Identifying Vehicles for Parking Records: Image Processing and Data Mining

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Advanced parking solutions have evolved in recent years. Our parking systems require manpower. As a result, time is wasted and constant labour is required. In order to stop the wastage of time and continuous labour, advanced technology is needed. The purpose of this study is to provide an image processing and data mining approach for identifying vehicle information in order to retain parking records. This study highlights an essential technology that leads to a cost-effective solution to the parking issue.

1 INTRODUCTION

A vehicle is a mechanism that carries people or commodities from one place to another. [1] The detection of the vehicle necessitates the use of a CCTV system, which functions as an automated method for monitoring traffic in a specific area.[2] The Image processing is a technology that can be used for developing the proficiency of photos or attaining useful and important information from them.[3] The images acquired can provide significant hints to authorities and other public tracking agencies, all of which could lead to evidence of a crime or other unplanned or bad events. [2] Due to human error and a variety of other factors that affect living beings, manual labour has always been shown to be slower and less effective.[2] Use of Such CCTV cameras to monitor traffic movement and accurately track moving vehicles has become widespread in industrialized countries as a result of technical advancements in intelligent transportation systems.[4] The speed limit can be estimated through using camera calibration data. [8] Automobiles can be defined utilizing morphological strategy. In transportation planning and flow control, automotive classification based on size or aspect is vital.[5] There is an important feature called data mining which can be used for extracting the information regarding the vehicle There is a powerful function called data mining that may be utilized to obtain information about the vehicle.[6] Cars can also be characterized using data mining algorithms based on their GPS shadows.[7] The detection and categorization of vehicle play an essential part in traffic control and managerial decision making.[5] In this research, we explore at how image processing and data mining systems can be used to evaluate an automobile parking system in order to prevent the car parking issues in different institutes. In

this study, the Image Processing system will be used to detect the vehicle's classification and the identity and then the data mining system will be used to identify the information regarding the vehicle so that the parking records such as entering, ejecting, parking duration, bills and other information can be added and visible to the vehicle's owner's account.

2 RESEARCH METHODOLOGY

2.1 Research Objective

The use of CCTV cameras to monitor traffic movement and accurately track moving vehicles has become widespread in industrialized countries on the basis of technical advancements in intelligent transportation.[4] By recognizing vehicles using different morphological processes-based image processing algorithms, traffic problems, financial waste, and blocking on overpass and over bridges can all be handled. [22] Vehicle identification utilizing video surveillance is avery anticipated recent advances for wireless big data collecting and improved traffic. [1] Surveillance camera systems is being utilized in critical conditions areas to secure their safety. [4] They are, The first one is generation (1GSS), the second one is generation (2GSS), and the last one is generation (3GSS). To improve the procedure more precise and robust, smart surveillance systems utilize object detection and tracking in motion. In order to achieve valid information, an optimal algorithm provides the apparent movement of object detection, categorization, and tracking in diverse settings. [4] It is recommended to construct a unique method for vehicle data detection and tracking utilizing a Gaussian mixture model in order to make improvements.[24] A real time vehicle detection system in low light condition is conducted using a special type of camera capable of capturing video footage in low light. While detecting the vehicle some major issue like different shape, the position and the order of the vehicle etc has been solved.[18] To identify and count automobiles, Kota and Rao introduced the frame difference method to detect moving zones with variety of time occurrences.[19] For categorizing the cars, a Data Mining technique is used, which compares classifiers constructed with different classification algorithms for two separate variants of the class variable, each with three or two potential values. [7] Machine learning on vehicle categorization is effective when the sets of data are large enough, which is primarily related with the fields of data mining and pattern recognition.[21]

2.2 Research Questions

The primary goal of this research is to reduce continuing labor and time waste. It will be helpful for both the institution who has a vehicle parking facility and the customers who has a vehicle which needs to be parked for a specific period of time.

The central theme of this investigation is,

"Identifying answers to challenges that arise in parking lots through technological advancements that provide satisfaction to both customers and authorities."

In light of these circumstances, the research investigates the following set of research questions,

I. What are the issues that arise in parking lots?

II. What technologies can be utilized in parking lots to detect vehicles and identify their details?

III. How can technological advances be used to deal with the problem in a cost and time effective direction?

IV. How will the authorities and the customers conceive the modern innovation in this particular area?

V. How does detecting vehicle impact society?

VI. What is the overall objective of vehicle detection in our proposed system ?

2.3 Article Selection

2.3.1 Image Processing: CCTV camera,Computers,Vehicle Identify.

Data Mining: Computers, Training Set, WEKA software, Classification.

2.3.2 Google Scholar, IEEE Computer Society Digital Library, ResearchGate these three digital libraries were used in this paper.

2.3.3 Manual selection was done by examining the title, abstract and keyword of the papers. For a few instances, the result of the paper also analyzed and included in this paper.

2.3.4 Nine set of article were studied and reference of those paper were included in the paper. Each author has studied 3 papers individually.

3 DISCUSSION

3.1 What are the issues that arise in parking lot?

Overcrowding of parking places is one of today's most prevalent issues. Vehicles are outnumbering available parking spots, jamming highways. Violence as a consequence of overcrowding, distorted automobiles as a result of a space crisis, and overcharging for parking are some of the issues that arise.[25]

3.2 What technologies can be utilized in parking lots to detect vehicles and identify their details?

One of the most popular technique for identifying parking occupancy information is sensors. Detection systems using Active Infrared Sensors would emit infrared energy and utilize the amount mirrored to recognize any object or automobile. Machine vision may be used to recognize license plates or determine parking lot occupancy using a visual camera for identifying their details.[26]

3.3 How does detecting vehicle impact society?

A huge number of individuals die in automobile accidents across the world. Building an autonomous traffic accident detection system and minimizing the time it takes for an accident to occur are two successful approaches for lowering road deaths.So, with automobile verification, we can quickly catch road accidents and other crimes in this project.[27]

4 FUTURE RESEARCH DIRECTIONS

4.1 Objective of our research in perspective of our country

The main objective was of this research to identify the vehicle through video camera and propose a automated parking lot system. Behind the scene there image processing and machine learning was used. Image processing is used to capture the vehicle from real time video and extract the valuable information for identifying the vehicle. For differentiating the vehicle we used data mining.

4.2 Limitation of the research and how it can be developed

Using of CCTV cameras makes it a bit difficult to identify the vehicle as the quality of the footage is not that much high. For this kind of purpose high resolution video cameras can be used to identify the vehicles information very easily and fetch the data from that, and by using high resolution cameras it makes the process a bit costly.

4.3 Areas where the main principle of our study can be utilized

Our suggested strategy is limited to parking places, but the principles of this approach can be applied to a variety of situations. We can utilize an autonomous traffic control system to manage traffic, that can be constructed on the very same ideas as the system we described. Traffic cameras will capture the vehicle movement and how much traffic are on the road. Based on that information the traffic lights will work. So here no manual input is needed for traffic light to work. Another example is human face recognition in shopping malls. Like this there are many other places where the principle can be used by extending some of it's features.

5 VALIDITY THREAT

When it comes to Image Processing and Data Mining Systems, the word "Validity Threat" is essential. As we have to use several tools to activate the approach, there is a huge need of proper management. In this strategy, the computer science experts on Image Processing and Data Mining are highly recommended. Otherwise, the company can face obstacles if there is any technical issue and a proper managements will not be accomplished. In the fact of Data Mining, there includes database management systems and data science which works with machine learning, statistics and various algorithms. The programs will be needed to be tested, verified and updated according to the circumstances. Otherwise, the software might get obsolete. In the case of Image Processing, the images will be digitally manipulated by different algorithms for appropriate detection of the vehicles information. Else it will become quite impossible to build the approach. So, experts in programming algorithms and digital signal processing will be required. Additionally, as there are CCTV cameras, Image Sensors and other components, they should be invigilated by the technicians once in a month as there can be problems which may occur in the vital moments. One very essential matter is, we must have security specialists for this project. The offenders and hackers might try to hack and manipulate the system and get their wanted information for different crime purposes. For that the system can be resulted as quite destructive for both the company and the customers. The system managers must be aware in the cases of privacy and security. As a result, a Cyber Security Specialist is a must-have. Customers and the corporation may face plenty of problems if this does not happen. If all of the needs are properly developed and managed with total sincerity, the project will be a fantastic success for both the organization and the clients.

6 CONCLUSION

This study examines the different strategies in detail regarding the detection of vehicles in the parking slots of various organizations. The research demonstrates about the Data Mining and the Image Processing techniques which will operate efficiently and fulfill the major purpose of the project. As the technology is being advanced, it was necessary to connect a established process in the parking systems in order to save time, costs and labor works. The whole study provides a better understanding of vehicle parking systems and highlights difficulties and solutions.

REFERENCES

[1] Merriam Webster, Vehicle | Definition of Vehicle by Merriam-Webster

[2] Vehicle Detection and Recognition, Sriashika Addala Dept. of CSE Lovely Professional University Punjab, India.

[3] University of Tartu, Digital Image processing. Introduction to image processing | Digital Image Processing (ut.ee)

[4] A Survey On Vehicle Detection And Tracking Algorithms In Real Time Video Surveillance Sri Jamiya S, Esther Rani P

[5] Vehicle Detection Using Morphological Image Processing Technique (1)Aisha Ajmal and (2) Ibrahim M. Hussain Department of Computer Engineering, Sir Syed University of Engineering and Technology, KarachiPakistan

[6] DATA MINING TECHNIQUES AND APPLICATIONS Mrs. Bharati M. Ramageri, Lecturer Modern Institute of Information Technology and Research, Department of Computer Application, Yamunanagar, Nigdi Pune, Maharashtra, India-411044.

[7] Data Mining Classification of Cars Based on GPS Shadows in Forward Scatter Radar Systems Christo Kabakchiev1, Dorina Kabakchieva2,Ivan Garvanov3, Vera Behar4, K. Kabakchiev5, H. Rohling6, K. Kulpa7, A. Yarovoy8

[8] Vision-based vehicle detection and counting system using deep learning in highway scenes Huansheng Song, Haoxiang Liang* , Huaiyu Li, Zhe Dai and Xu Yun

[9] Bhaskar, Prem Kumar; Yong, Suet-Peng (2014). [IEEE 2014 International Conference on Computer and Information Sciences (ICCOINS) - Kuala Lumpur, Malaysia (2014.6.3-2014.6.5)] 2014 International Conference on Computer and Information Sciences (ICCOINS) - Image processing based vehicle detection and tracking method. 1–5. doi:10.1109/ICCOINS.2014.6868357

[10] Paul Viola, Michael Jones. Rapid Object Detection using a Boosted Cascade of Simple Features (IJCV). 2001

[11] Kari Pulli, Anatoly Baksheev, Kirill Kornyakov,Victor Eruhimov. Realtime Computer Vision with OpenCV. Volume 10 Issue 4, April 2012.

[12] Yongjian Fu (1997). Data mining. , 16(4), 18–20. doi:10.1109/45.624335

[13] Suguitan, Agnes S.; Dacaymat, Lucille N. (2019). [ACM Press the 2nd International Conference - Xi'an, China (2019.05.24-2019.05.26)] Proceedings of the 2nd International Conference on Computer Science and Software Engineering - CSSE 2019 - Vehicle Image Classification Using Data Mining Techniques. , (), 13–17. doi:10.1145/3339363.3339366

[14] Advantages of Data Mining in Machine Learning - DataFlair (data-flair.training)

[15] Detection and classification of vehicles | IEEE Journals Magazine | IEEE Xplore

[16] Vehicle Detection and Recognition Sriashika Addala Dept. of CSE Lovely Professional University Punjab, India

[17] Zhang BL, Zhou Y, Pan H (2013) Vehicle classification with confidence by classified vector quantization.

[18] Zehang Sun, ; Miller, R.; Bebis, G.; DiMeo, D. (2002). [IEEE Comput. Soc Sixth IEEE Workshop on Applications of Computer Vision (WACV 2002) - Orlando, FL, USA (3-4 Dec. 2002)] Sixth IEEE Workshop on Applications of Computer Vision, 2002. (WACV 2002). Proceedings. - A real-time precrash vehicle detection system. , (), 171–176. doi:10.1109/ACV.2002.1182177

[19] Ravi Kumar Kota, Chandra Sekhar Rao T; "Analysis Of Classification And Tracking In Vehicles Using Shape Based Features", International Journal of Innovative Research and Development, IJIRD, Vol 2. Issue 8, pp. 279-286, August 2013.

[20] Soo Teoh and Thomas Bräunl, "A reliability point and Kalman filter-based vehicle tracking technique", Proceedings of the International Conference on Intelligent Systems (ICIS'2012), Penang, Malaysia, pp. 134-138, May 2012.

[21] M. Mozumdar, "Development of Micro Wireless Sensor Platforms for Collecting Data of Passenger – Freight Interactions," Department of Electrical Engineering, California State University

[22] International Journal of Computer Science Communication, Vehicle Detection Using Image Processing and Fuzzy Logic.

[23] Michalopoulos, P.G. (1991). Vehicle detection video through image processing: the Autoscope system. IEEE Transactions on Vehicular Technology, 40(1), 21–29. doi:10.1109/25.69968 Michalopoulos, P.G. (1991). Vehicle detection video through image processing: the Autoscope system. IEEE Transactions on Vehicular Technology, 40(1), 21–29. doi:10.1109/25.699

[24] Mallikalava, Vishnu; Yuvaraj, S.; Vengatesan, K; Kumar, Abhishek; Punjabi, Shivkumar; Samee, Sayyad 2020 - Theft Vehicle Detection Using Image Processing integrated Digital Signature Based ECU. , (), 913–918. doi:10.1109/ICSSIT48917.2020.9214174

[25] Issues with Parking in Indian Metropolises by Shubhankar Gautamon February 14, 2019

[26] Smart parking sensors, technologies and applications for open parking lots: A Review Vijay Paidi, Hasan Fleyeh, Johan Håkansson, Roger G. Nyberg School of Technology and Business studies, Dalarna University, Borlänge, Sweden

[27] Hai Wang, Xinyu Lou, Yingfeng Cai, Yicheng Li, Long Chen, "Real-Time Vehicle Detection Algorithm Based on Vision and Lidar Point Cloud Fusion", Journal of Sensors, vol. 2019, Article ID 8473980, 9 pages, 2019. https://doi.org/10.1155/2019/8473980

[28] Image Processing Based Vehicle Detection And Tracking System Poonam A. Kandalkar1, Gajanan P. Dhok2ME, Scholar, Electronics and Telecommunication Engineering, Sipna College of Engineering and Technology, Amravati, Maharashtra, India1 Professor, Instrumentation Engineering, Sipna College of Engineering and Technology,Amravati, Maharashtra, India

[29] Bertozzi, M.; Broggi, A.; Fascioli, A.; Nichele, S. (2000). [IEEE IV 2000 Intelligent Vehicles Symposium - Dearborn, MI, USA (3-5 Oct. 2000)] Proceedings of the IEEE Intelligent Vehicles Symposium 2000 (Cat. No.00TH8511) - Stereo vision-based vehicle detection. 39–44. doi:10.1109/ivs.2000.898315

[30] Real time vehicle detection and tracking on multiple lanes Kristian Kovaci ˘ c, Edouard Ivanjko, Hrvoje Gold ´Department of Intelligent Transportation Systems Faculty of Transport and Traffic Sciences, University of Zagreb

[31] Marin van Heel; George Harauz; Elena V. Orlova; Ralf Schmidt; Michael Schatz (1996). A New Generation of the IMAGIC Image Processing System. , 116(1), 0–24. doi:10.1006/jsbi.1996.0004

[32] Classification of Vehicles using Image Processing Techniques, Shobha Rani.B.R Dept. of M.C.A ,Dr. Ambedkar Institute of Technology Bangalore, India,Suparna.B. M Dept. Dept. of M.C.A ,Dr. Ambedkar Institute of Technology Bangalore, India Teja.K.S,Dept. Dept. of M.C.A ,Dr. Ambedkar Institute of Technology Bangalore, India

[33] Zhang, Shichao; Zhang, Chengqi; Yang, Qiang (2003). Data preparation for data mining. Applied Artificial Intelligence, 17(5-6), 375–381. doi:10.1080/713827180

A CONTRIBUTION RECORD

A.1 Paper Assessment

Populate the following table with the required information.

Student id & name	Paper No frm Ref	Paper Title
19-39745-1, AHMED, ZUBAIR	10, 14, 21	Paul Viola, Michael Jones. Rapid Object Detection using a Boosted Cascade of Simple Features (IJCV). 2001, Advantages of Data Mining in Machine Learning - DataFlair (data-flair.training), M. Mozumdar, "Development of Micro Wireless Sensor Platforms for Collecting Data of Passenger – Freight Interactions," Department of Electrical Engineering, California State University
18-38671-3, BAHADUR, MD. IBRAHIM	17, 22, 11	Zhang BL, Zhou Y, Pan H (2013) Vehicle classification with confidence by classified vector quantization, International Journal of Computer Science & Communication, Vehicle Detection Using Image Processing and Fuzzy Logic, Kari Pulli, Anatoly Baksheev, Kirill Kornyakov,Victor Eruhimov. Realtime Computer Vision with OpenCV. Volume 10 Issue 4, April 2012.
19-39763-1, JANNAT, MANJILATUL	7, 19, 8	Data Mining Classification of Cars Based on GPS Shadows in Forward Scatter Radar Systems Christo Kabakchiev1, Dorina Kabakchieva2,Ivan Garvanov3, Vera Behar4, K. Kabakchiev5, H. Rohling6, K. Kulpa7, A. Yarovoy8, Ravi Kumar Kota, Chandra Sekhar Rao T; "Analysis Of Classification And Tracking In Vehicles Using Shape Based Features", International Journal of Innovative Research and Development, IJIRD, Vol 2. Issue 8, pp. 279-286, August 2013, Vision-based vehicle detection and counting system using deep learning in highway scenes Huansheng Song, Haoxiang Liang* , Huaiyu Li, Zhe Dai and Xu Yun

Table 1. Paper collected and read by the group member

A.2 Paper writing contribution

Populate the following table with the required information.

Student id & name	Section No	Section Title
19-39745-1, AHMED, ZUBAIR	1,5,6,2.1	INTRODUCTION,VALIDITY THREAT,CONCLUSION, Research Objective
18-38671-3, BAHADUR, MD. IBRAHIM	2,4,2.1,2.3	RESEARCH METHODOLOGY,FUTURE RESEARCH DIRECTIONS, Research Objective, Article Selection
19-39763-1, JANNAT, MANJILATUL	2.1,2.2,3	Research Objective,Research Questions,DISCUSSION

Table 2. Section(s) Written in the paper by the group member