful observation by camera[11]. The ANPR framework is all around created in certain nations like USA and Dubai, and it is now existed from a some time in the past, yet in 90s it become a vital application due to enormous expansion in the quantity of vehicles[2]. The information that is gathered from the tag is generally utilized for traffic observing, access control, leaving, motorway street ringing, and boundary control, making vehicle logs for leaving systems[4], venture time estimation for tollgate and so on by the law implementation offices. The issue that emerges in acknowledgment is by and large sub separated in to 5 parts: (1) Image obtaining for example catches the picture in the tag (2) pre-handling the picture (3) confining the tag (4) character division for example recognize the image pictures on the plate, (5) optical person acknowledgment. Here it assists with fine tuning the framework[7][12]. So the issue can decrease the application in explicit country. For instance, the standard will print the tag number in dark tone on a white back ground for private vehicles and for business vehicles yellow back ground is utilized in India.

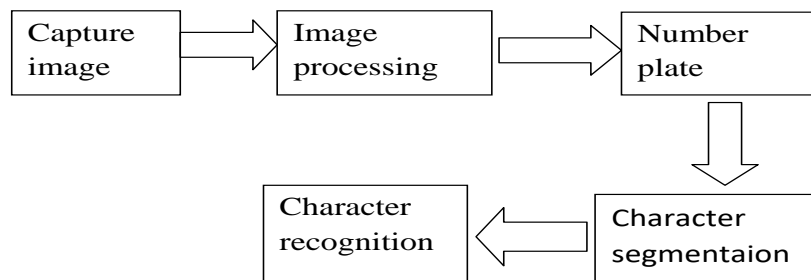


Fig 1: Block diagram of ANPR model

Number Plate Identification:

Hybrid techniques are used in the algorithm to detect the number plate in the vehicle. Some following factors that are used to detect the vehicle number plate are to be considered.

By using image segmentation number plate can be extracted[6]. Various methods are used in image segmentation to detect number plate.

Image Binarization:

Image binarization is an interaction which is utilized to change over a picture from highly contrasting. Here edge is utilized to separate certain pixels as white and certain pixels as black. The principle issue is to address edge an incentive for specific picture. Now and again it is difficult to choose ideal edge value[4]. To defeat this issue Adaptive edge is utilized. By choosing calculation or physically chose by client naturally is called programmed edge.

Character Segmentation:

After detecting number plate, selected characters are tested for the further process. For plate segmentation many methods are used to recognize the character. Many methods are used to use to fall in more than one category but it is impossible to do category wise discussion. Here some of the methods that are used for character segmentation are image binarisation and CCA[14]. Characters that are recognized by using character segmentation. Character identification is not possible in character segmentation due to errors that are occurred sometimes[4]. Vertical and horizontal projection gives better results for segmentation.

Character Recognition:

Character recognition helps to identify and it is going to convert the image text in to modifiable text[6]. Character recognition is a process of transforming data from bit map representation in to form of descriptors, which are more suitable for the computers[15]. Here character recognition should be invariant towards the user font type, or deformation formed by a skew.

Problem Statement:

The rapid increase of globalization evolved the need of efficient tracking and management of road traffic. Number Plate Recognition is the technique which is utilized to identify and perceived the vehicle number plate or tag. Here we use image handling methods to remove the vehicle number plate from advanced images[17]. Number Plate Recognition comprises of two parts: First one is A camera that is utilized to catch vehicle number plate pictures, and programming the concentrates number in the vehicle tag by catching the pictures utilizing character acknowledgment apparatus that takes into consideration pixels to move information in mathematical to intelligible characters[3]. It is exceptionally utilized in many fields, for example, vehicle following, traffic checking, programmed installment of costs on roadways or spans, reconnaissance frameworks, tolls assortment focuses and leaving the executives systems[15].

II LITERATURE SURVEY

Scope of the work:

To construct a system for identifying a vehicle's licence plate and storing the extracted characters from the number plate in a database together with the time stamp[3]. This paper aims to create real-time application which can be used for identifying characters on the number plate that is used for vehicle tracking, automatic toll payment, surveillance systems etc.

Functional Requirements:

1. Vehicle automatic recognition, number plate location, and feature extraction capabilities.
2. Save the information gleaned from the licence plate.
3. If there is a requirement for evidence in a disagreement or a criminal situation, retrieve and change information.

Non-Functional Requirements:

1. User information (confidential data) is accessed in a secure manner.
2. Availability should be 24 hours a day, seven days a week, and efficient.
3. Optimized component design for maximum performance.
4. A flexible service-based architecture will be especially desired for future development.
5. In the event of a system failure, the system must show the essential information to prevent the system from failing.

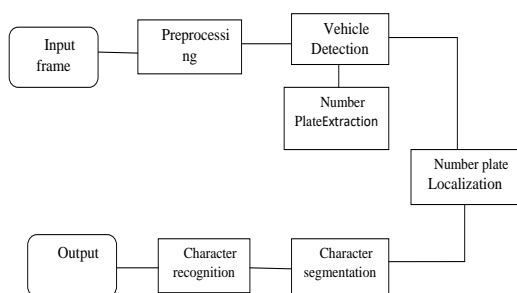


Fig: vehicle number plate recognition

Summary of Research work:

□ **K. Pranathi and S. Kranthi:** They proposed in this work that Automatic Number

Plate Recognition (ANPR) is a method for capturing a vehicle's image and verifying its licence number. The usage of ANPR in the display of stolen automobiles is possible. ANPR can be utilised in a variety of ways, including locating a stolen vehicle on the highway.

□ **Abd Kadir Mahamad:** They showed how to use image processing and optical character recognition to do an automatic number plate inspection of letter sets of plates in this paper. Using the LABVIEW programme, an imperative system of training interface was constructed.

□ **Kuldeepak and his colleagues:** They stated in their study that when streets are crowded and a large number of vehicles pass through, a high level of precision is required for number plate recognition. They achieved a precision of 98 percent in this paper by tweaking several parameters[19]. It is critical that for the tracking of stolen automobiles and vehicle monitoring, 100 percent accuracy cannot be compromised. As a result, improved precision streamlining is necessary. Additionally, stains, hazy areas, and smudges with varying font styles and sizes should be remembered. This work can be expanded in order to reduce errors caused by them.

□ **Amr Badr and his colleagues:** In this paper, we show how automatic recognition of a vehicle's licence plate number has become an indispensable part of our daily lives. This study explains how to use Morphological operations, Histogram manipulation, and Edge finding Techniques for plate localisation and character segmentation in an Automatic Number Plate Recognition System (ANPR). Character classification and recognition are done using Artificial Neural Networks. Model T of the Anpr System[13].

□ **S. Du, M. Shehata, W. Badawy [2]:** Describe a comprehensive overview of existing ALPR techniques by categorising them based on the features used in each stage. In terms of benefits, drawbacks, recognition outcomes, and processing speeds, they were compared. At the conclusion, an ALPR forecast was given. Multi-

style plate recognition, video-based ALPR leveraging temporal information, multi-plate processing, high-definition plate image processing, and ambiguous-character recognition should be the focus of future ALPR research[11].

□ **B. Madhuravani et.al [23-27]** , explained Automatic prediction of silent heart attacks using hybrid classification algorithms with a strong security using multi chaotic authentication model.

III METHODOLOGY

The detection of a number plate region is the initial stage in this procedure. This is accomplished by incorporating algorithms capable of detecting a rectangular region of the number plate in an original image. There are four key phases in the detection and recognition process.

By acquiring pictures of data it does the variety of vehicles, which are then sent into the computer code, which converts them to greyscale images. To get the quantity plate and its characters, modifications in contrast, brightness, and gamma are made to their optimal values. The region with the highest chance of a number plate is then masked and removed for further processing. The resulting region of interest is now searched for characters and digits by constantly altering the enclosing box's coordinates. The result is recorded in computerized software, which verifies whether it has all of the digits in the number plate on each loop. When the results fulfil the specified requirements, the computer shows the quantity and ends the programme execution so that the next image may be analyzed. Here to develop system the following steps are involved.

Proposed Solution:

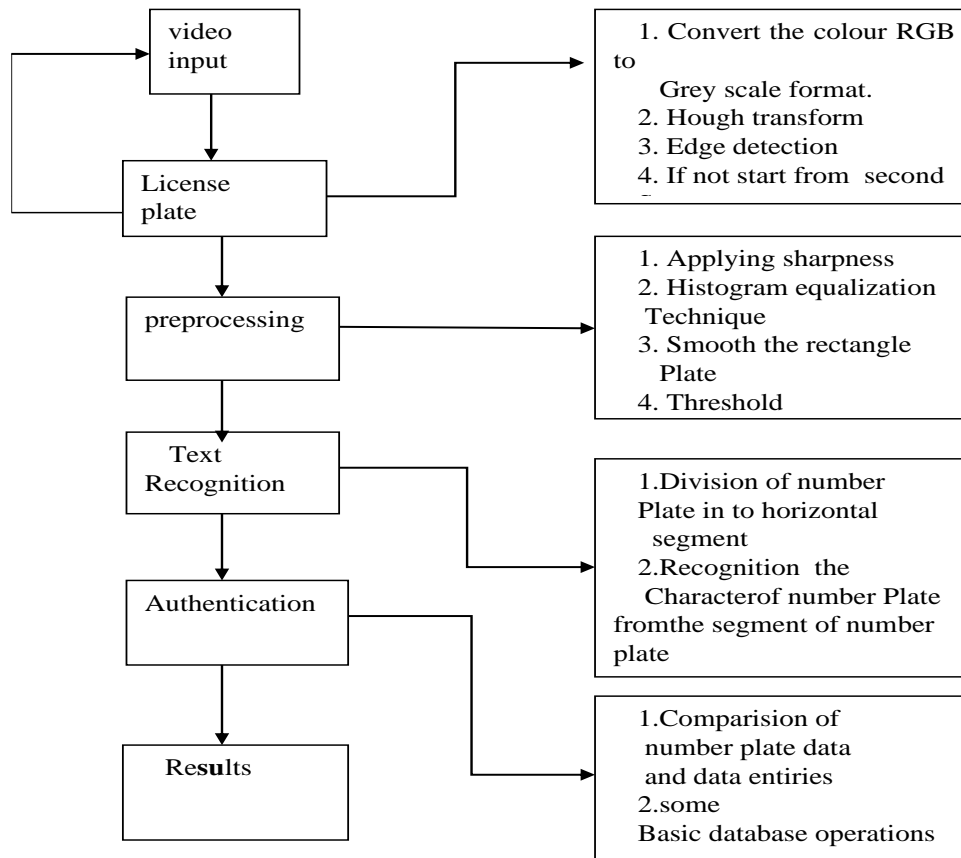


Fig : Flow chart of proposed system

Pre-processing:

The input image includes a lot of colours, therefore it's preprocessed to improve the standard and get it ready for the following steps. Because the image contains varied colours, the system uses the NTSC standard to transform the RGB images to grey scale images.

$Gray=0.299*Red+0.587*Green+0.114*Blue$

In the following part, the grey picture is filtered with a median filter to reduce noise while maintaining image clarity. We utilize a nonlinear filter to replace each pixel with a value calculated by computing the median of pixel values. By categorizing images into many groups by

Total number of groups = Height / Candidate region Extraction

Segmentation :

After identifying the number plate region in an image/video, this is the following step to segment characters. It is one of the most essential procedures in automatic number plate identification, when all phases are taken into account. If segmentation fails, a character may be incorrectly united or separated into two halves. If only one-row plates are assumed, segmentation can be accomplished by identifying character boundaries.



The acquired segments are improved in the second part of the segmentation. The segment phase of a plate comprises not just characters, but also unwanted elements such as dots and superfluous space on the character's borders. These elements must be removed, leaving simply the character. By identifying the space in its horizontal projection, we can partition it. We use the adaptive threshold filter on a regular basis to strengthen the plate before segmentation phase's vicinity. With non-uniform lighting, the adaptive threshold aids in distinguishing dark foreground from light background.

IV AUTOMATIC NUMBER PLATE RECOGNITION SYSTEM

Typical ANPR system consists of four steps these are Image Acquisition, License Plate extraction, character segmentation, and character recognition[1].

Image Acquisition:

The first stage in this system is image acquisition, which involves taking a picture using a digital camera connected to a computer. Because the pictures were recorded in RGB format, they could be processed further for Number Plate Extraction. The database system stores the car owner's personal information as well as a few plate vehicle pictures, abbreviations, and acronyms[2].

Image Conversion:

After the image is acquired, Numerous factors influence the acquired picture, such optical structure bending, system irritation, nonattendance of show, or extreme relative development of the camera or vehicle, and so forth The outcome is a spoiled gotten vehicle picture and a horrendous impact on resulting picture processing[7][8]. In this manner before the fundamental picture dealing with, pre-planning of the acquired picture should be taken out which contain changing RGB over to dim, commotion clearing, and line improvement for brightness[1][9].

Plate Localization:

The principle objective in acknowledgment of vehicle Number Plate is to recognize the plate size. Number plates resemble rectangular plate, area props work is given by mat lab tool compartment. It is utilized to communicate a bunch of properties for each checked district in the lattice. In this we utilized bouncing box to appraise the properties of the picture area. In the wake of marking the related components[5], the area will remove from the information picture. Number plate restriction is showed up.

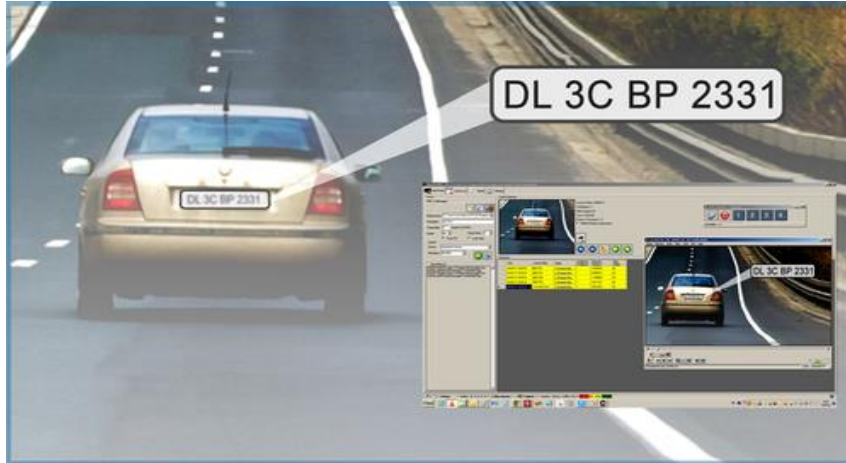


Fig: Captured Image, Converted to Gray Image and Recognized characters in the image

Image Segmentation:

In an ANPR system, number plate segmentation is critical. The following is used to determine which picture pixels fulfil the requirements. At every location when such a pixel is found, its neighbor's are evaluated, and if any of them meet the requirements, both pixels are considered to be in the same region. We extract individual characters and numbers from the picture using vertical and horizontal scanning techniques[16].

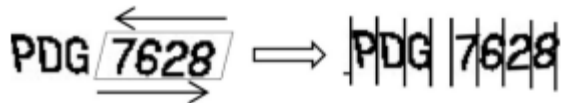


Fig: Example of Plate Segmentation

Character Recognition:

This is the most significant and essential period of the ANPR framework. It shows the methods that were utilized to request and

afterward decipher the singular characters. The order is done dependent on the extricated highlights. By utilizing factual, syntactic or neural philosophies highlights are arranged. For acceptance of letters and characters in the paper we utilize particular strategies[10][13]. ID is done by working out the similarity of provisions.



Fig: Database of templates.

Proposed Methodology:

At first add all structures and add them into mat file to recognize number plate. After that read the picture and change it into gray scale. Now the gray scale picture will be converted into binary image by performing thresholding.

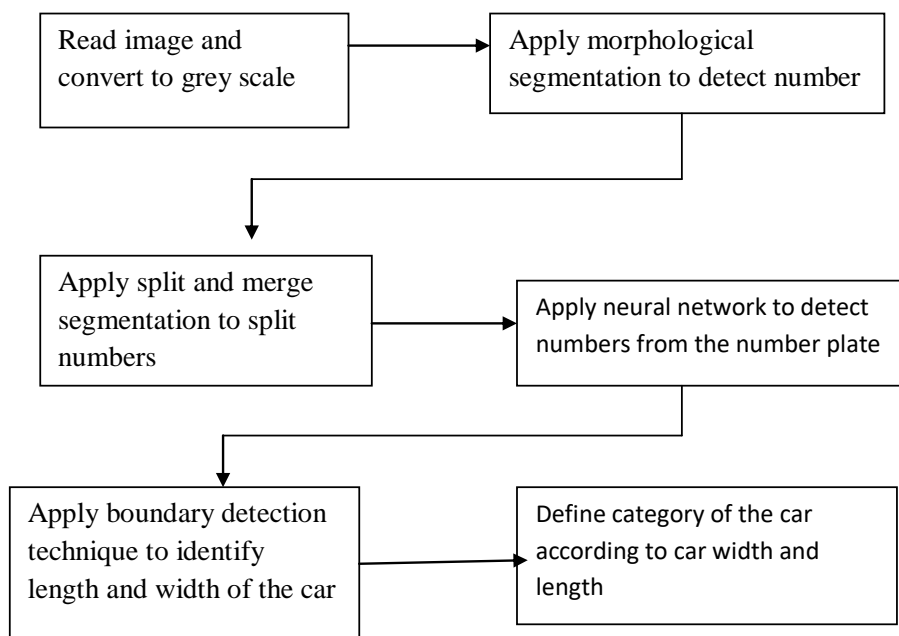


Fig: Flowchart

V CONCLUSION

We have successfully developed a fully working Number plate recognition system that uses two convolutional neural networks in association with Character recognition and Character segmentation and licence plate detection is used to detect the number plate. The majority of the number plate acknowledgment system's components have been successfully deployed. Our proposed approach works in general situations when the distance between the camera and the vehicle is unrestricted and weather conditions are unfavourable. However, when the distance between the camera and the vehicle remains constant, the performance of our system improves. To enhance the segmentation section and we collect more data has successfully trained. Other prominent methods, such as Artificial Neural Network, can help enhance optical character recognition. I mean to make a ANPR framework with its own information base, UI, and approval framework dependent on number plate distinguishing proof.

REFERENCES

1. Cynthia Lum, Julie Hibdon, Breanne Cave, Christopher S. Koper, and Linda Merola,

"License plate reader(LRP) police patrols in crime hot spots: an experimental evaluation in two adjacent jurisdictionss," Journal of Experimel Criminology, Springer Netherlands, , pp. 321-345, 2011.

2. K.V. Suresh, G. Mahesh Kumar, and A.N. Rajagopalan, "Superresolution of license plates in real traffic videos," IEEE Trans. Intell. Transp. Syst, vol. 8, no. 2, pp. 321- 331, 2007.

3. YushuangTian, Kim-Hui Yap, and Yu He, "Vehicle license plate super-resolution using soft learning prior," Multimedia Tools and Applications, Springer US, pp. 519-535, 2012.

4. D.H. Ballard, "Generalizing the Hough Transform to Detect Arbitrary Shapes," Pattern Recognition, vol. 13, no. 2, pp. 111-122, 1981.

5. Shen-Zheng Wang and Hsi-Jian Lee, "A cascade framework for real-time statistical plate recognition system," IEEE Trans. Inf. Forensics security, vol. 2, no. 2, pp. 267-282, 2007.

6. PrathameshKulkarni, AshishKhatri, PrateekBanga, and Kushal Shah, "Automatic Number Plate Recognition (ANPR)," in RADIOELEKTRONIKA.19th International Conference, 2009.

7. Hui Wu and Bing Li, "License Plate Recognition System," in International

Conference on Multimedia Technology (ICMT), 2011, pp. 5425-5427.

8. AbdulkarSengur and YanhuiGuo, "Color texture image segmentation based on neutrosophic set and wavelet transformation ," Computer Vision and Image Understanding, vol. 115, no. 8, pp. 1134-1144, August 2011.

9. Jiann-Jone Chen, Chun-Rong Su, W.E.L Grimson, JunLin Liu, and De-HuiShiue, "Object Segmentation of Database Images by Dual Multiscale Morphological Reconstructions and Retrieval Applications," IEEE Transactions on Image Processing, vol. 21, no. 2, pp. 828-843, 2012.

10. MahmoodAshooriLalimi, SedighehGhofrani, and Des McLernon, "A vehicle license plate detection method using region and edge based methods," Computers & Electrical Engineering, November 2012.

11. M. S. Sarfraz et al., "Real-Time automatic license plate recognition for CCTV forensic applications," Journal of Real-Time Image Processing- Springer Berlin/Heidelberg, 2011.

12. Rongbao Chen and YunfeiLuo, "An Improved License Plate Location Method Based On Edge Detection," Physics Procedia, vol. 24, pp. 1350-1356, 2012.

13. T Naito, T Tsukada, K Kozuka, and S yamamoto, "Robust license-plate recognition method for passing vehicles under outside environment," IEEE Transactions on Vehicular Technology, vol. 49, no. 6, pp.

14. DewenZhuang and Shoujue Wang, "Content-Based Image Retrieval Based on Integrating Region Segmentation and Relevance Feedback," in International Conference on Multimedia Technology (ICMT), 2010, pp.

15. Bo Peng, Lei Zhang, and D Zhang, "Automatic Image Segmentation by Dynamic Region Merging," IEEE Transactions on Image Processing, vol. 20, no. 12, pp. 3592-3605, 2011.

16. Cheng, Chang; Koschan, A; Chen, Chung-Hao; Page, D.L; Abidi, M.A, "Outdoor Scene Image Segmentation Based on Background Recognition and Perceptual Organization," IEEE Transactions on Image Processing, vol. 21, no. 3, pp. 1007-1019, 2012.

17. ShahidMehmood, Stefano Cagnoni, Monica Mordonini, and Shoab Ahmad Khan, "An

embedded architecture for real-time object detection in digital images based on niching particle swarm optimization," Journal of RealTime Image Processing, Springer-Verlag, pp. 1-15, 2012.

18. FatihKurugollu, BülentSankur, and A. EmreHarmanci, "Image segmentation by relaxation using constraint satisfaction neural network," Image and Vision Computing, vol. 20, no. 7, pp. 483-497, May 2002.

19. S.H. Ong, N.C. Yeo, K.H Lee, Y. V. Venkatesh, and D.M. Cao, "Segmentation of color images using a twostage self-organizing network," Image and Vision Computing, vol. 20, no. 4, pp. 279-289, 2002.

20. EtyNavon, Ofer Miller, and Amir Averbuch, "Color Image segmentation based on adaptive local thresholds," Image and Vision Computing, vol. 23, no. 1, pp. 69-85, January 2005.

21. Ying Zhuge, Jayaram K. Udupa, and Punam K. Saha, "Vector scale-based fuzzy-connected image segmentation," Computer Vision and Image Understanding, vol. 110, no. 2, pp. 177-193, March 2006.

22. Daniel Crevier, "Image segmentation algorithm development using ground truth image data sets," Computer Vision and Image Understanding, vol. 112, no. 2, pp. 143-159, November 2008.

23. B. Madhuravani, N. Chandra Sekhar Reddy, B. Lakshmi, Parallel Enhanced Chaotic Model-Based Integrity to Improve Security and Privacy on HDFS, Smart Innovation, Systems and Technologies, 2021, 224, pp. 141–148

24. B. Madhuravani, Gudipati Sri Sowmya, P. Sowjanya, Automatic prediction of silent heart attacks using neural networks based hybrid classification system, International Journal of Advanced Trends in Computer Science and Engineering, 2020, 9(5), pp. 7165–7169, 40

25. B. Madhuravani, Dr DSR Murthy, A novel secure authentication approach for wireless communication using chaotic maps, Proceedings - International Conference on Trends in Electronics and Informatics, ICEI 2017, 2018, 2018-January, pp. 360–363

26. B. Madhuravani, Dr DSR Murthy, A hybrid parallel hash model based on multi-chaotic maps for mobile data security, Journal of

Theoretical and Applied Information Technology,
2017, 95(3), pp. 661–669

27. B. Madhuravani, N. Chandra Sekhar Reddy, K. Sai Prasad, B. Dhanalaxmi, V. Uma Maheswari,. Strong and secure mechanism for data storage in cloud environment, International Journal of Advanced Trends in Computer Science and Engineering, 2019, 8(1.3 S1), pp. 29–33