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Pedestrian motion detection for Autonomous Vehicles

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ABSTRACT– Pedestrians are among the most vulnerable road user in India as compared to others like bicycle, car, autorickshaws etc. It accounts 13.09 % of total fatalities of all road users. Among thses death percentage is 15.04%. Thus in future AV will face major hurdle in managing the pedestrians passing by .The proposed system aims to predict the motion as well as pose of pedestrains using different machine learning algorithms viz Haar Cascade, HOG, CNN. The output obtained was for each algorithm was compared and analyzed.False and missed detection was observed in case of HOG and HaarCascade,However for CNN a much greater accuracy was obtained.

Keywords-Haar Cascade, HOG, CNN.

I. INTRODUCTION

In this fast growing world of advanced technology, Autonomous Vehicles(AV) has emerged as modern solution to many problems. However one such problem which remain unaddressed is pedestrian movement on roads and their overall impact on the vehicle's path.To overcome such obstacles government has been making provision time to time but has failed to achieve desired results.

India has also seen a rise in number of road accidents and situation is more worrisome in AV scenario.So proposed study consists of implementation and analysis of different algorithms for detection of pedestrian motion

The paper is structured as follows: Section II explains about the literature having the same models.Section III explains the methodology used in the projects with a few concepts of the method.

Section IV explains the evaluation of the results after the model was working . SectionV talks about the conclusion.Section VIdiscusses the future scope of the project.

II. LITERATURE REVIEW

The paper[1] talks about the concept of integral image which allows the attributes used by our detector to be computed very quickl.It generates sub-rectangles, rather than calculating at each pixel value.These are then used to compute the Haar features[2].Integral Image is like a collection of rectangular features.The second is a learning algorithm, based on AdaBoost[3], which choses a small number of critical visual attributes from a larger set and yields extremely efficient classifiers. Adaboost essentially chooses the best features and trains the classifiers to use them. It uses a combination of "weak classifiers" to create a "strong classifier" that the algorithm can use to detect objects.Hereour first initialize weights for a given image and then normalization was performed to construct probability distribution.

Paper [4] refers about HOG approach for efficient multi-object detection. Here system was built to recognize three things pedestrians cars and Bicycles , at the same time.For each target type, a holistic detector in a cascade manner was constructed, using a dense overlapping grid based on histograms of oriented gradients (HOG).The proposed multi-object detection system is composed of three unitary detectors, called as "detection units". To construct a detection unit, a cascade of classifiers with a fixed size model based on HOG features is trained. It is then applied to each image in several scales and positions .Histograms of oriented gradients (HOG) represent objetcts appearance and shape using intensity distribution and contours direction. HOG features extraction process[5] includes Gamma Normalization, Gradient Computation, Histograms Construction and Blocks Normalization. The detection system has been tested both offline on well known datasets, and online on a car-like mobile robot navigating in a real road. Obtained results are very promising in term of detection rate, and also processing time for pedestrian and car detectionPaper [6] talks about real time detection using tensorflow

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approach using PyTorch. It is an open source in the machine learning library for Python, While, TensorFlow[7] is an open-source programming library for dataflow programming .From the following points we can conclude that using Tensor-Flow the process is more efficient and is more reliable than Pytorch. YOLO algorithm [8] was observed more efficient as Speed (45 frames per second), faster than real-timeAlso It is a faster version with a smaller architecture of 155 frames per sec, but is less accurate.Although YOLO has certain disadvanages like it has Comparatively low recall and more localization error compared to Faster R_CNN also it faces problems while detecting small objects. Computer vision finds its application in detecting whether the image or the video carries the pedestrian and further identifying the exact location of person[9].The algorithms[10] can be divided into three groups viz based on background framework,based on template matching and based on statistical modelling.The template based technique [11] uses the attributes like texture,contour and gray information in image inorder to identify the object.This technique is easy as here feature extraction of image doesn't takes place however the concern is it takes longer time for execution.The work[12] proposed by Dalal et al.,uses HOG features together with linear SVM and thus good results were obtained.In paper[13],Deformable Part Model(DPM) was presented by integrating HOG.This produced greater accuracy for detection and is mainly applicable foe pedestrian blockage scenarios.Recent developments in Autonomous cars with help of AI and ML has led to designing of Advanced Driver Assistance Systems (ADASs)[14] and many such sytems like AlphaGo by Google [15] exists.

III. METHODOLOGY/EXPERIMENTAL

Following algorithms were implemented:

Haar Cascade

1. Haar Feature Selection-here Haar features refers to set of common or basic features of the pedestrian.They are like convolution kernels in CNN except they are manually derived.Each feature gives a specific value which is calculated by subtracting the sum of pixels of a white rectangle from the sum of pixels of the black rectangle
2. Create integral image-the integral image of the pixel is the sum of above and the left of the given pixel
3. Adaboost Training-AdaBoost is used to remove redundant features and choose the relevant features.
4. Cascading Classifiers- A series of classifiers are applied to every subwindow. Here,the classifiers are simple decision trees and if the first classifier is positive, then move on to the second and if the second classifier is positive, then move on to the third

HOG

1. Convert image from RGB to grayscale
2. Assume one random grid of dimension 4*4
3. Now calculate horizontal and vertical gradients
4. In the next step calculate gradient magnitude and gradient angle for each of the above 16 pixels.
5. Slide the 4*4grid across the image and plot the HOG features

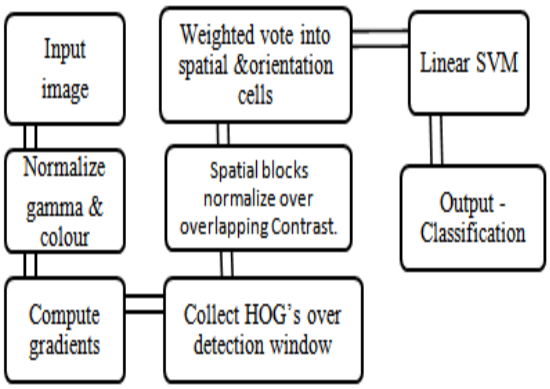

Fig 1. HOG Workflow

CNN

In the CNN technique, frstly image is passed through the pre-trained Convolutional Neural Network.This network made up of the convolutional layer which is used to obtain essential feature maps of each pixel.Then for each feature map, there are multiple boxes which have varying scales,sizes, and aspect ratios. For eachbox, prediction of the particular binary class is made and bounding box is generated for the same.Nextthis is passed on to the region of interest (RoI) pooling layer.This layer is used to get two inputs of the pre-trained model and algorithm to provide a fully connected layer with an output.

IV. RESULTS AND DISSCUSIONS

Fig 3. Haar cascade implementation

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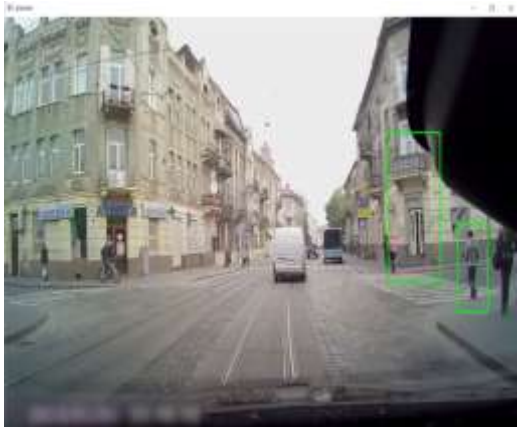

Fig 4. HOG implementation

Fig 5. CNN implementation

V. CONCLUSIONS

In this paper different algorithms for pedestrian motion detection were implemented and a comparative analysis of these techniques was performed.In case of Haar cascade and HOG approach false objects were identified and true object were missed.CNN proved to be better approach for real time detection with greater accuracy and minimum computational cost.

VI. FUTURE SCOPE

In future,additional option for steering angle prediction using input pedestrian data can be addedo.

REFERENCES

[1]. Viola, Paul, and Michael Jones. "Rapid object detection using a boosted cascade of simple features." In Proceedings of the 2001 IEEE computer society conference on computer vision and pattern recognition. CVPR 2001, vol. 1, pp. I-I. Ieee, 2001.

[2]. M. Pham and T. Cham, "Fast training and selection of Haar features using statistics in boosting-based face detection," 2007 IEEE 11th International Conference on Computer Vision, 2007, pp. 1-7, doi: 10.1109/ICCV.2007.4409038.

[3]. Ying, Cao, Miao Qi-Guang, Liu Jia-Chen, and Gao Lin. "Advance and prospects of AdaBoost algorithm." Acta AutomaticaSinica 39, no. 6 (2013): 745-758.

[4]. Dalal, Navneet, and Bill Triggs. "Histograms of oriented gradients for human detection." In 2005 IEEE computer society conference on computer vision and pattern recognition (CVPR'05), vol. 1, pp. 886-893. Ieee, 2005.

[5]. Hong, Gwang-Soo, Byung-Gyu Kim, Young-Sup Hwang, and Kee-Koo Kwon. "Fast multi-feature pedestrian detection algorithm based on histogram of oriented gradient using discrete wavelet transform." Multimedia Tools and Applications 75, no. 23 (2016): 15229-15245.

[6]. Rane, Milind, Aseem Patil, and Bhushan Barse. "Real object detection using TensorFlow." In ICCCE 2019, pp. 39-45. Springer, Singapore, 2020.

[7]. Phadnis, Rasika, Jaya Mishra, and Shruti Bendale. "Objects talk-object detection and pattern tracking using TensorFlow." In 2018 Second International Conference on Inventive Communication and Computational Technologies (ICICCT), pp. 1216-1219. IEEE, 2018.

[8]. Du, Juan. "Understanding of object detection based on CNN family and YOLO." In Journal of Physics: Conference Series, vol. 1004, no. 1, p. 012029. IOP Publishing, 2018.

[9]. Li Hailong, Z. Wu, and J. Zhang, "Pedestrian detection based on deep learning model," International Congress on Image and Signal Processing, Biomedical Engineering and Informatics IEEE, 2017:796- 800.

[10]. Huang Chengdu, Huang Wenguang, Yan Bin, “Video pedestrian detection based on Codebook background modeling,” Transducer and Microsystem Techologies, 2017, 36 (3): 144-146.

[11]. Zhang Chunfeng, Song Jiatao, and Wang Wanliang, “A survey of pedestrian detection technology,” Television technology, 38.3 (2014): 157-162.

[12]. Dalal, Navneet, and B. Triggs, "Histograms of oriented gradients for human detection," Computer Vision and Pattern Recognition, 2005. CVPR 2005. IEEE Computer Society Conference on IEEE, 2005:886- 893.

[13]. Wu, Pei Chen, C. Y. Chang, and C. H. Lin, "Lane-mark extraction for automobiles under complex conditions," Pattern Recognition 47.8(2014):2756-2767.
[14]. D. Geronimo, A. M. Lopez, A. D. Sappa, and T. Graf, "Survey of pedestrian detection for advanced driver assistance systems," IEEE Trans. Pattern Anal. Mach. Intell., vol. 32, no. 7, pp. 1239–1258, Jul. 2010.
[15]. D. Silver et al., "Mastering the game of Go with deep neural networks and tree search," Nature, vol. 529, no. 7587, pp. 484–489, Jan. 2016.