International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Special Issue Apr 2021 www.irjet.net p-ISSN: 2395-0072

SMART CAR PARKING SYSTEM USING IMAGE PROCESSING AND DEEP LEARNING

[1]Mrs.R.Anjana Devi, [2]V.Seethalakshmi,[3]S.S Sreenidhi, [4]S.Sridevi, [5]B.Srilekha

[1]Assistant professor,[2]Student,[3]Student,[4]Student,[5]Student
Department of Electronic and Communication Engineering
Adhiyamaan college of Engineering, Hosur

[1]anjanadevi.ece@adhiyamaan.in, [2]lakshmiseetha2501@gmail.com, [3]1999sreenidhi@gmail.com,
[4]ussridevi2000@gmail.com,[5]srilekhabalakrishnana@gmail.com

---

Abstract: The Car Parking Guidance and Information (CPGI) systems have a potential to reduce the congestion in crowded areas by providing real-time indications of occupancy of parking spaces and time saving. Now-a-days, these systems are widely applied for indoor environments using costly sensor-based methods. Thus, with the increasing requirement for PGI systems in outdoor environments, low-cost image-based detection methods have become a center of research and development lately using camera. Interested by the significant performance of Convolution Neural Networks (CNNs) in various image category recognition tasks, this study presents a robust parking occupancy detection framework by using a deep CNN and a binary Support Vector Machine (SVM) classifier to spot the occupancy of outdoor parking spaces from images. The classifier was trained and tested by the features learned by the deep CNN from public datasets (PKLot) having different intensity and weather conditions. Consequently, we assess the transfer learning performance (the capability to simplify results to a new dataset) of the established technique on a parking dataset generated for this research our system will give before notification to users. We state detection accuracies of 99.7% and 96.7% for the public dataset and our dataset respectively, which shows the remarkable ability of this technique to offer an inexpensive and consistent solution to the CPGI systems in outdoor environments.

Keywords—CPGI, image-based detection methods, CNN, robust parking occupancy detection framework, SVM classifier

I. INTRODUCTION

In current years, the population of the world has risen largely; the complexity of transportation has dramatically increased. Subsequently, there is huge traffic increase in vehicle movement, the work of huge movement of various institutions. Some organizations, like law enforcement, are responsible for monitoring every car and arresting the illegal vehicles. There is a plenty of work to do, such as a license plate register. But on the streets, huge number of vehicles made the task to more tough work. Thus, it is required to recognize vehicles using machine

learning techniques, and automatic vehicle identification has become the essential stage in the up-to-date transportation system. The organization of vehicles using a general applet or algorithm will make life easy for managing traffic and forbidden parking. Largely precise vehicle recognition system will also help in consistent approval in controlled areas. The organization and pattern recognition of an object requires overall knowledge of image processing and artificial intelligence and also requires computational method and design. In that image pre-processing and picking up details including feature extraction methods. An aim of the project is to decide a vehicle's fitness for parking by considering the length and height of the vehicle and relating the vehicle with its classes to check the exactness of the outcome. These days, there are many methods used in identifying the parking vehicles in parking lots as listed in references. A camera is used as a sensor for video image recognition. This is due to its competence and realization cost. The related project that used camera for video image recognition have presented .

This project applies the edge detection with boundary condition technique for image detecting module which is used as point detection with canny operator method. In that we can use moving vehicles as a reference image to spot the parking lot. This proposed project is smart car parking using deep learning. This project is very useful to time save and know the parking space availabilities, using camera we can accurately monitor while compared to sensor based project.

II. RELATED WORKS

[1] Y. Bengio "Learning deep architectures for AI".
In this project, we propose a method for the recognition of car parking occupancy based on Deep Learning. Deep Learning (DL) is a branch of Artificial Intelligence that aims at developing methods that allow computers to learn complex perception tasks, such as seeing and hearing, at human level of accuracy. It gives approximate to human level accuracy in image classification, object detection, speech recognition, natural language processing, vehicle and pedestrian detection, and more.

[2] N. Dan "Parking management system and method".
Lately, several methods relying on to determine video cameras have been planned to observe the occupancy of parking lots. But, in spite of these fine efforts, empty parking space recognition using only visual information is yet an open challenge. Most of these methods rely on particular visual techniques personalized to the particular scenario, and absence of simplification when applied to various parking lots. In this paper, we provide a allocated, operative, competent and mountable solution for real-time parking occupancy recognition, based on deep Convolution Neural Networks (CNN).

[3] R. Girshick, J. Donahue, T. Darrell, and J. Malik "Rich feature hierarchies for accurate object detection and semantic segmentation".
A Deep Learning methodology mostly operative for vision tasks exploit Convolution Neural Networks (CNN). A CNN is comprised of a feasibly huge hidden layers, each of which performs mathematical calculations on the input and gives an output that is given in input to the succeeding layer.

III. EXISTING SYSTEM

- The existing system is the combination of the hardware and software to form a complete module.
- Exchanging of all the information or data between mobile and sensor circuitry is done.
- It contains an nano microcontroller as the main processing unit and it gets inputs from the IR sensors which guide the user to know the empty parking space.
- Nano controller runs with software IDE application that should be installed in system.
- Simple embedded C code in microcontroller and directly put it into the software system. Hence, it works according to code system keeps track of number of cars entered in parking building.

IV. PROPOSED SYSTEM

• The proposed system of this project is to automatically identify every parking slot in the camera.
• It should be observed that the lines dividing the parking slots have to be obvious, unobstructed and clear in the initialization process.
• The camera is expected to be in a static position and fronting a static direction every time.
• The initialization process will begin with the program searching for the size and height, length of the car image by detecting the shape of the image.
• Detected image are then analysis to determined available parking slot.
ADVANTAGES:
• The conceptualization of this project is to discover the parking system by using deep learning instead of using sensor base.
• It makes the process of identifying image as a reference more effective compared to the use of a moving object.
• Intelligent parking system is developed using an integrated deep learning approach to reduce cost of sensor and wiring hassle.

V SYSTEM FUNCTION

ARCHITECTURE DESIGN

Firstly, the image of the parking space will be captured and the acquired image will be handled for the further processing. Next the system will extract the image from the Database Management system (DBMS) for the purpose of comparing the obtained image with the dataset in the database which consists of the image with a vehicle in parking space and a vacant parking slot without any vehicle. Now the images will not be compared directly after fetching as it requires some image processing techniques to compare the two images at most precision. So the next step will be processing the image for the purpose of accurate comparison to find out the vacant slots in the parking space. For this, the input image will be processed in segmentation process which contains the following steps

- Gray scale conversion
- Thresholding and canny edge detection
- Morphological transformation
- Contour detection

After the completion of segmentation process, the image will be fed into Gaussian filter which will remove the blur noise from the image is well kept to perform the comparison of images without any interruption due to presence of some noises in the image. Since the noise is filtered successfully from the image, now the image is finely ready to be compared with the dataset to find whether there is car in the image or not i.e., vacant parking slot in the parking space. For comparison, the two images (the dataset and the input image) will be positioned (contour position) in a boundary box, then those positioned images will be compared and finally the system will know whether there is car present or not in the input image. And it will notify the user that there is a presence of car and the space is occupied if there is car or there is a absence of car and the pace is not occupied (vacant/free) if there is no car in the parking slot. All these processes will be done in camera view and that's why the user himself/herself can't find out the occupancy or vacancy of the parking slot and that's where the use of this system helps the user to determine the occupancy or vacancy of the parking slot in that space where the user is desiring to park his/her car.

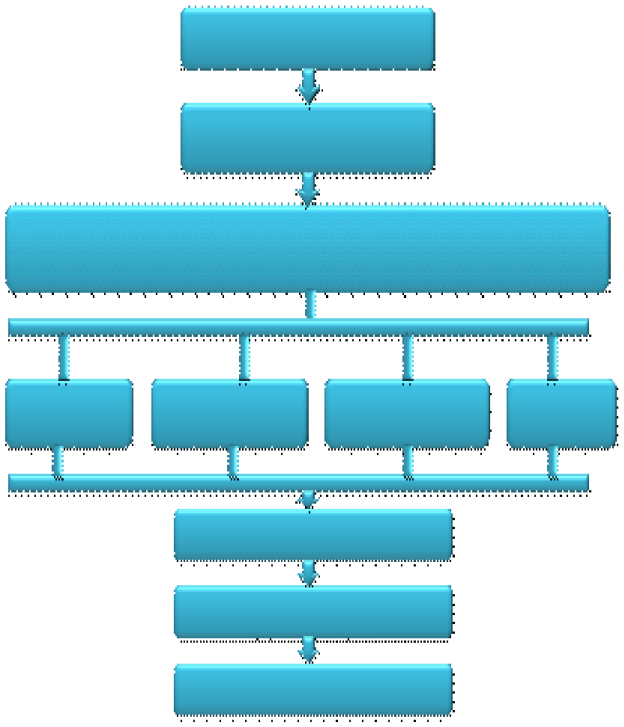

Fig 1: Block diagram

VI ALGORITHMS

Deep learning is a subdivision of machine learning, algorithms enthused by the human brain, learn from huge amounts of data. Deep learning permits machines to solve complicated problems even when using a data set that is very varied, formless and inter-connected. Design intelligent systems that learn from complicated and/or large-scale datasets. You will learn to solve new classes of problems that were once thought prohibitively challenging and come to better appreciate the convoluted nature of human intelligence as you solve these similar problems easily using deep learning techniques.

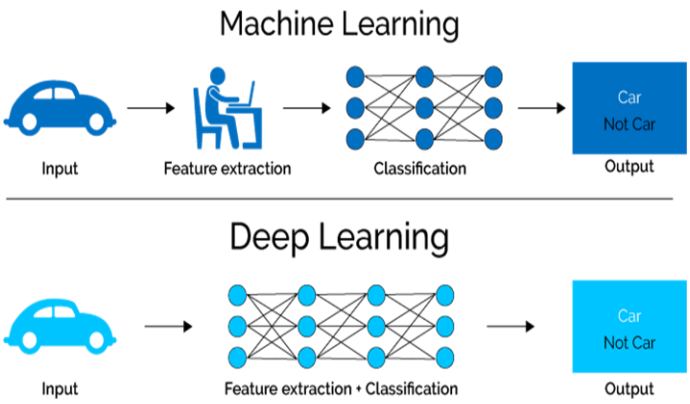

Fig 2: Machine learning and Deep learning

SUPPORT VECTOR MACHINE (SVM)

Support Vector Machine (SVM**)** is a supervised machine learning algorithm that will be applied for categorization as well as regression challenges. But, it is mainly applied in categorization challenges. In the SVM algorithm, we assign each data item as a point in n-dimensional area (n=number of features) with the value of each feature being the value of a specific coordinate. Next, we do categorization by finding the hyper-plane that discriminates the two classes' pretty fine. Support Vectors are merely the co-ordinates of separate examination. The SVM classifier is a frontier which finely differentiates the two classes (hyper-plane/ line).

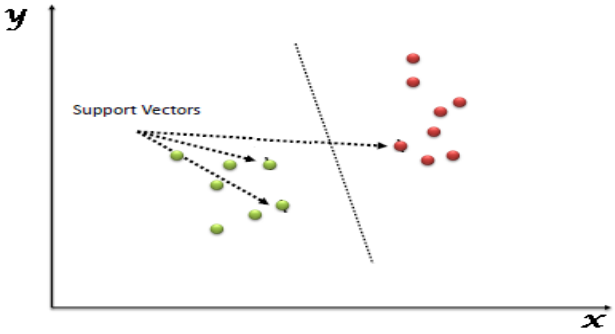

Fig 5: Support vector machine

VII RESULTS

The following images shows the captured image and the output image respectively which was generated after the image processing technique using CNN and SVM classifier. Here, the output image will be displayed with the command that says about the availability of the space in the parking slot in the image.

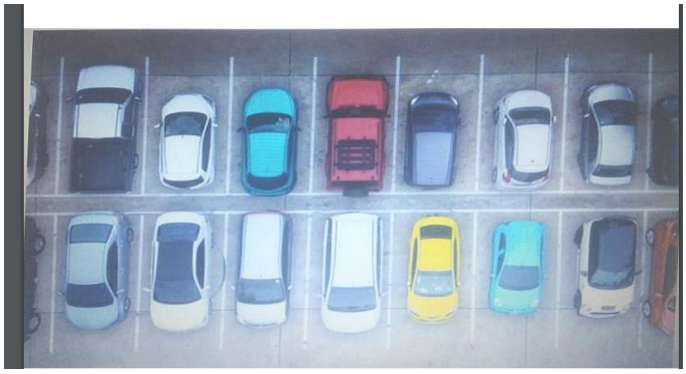

Fig 3: Captured image with no available space

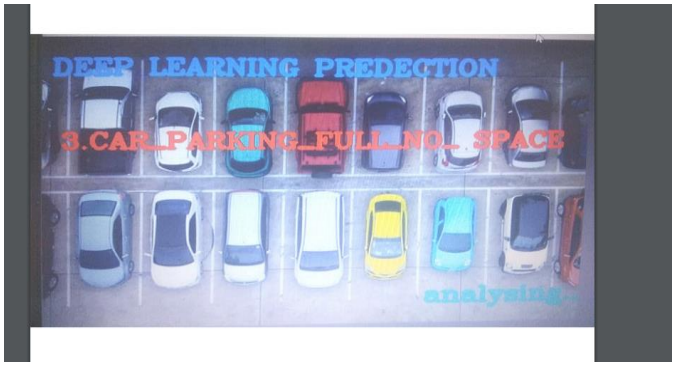

Fig 4: Output image with command saying "NO SPACE"

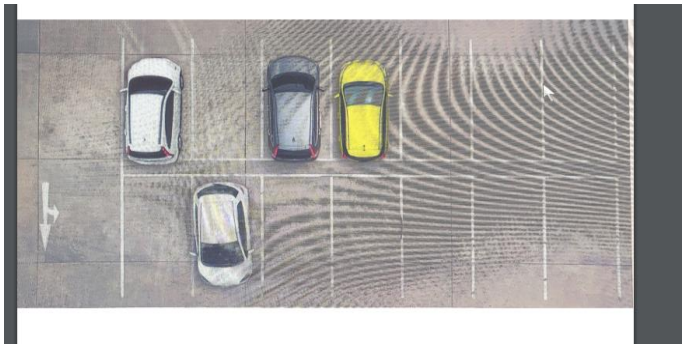

Fig 5: Captured image with available parking space

Fig 6: Output image with command saying "10 SPACES AVAILABLE"

VIII.CONCLUSION

An image-based framework is developed in this project for identifying parking space occupancy in outdoor environments using features extracted by a pre-trained deep CNN and their subsequent classification by an SVM classifier. The framework attained a elevated precision of 99.7% on the training dataset, and a transfer learning precision of 96.6% on an independent test dataset, which shows its appropriateness for mass uses in all weather conditions. A camera is applied as a sensor for video image recognition. This is because of its competence and realization cost. The related project that applied camera for video image recognition was presented in. This project applies the edge detection with boundary condition technique for image detecting module. So thus we can easily identify the parking slots.

REFERENCES

[1] N. Dan, "Parking management system and method," Jan. 2017, uS Patent App. 10/066, 2017.

[2] Q. Wu, C. Huang, S.-y. Wang, W.-c. Chiu, and T. Chen, "Robust parking space detection considering inter-space correlation," in Multimedia and Expo, IEEE International Conference on. IEEE, 2018, pp. 659–662.

[3] C. G. del Postigo, J. Torres, and J. M. Menendez, "Vacant parking area ´ estimation through background subtraction and transience map analysis," IET Intelligent Transport Systems, 2017.

[4] P. R. de Almeida, L. S. Oliveira, A. S. Britto, E. J. Silva, and A. L. Koerich, "Pklot–a robust dataset for parking lot classification," Expert Systems with Applications, vol. 42, no. 11, pp. 4937–4949, 2018.

[5] Y. Bengio, "Learning deep architectures for AI," Foundations and trends R in Machine Learning, vol. 2, no. 1, pp. 1–127, 2018.

[6] X. Chen, S. Xiang, C.-L. Liu and C.-H. Pan, "Vehicle detection in satellite images by hybrid deep convolutional neural networks," Geoscience and Remote Sensing Letters, IEEE, vol. 11, no. 10, pp. 1797–1801, 2019.

[7] F. Duarte and C. Ratti, "The impact of autonomous vehicles on cities: A review," Journal of Urban Technology, pp. 1–16, 2018.

[8] "Occupational employment and wages, may 2017 33-3041 parking enforcement workers," https://www.bls.gov/oes/current/oes333041.htm# (3), accessed: 2018-07-08.

[9] G. Pierce and D. Shoup, "Getting the prices right: an evaluation of pricing parking by demand in san francisco," Journal of the American Planning Association, vol. 79, no. 1, pp. 67–81, 2016.

[10] Y. Geng and C. G. Cassandras, "New" smart parking" system based on resource allocation and reservations." IEEE Trans. Intelligent Transportation Systems, vol. 14, no. 3, pp. 1129–1139, 2017.

[11] P. R. De Almeida, L. S. Oliveira, A. S. Britto Jr, E. J. Silva Jr, and A. L. Koerich, "Pklot–a robust dataset for parking lot classification," Expert Systems with Applications, vol. 42, no. 11, pp. 4937–4949, 2015.

[12] Security Technology, 2015. CCST'05. 39th Annual 2015 International Carnahan Conference on. IEEE, 2015, pp. 271–274.

[13] G. Amato, F. Carrara, F. Falchi, C. Gennaro, C. Meghini, and C. Vairo, "Deep learning for decentralized parking lot occupancy detection," Expert Systems with Applications, vol. 72, pp. 327–334, 2017.

[14] D.Bong, K.Ting, and K.Lai, "Integrated approach in the design of car park occupancy information system (coins)." IAENG International Journal of Computer Science, vol. 35, no. 1, 2018