Real Time Moving Vehicle Detection by using Haar Cascade Classifier

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Abstract— Vehicle detection plays a crucial role in various real time applications including Traffic Monitoring, Security , Robotics , Surveillance and Autonomous driving system and Automotive industry. In this project we are using open-cv for image processing and Haar Cascade Classifier which is used for vehicle detection. The Haar Cascade Classifier is a machine learning based approach capable of detecting objects in images with high accuracy and better efficiency .We can also create our own customized haar cascade classifier. In the process of moving vehicle detection involves capturing video frames from a camera feed in real time ,pre-processing the frames to enhance features and apply the Haar Cascade Classifier to detect the vehicles .In data collection ,Gather a large dataset of positive and negative images Positive images contain the objects what we want to detect(example.. vehicles),while the negative images contains the unwanted data(it does not contain any instance of object).After data collection we will convert the image in to gray scale and potentially applying other preprocessing techniques like histogram equalization to enhance the contrast. All the negative images are filtered (removed) by the step pre-processing.

Index Terms- Haar cacade classifier, viola-jones algorithm, Open CV.

I. INTRODUCTION

Object detection is the new encouraging and testing field in computer vision and instance investigation explore zone. Object detection is distinguishing objects in video stream and bunching pixels of these objects. There are numerous strategies and strategy which have been proposed and created since the most recent decade. Programmed detection of moving objects in videos is the primary pivotal stage for different potential applications, for example, person on foot and vehicle following, activity and occasion acknowledgment, comment of video documents, and so on. A few refined works for recognizing moving objects have been exhibited for stationary camera. In this section we presented diverse methodologies of recognizing objects utilizing respectful techniques, for example, frame differencing, optical flow, point detectors, background subtraction, temporal differencing and are talked about underneath.

Image analysis and recognition with the reason for inferring a obliging clear social structure fitting for taking certain choices from a given picture or scene is an random responsibility. Much exertion has been dedicated to different parts of image preparing the vast majority of which it is placed. Image processing is a strategy to change over an image into digital structure and play out certain activities on it, so as to get an upgraded image or to separate some helpful data from it. It is a sort of flag regulation in which input is image, similar to video edge or photo and yield might be image or attributes related with that image. Generally, Image Processing framework incorporates regarding images as two-dimensional signs while applying officially set flag processing techniques to them.

II. EXSTING SYSTEM

One common methodology for moving vehicle detection involves the following steps:

1. Data Collection: Gather a dataset of images or videos containing various traffic scenes with moving vehicles. This dataset should cover different lighting conditions, weather, road types, and vehicle types.

2. Pre-processing: Pre-process the data to enhance relevant features and remove noise. This may include techniques such as resizing, normalization, gray scale conversion, and background subtraction to isolate moving objects.

3. Feature Extraction: Extract features from the pre-processed images or frames that are indicative of

vehicles. Common features include colour histograms, gradient magnitude and orientation, Haar-like features, and deep features extracted from pre-trained convolution neural networks (CNNs).

4. Model Selection and Training: Choose a suitable detection model and train it using the extracted features and annotated data. Popular choices include traditional machine learning models like support vector machines (SVM), decision trees, random forests, or deep learning architectures such as convolution neural networks (CNNs) and region-based convolution neural networks (R-CNNs).

5. Training Data Augmentation: Augment the training data to increase the diversity of the dataset and improve the model's generalization ability. Augmentation techniques may include random rotations, flips, translations, and brightness adjustments.

6. Model Evaluation: Evaluate the trained model's performance using metrics such as accuracy, precision, recall, and F1 score on a separate validation dataset. Fine-tune the model and hyper parameters based on the evaluation results.

7. Post-processing: Apply post-processing techniques to refine the detection results and reduce false positives. This may involve methods like non-maximum suppression to merge overlapping detections or Kalman filtering for object tracking.

8. Deployment: Deploy the trained model in real-world applications, either embedded on edge devices for real-time processing or deployed on servers for processing video streams. Continuously monitor and update the model to improve its performance over time.

Throughout the project, it's crucial to iterate and refine each step based on the performance evaluation results and domain-specific requirements. Additionally, keeping up with advancements in computer vision research and methodologies can help improve the effectiveness of the detection system.

III. PROPOSED SYSTEM

Tracking objects in video processing is a vital and quickly developing advance for following the moving objects in visual-based observation frameworks. The object following in video grouping of observation camera turns into a testing and requesting undertaking for analysts to improve acknowledgment and following exhibitions. To follow the physical appearance of moving objects, for example, the vehicles and distinguish it in unique scene, it needs to find the position, gauge the movement of these masses and pursue their developments between two of back-to-back frames in video scene. This section proposed the quick and precise detection framework dependent on four stages to be specific preprocessing, object extraction, highlight extraction and classification.

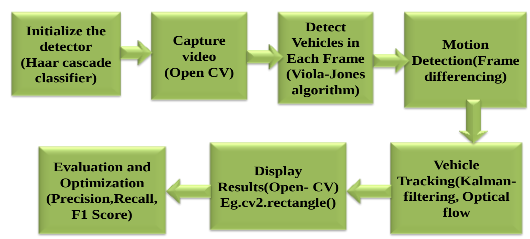

Fig: Block diagram of proposed algorithm

- FUNCTIONS OF EACH BLOCK

1. Initialize the detector: Load a pre-trained Haar-Cascade classifier for vehicle detection .Open cv provides pre-trained classifiers for various objects, including vehicles.
Eg:" Haarcascade_car.xml"

2. Capture Video: Initialize a video capture object to read frames from a video source (e.g., a webcam , live video stream).

3. Detect vehicles in each frame:

- Read a frame from the video stream.
- Convert the frame to grayscale.
- Apply the Haar Cascade classifier to detect vehicles in the grayscale frame.
- Draw bounding boxes around the detected vehicles
- 4. Motion Detection:
- Compare consecutive frames to detect moving vehicles.

- Use techniques such as frame differencing, optical flow, background subtraction to identify pixels or regions with significant changes between frames.
- Threshold the difference image to extract moving regions. Optionally, apply morphological operations (e.g., dilation, erosion) to refine the detected regions.
- 5. Vehicle tracking:
- Track the detected vehicles across frames to estimate their trajectories.
- Use methods such as optical flow tracking or object tracking.
- 6. Display results:
- Draw bounding boxes around moving vehicles on the original frame.
- Optionally display additional information such as trajectory paths.
- Show the processed frame with vehicle detection and tracking results.
- 7. Evaluation and optimization:
- Evaluate the performance of the vehicle detection and tracking system using appropriate metrics.

IV. RESULT AND DISCUSSION

With the advancement of computer image processing advances, road detection grows quickly. Road moving object detection in a traffic video is a troublesome undertaking. Traffic monitoring framework which dependent on the video image succession is a mix of digital video images and fake example acknowledgment innovation, and it analyzed the video images with qualities of instinct, productivity, wide detection range and high exactness. Scientists proposed numerous strategies to distinguish moving targets, for example, Background subtraction, just as various approaches to following vehicles, for example, area based, unique form, and feature based techniques. Consequently, in this examination we present another framework so as to control the vehicles includes by distinguishing and following of various road moving objects. This created framework depends on computer vision strategies that mean to take care of this issue by utilizing Haar like features and Background Subtraction procedure. Here, we examined the consequence of proposed strategy and contrasted and the after effect of existing systems.

Fig a. Input frame

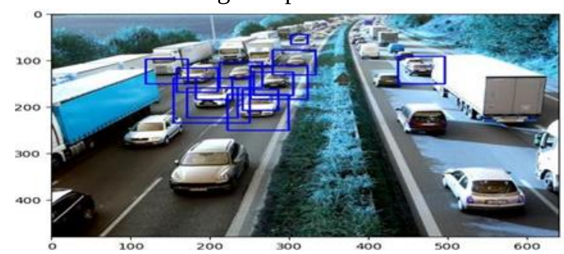

Fig b. Output frame

V. CONCLUSION AND FUTURESCOPE

Moving object detection and segmentation is important for traffic surveillance and object recognition in security surveillance. Moving object detection in dynamic environment video is more complex than the static environment videos. In this chapter, moving objects in video sequences are detected and segmented using feature extraction based Haar Cascade classifier approach. In conclusion, the use of Haar cascade classifier for moving vehicle detection in this project has proven to be effective and reliable.

By leveraging computer vision techniques, we were able to accurately identify and track vehicles in real-time, contributing to improved safety and traffic management systems. The robustness of the classifier, combined with its ability to handle various environmental conditions, makes it a valuable tool for applications in surveillance, transportation, and urban planning. However, continued research and development are essential to further enhance the system's accuracy and performance, ensuring its continued effectiveness in dynamic and challenging scenarios.

In this project we are using frame differencing and object tracking to identify moving vehicles accurately. The proposed system operates in real- time making it suitable for applications requiring timely detection and response. We evaluate the performance of the vehicle detection system on various data sets and analyze its speed, accuracy and robustness and different conditions. The result demonstrate the effectiveness of the proposed methodology for real-time moving vehicle detection, highlighting its potential for deployment in smart transportation system, and traffic management applications.

The future scope of this research work can be given in the following statements.

- This research work can also be extended to detect the moving objects or vehicles in thermal images.
- Automatic gesture recognition can be developed using the extension of this research work in future.
- This work can be extended to include different maneuvers to make the driving system capable of dealing with all driving environments.

REFERENCES

[1] [1] J. Heikkila and O. Silven. A real-time system for monitoring of cyclists and pedestrians. In Proc. of Second IEEE Workshop on Visual Surveillance, pages 74–81, Fort Collins, Colorado, June 1999.

[2] [2] C. Stauffer and W. E. L. Grimson. Adaptive background mixture models for real-time tracking. In Proc. Computer Vision and Pattern Recognition, 2: 246–252, 1999.

[3] [3] A. J. Lipton, H. Fujiyoshi, and R.S. Patil. Moving target classification and tracking from real-time video. In Proc. of Workshop Applications of Computer Vision, pages 129–136, 1998.

[4] [4] R. T. Collins et al. A system for video surveillance and monitoring: VSAM final report. Technical report CMU-RITR-00-12, Robotics Institute, Carnegie Mellon University, May 2000.

[5] [5] Y. Yuan, Z. Xiong, and Q. Wang, (2017)., ―An incremental framework for video based traffic sign detection, tracking, and recognition,‖ IEEE Trans. Intell. Transp. Syst., vol. 18, no. 7, pp. 1918–1929, Jul. 2017.

[6] [6] Peng Chen, Yuanjie Dang, Ronghua Liang., (2018), RealTime Object Tracking on a Drone With Multi-Inertial Sensing Data, IEEE Transactions On Intelligent Transportation Systems, VOL. 19, NO. 1, JANUARY 2018.

[7] [7] Horn, B. and Schunck, B. (1981). Determining Optical Flow, Artificial intelligence 17(1): 185– 203.

[8] [8] Lucas, B. and Kanade, T. (1981). An Iterative Image Registration Technique with an Application to Stereo Vision, Proceedings of the 7th international joint conference on Artificial intelligence .

[9] [9] Denman, S., Fookes, C. and Sridharan, S. (2009). Improved Simultaneous Computation of Motion Detection and Optical Flow for Object Tracking, Saleh Ali Alomari Digital Image Computing: Techniques and Applications, DICTA 2009., IEEE, pp. 175–182.

[10] [10] Kim, J., Ye, G. and Kim, D. (2010). Moving Object Detection Under FreeMoving Camera, Image Processing (ICIP) .

[11] [11] Shafie, A., Hafiz, F. and Ali, M. (2009). Motion Detection Techniques Using Optical Flow, World Academy of Science, Engineering and Technology 56.

[12] [12] Yokoyama, M. and Poggio, T. (2005). A Contour-Based Moving Object Detection and Tracking, Visual Surveillance and Performance Evaluation of Tracking and Surveillance, 2005. 2nd Joint IEEE International Workshop on, IEEE, pp. 271–276.

[13] [13] Zhang, P., Cao, T. and Zhu, T. (2010). A Novel Hybrid Motion Detection Algorithm Based on Dynamic Thresholding Segmentation, Communication Technology (ICCT), 2010 12th IEEE International Conference on, IEEE, pp. 853–856.

[14] [14] Girisha, R. and Murali, S. (2011). Tracking Humans using Novel Optical Flow Algorithm for Surveillance Videos, Proceedings of the Fourth Annual ACM Bangalore Conference, ACM, pp: 7. [15] Tzagkarakis, G., Charalampidis, P., Tsagkatakis, G., Starck, J.-L. and Tsakalides, P. (2012). Compressive Video Classification for Decision Systems with Limited Resources, Picture Coding Symposium (PCS), 2012, IEEE, pp. 353–356.

[15] [16] Braillon, C., Pradalier, C., Crowley, J. L. and Laugier. Braillon, C., Pradalier, C., Crowley,

J. L. and Laugier, C. (2006). Real-Time Moving Obstacle Detection using Optical Flow Models, Intelligent Vehicles Symposium, IEEE, pp. 466–471.

[16] [17] Hrabar, S. and Sukhatme, G. S. (2004). A Comparison of Two Camera Configurations for Optic-Flow Based Navigation of a UAV Through Urban Canyons, Intelligent Robots, and Systems, 2004. (IROS 2004). Proceedings. 2004 IEEE/RSJ International Conference on, Vol. 3, IEEE, pp. 2673–2680.

[17] [18] Hrabar, S., Sukhatme, G. S., Corke, P., Usher, K. and Roberts, J. (2005). Combined Optic-Flow and StereoBased Navigation of Urban Canyons for a UAV, Intelligent Robots and Systems, 2005. (IROS 2005). 2005 IEEE/RSJ International Conference on, IEEE, pp. 3309–3316.

[18] [19] Xiao, J., Cheng, H., Feng, H. and Yang, C. (2008). Object Tracking and Classification in Aerial Videos, Proceedings of SPIE, the International Society for Optical Engineering, Society of Photo-Optical Instrumentation Engineers, pp. 696711–1.

[19] [20] Basavaiah, M. (2012).Development of Optical Flow Based Moving Object Detection and Tracking System on an Embedded DSP Processor, Journal of Advances in Computational Research: An International Journal 1(1-2).

[20] [21] Hu, W., Tan, T., Wang, L. and Maybank, S. (2004). A Survey on Visual Surveillance of Object Motion and Behaviors, Systems, Man, and Cybernetics, Part C: Applications and Reviews, IEEE Transactions on 34(3): 334–352.

[21] [22] Shuigen, W., Zhen, C. and Hua, D. (2009). Motion Detection Based on Temporal Difference Method .Computer Vision 92(1): 1–31