Counting and Classification of Highway Vehicles by Using Raspberry Pi

Dr V KHANAA, Professor, BIST, Bharath Institute of Higher Education and Research. Bharath University

Dr M.Sundararajan, Professor, BIST, Bharath Institute of Higher Education and Research, Bharath University

Abstract
This paper describes an algorithm that counts and classifies road vehicles based on Raspberry Pi. Several calculations and advances have been produced to consequently control footers, haulage. A major problem in vehicle tracking, among many others, is selecting the appropriate features and models for target flat and tracking. Some of the basic selections to the function of visual objects are: color, intensity, shape and feature points. Classifying and counting vehicles is a difficult task because of issues such as blur picture, image resolution, etc. So far, several calculations have been produced for the classification and counting of vehicles. This paper proposes an Scale Invariant Feature transform (SIFT) and Random Sample Consensus Algorithm (RANSAC), due to its large property. These calculation used for moving vehicle arrangement and after characterization counting will be finished by the class. This will upgrade adequacy and immovable nature of vehicle characterization and counting strategy.

Keywords - Vehicle classification and counting, SIFT, RANSAC, Raspberry Pi.

I. INTRODUCTION
Vehicle recognition and counting was a dynamic Intelligent Transport System (ITS) search. Numerous strategies have been introduced for vehicle classification and counting utilizing a distinctive approach. These methods can be classified according to the type of sensors utilized in the selection and counting. Two regular methods of classifying and counting vehicles are based on hardcode and other programs. The vehicle grading and counting method incorporates various sensors, such as infrared sensors, radar, magnetic sensors, and so on. Classification of vehicles based on traditional hardware and counting strategy are essential and reliable, but with some gaps. Traditional methods of sorting and counting hardware-based vehicles are intrusive, whose constitution requires reconstruction of roads that need to be introduced. This road reconstruction may reduce the floor life. Another disadvantage of hardware based on vehicle classification and counting strategy is that they have set up area. Vehicle classification and tracking technique depends particularly on the algorithm instead of the sensor. Vehicle classification and counting techniques can be based on images or video. In this work, the transformation of the unchanged scale characteristic and the random sampling algorithm of consent to the classification of vehicles.

The non-invasive features of Scale Invariant Feature transform (SIFT) presented by David Lowe in 1999. This algorithm is usually used to detect key points. The technique is important for the reason that the characteristics used are invariant to image enlargement, translation, rotation, affine and above all, invariant to lighting variations. In the key point algorithm received and changed to appropriate the classification of vehicles and return a decent result.

II. Literature Survey
As for Jian Wu et al [1-9], SIFT maintains the invariance of scale and change of rotation and change of illumination. A certain degree of blurred image stability and refined transformation is maintained. The goal of this research paper is to use SIFT algorithm to count the vehicles according to class. In common object detection systems, due to having similar characteristics, shadows can be easily misclassified as either part of moving objects or independent moving objects. To address the problem of incorrect shadow classification as in the foreground, several methods have been introduced. They will addresses the main problematic situations associated with shadows and provides a comprehensive performance comparison on up-todate methods that have been proposed to tackle these problems. The evaluation is carried out using benchmark datasets that have been selected and modified to suit the purpose[2].

Improve urban administrator and increase confidence in roads and highways. The objective of this article is the basis for the classification of vehicles in neural networks. In this study we used a fixed camera that is located at a height almost near the surface of the road to detect and classify the vehicles. The algorithm used includes two general phases. In the first moment, they are continually moving vehicles in activity circumstances using a few systems including picture preparing and foundation.
picture evacuation and performing edge location operations and morphology. In the second stage, close-by cameras are chosen and prepared and separate particular elements. These elements apply to the neural system as a transporter for yields to decide the vehicle sort. The exhibited model can order vehicles in three classes: Heavy vehicles, light vehicles[3]. SURF algorithm is accomplished by depending on integral images for image convolutions can be processed and compared much faster. SURF algorithm not only guarantees the similar robustness with SIFT algorithm additionally it expands the computational effectiveness a great deal. After finding features and matching feature, they used RANSAC to choose a set of inliers that are compatible with a Homography between the images. Jiang et al. used the multi-scale geodesic dilation algorithm to reestablish and recreate the grain boundaries based on the enhanced finition of dilation [4]. A vigorous video-based framework for activity observing framework on the road during vehicle detection, vehicle arrangement and meaning powerful movement examination utilizing just a solitary standard camera. The fundamental goal of the work proposition is to recognize, track, group and include the vehicle halfway impedance and interface the shade on the streets. The watershed division technique controlled by markers was at first utilized for the extraction of areas in the forefront of the motorway scene. For following a Gabor channel is connected used to gauge the direction of the vehicle in video arrangements. For that vector machine to bolster productive vehicle order is utilized [5].

Table 1: summery of past work

<table>
<thead>
<tr>
<th>Author</th>
<th>Technique</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jian Wu et al. [1]</td>
<td>SIFT</td>
<td>count the vehicles according to class</td>
</tr>
<tr>
<td>Saroj K. Meher and M. N. Murty, [2]</td>
<td>Object tracking and recognition, shadow classification as in the foreground,</td>
<td>object detection systems</td>
</tr>
<tr>
<td>Jun Yee Ng. and Yong Haur Tay, [3]</td>
<td>scale-invariant feature transform (SIFT) technique, Canny's edge detector</td>
<td>edge location operations and morphology</td>
</tr>
<tr>
<td>Jiang M. X. and Chen G H.,[4]</td>
<td>SURF, SIFT, RANSAC (Random Sample Consensus Algorithm)</td>
<td>finding features and matching feature</td>
</tr>
<tr>
<td>Mrs. P. M.</td>
<td>background subtraction,</td>
<td>recognize, track,</td>
</tr>
</tbody>
</table>

III. VEHICLE CLASSIFICATION AND IMPLEMENTATION SCHEME COUNTING

The flow of proposed technique of vehicle classification and counting is shown in figure 1. The principal capacity is to peruse the video clip that is put away in the database and change over that video frame number. The second capacity is to discover the setting contrasts and to distinguish the background with background registration and subtraction. The accompanying post-handling is division is performed, and the vehicles are arranged utilizing the SIFT calculation. The objective is to outline a proficient calculation in view of the SIFT street.

A. Binary Detection of Moving Object

As a component of pre-processing, moving target are distinguished by taking the distinction of casings from two progressive edges[10-14]. After the paired recognition of such question is identified. At the point when the parallel question through the hindrance window, it is mulled over for further processing.

B. Segmentation

The following stage is segmentation. The division operation viably isolates homogeneous districts of whatever is left of the picture.

C. Feature Extraction Methods

This theory has concentrated diverse strategies for producing pictures, including SIFT, RANSAC, medium move, optical stream. Filter breakthroughs depend on key focuses[15-18]. The RANSAC strategy depends on parameters of a scientific model of a watched informational collection, the normal uprooting technique depends on part capacity and thickness degree, optical stream depends on changes in shading or power.
C.1 SIFT Algorithm

The calculation SIFT (Scale Invariant Feature transform) proposed by Lowe is an approach for extracting distinctive invariant features from pictures. In any case, in true applications, there is as yet a need to enhance the strength of the calculation as for the right matching of SIFT features. In this report, an enhanced SIFT unique calculation giving the most dependable feature matching on the reason for vehicle recognition. The principle thought is to partition the extricated elements of the object to be tested and the picture of the model into various subsets before they are matched. The components are subdivided into various sub-accumulations considering the attributes gotten from various octaves, that is, diverse recurrence spaces[19-22]. Filtering highlights have many points of interest like:

(1) SIFT features are all natural features of images. They are favourably invariant to image translation, scaling, rotation, illumination, viewpoint, noise etc.
(2) Good speciality, rich in information, suitable for fast and exact matching in a mass of feature database.
(3) Fertility: Lots of SIFT features will be explored even if there are only a few objects.
(4) Relatively fast speed. the speed of SIFT even can satisfy real time process after the SIFT algorithm is optimized.
(5) Better expansibility. SIFT is very convenient to combine with other eigenvector, and generate much useful information.

Detection stages for SIFT features are as follows:

(1) Scale-space extrema detection: The initial step of figuring hunts in all stairs and picture areas. It has been executed effectively by a Gaussian distinction to recognize potential purposes of intrigue that are invariant for introduction and scale.
(2) Key Point Position: Each competitor, then again, a definite model can decide the range and position. Key focuses are chosen in light of stability measures.
(3) Orientation assignment: at least one headings are appointed for each point position key in light of the angle picture of residential areas. All operations are executed later on with the picture information that has been handled in connection to the scale, introduction, and position for each feature, hence giving an invariance to these changes.
(4) Generating Key Points Descriptors: Local picture angles are measured in the chosen district around each scale key point. These inclinations are changed into a portrayal that backings noteworthy levels of neighborhood variety in light and mutilation of the shape.

1. Scale-space extrema detection

The purposes of enthusiasm for SIFT attributes relate to the nearby extremes of Gaussian distinction channels, at various scales. From the gaussian-obsurred picture portrayed as equation

\[ L(x, y, \sigma) = G(x, y, \sigma) * I(x, y) \]  

Where

\[ G(x, y, \sigma) = \frac{1}{2\pi\sigma^2}e^{-\frac{x^2+y^2}{2\sigma^2}} \]  

\[ D(x, y, \sigma) = L(x, y, \sigma k) - L(x, y, \sigma) \]  

Which is simply different from Gaussian blur in scale k σ and σ.

Fig. 2 Diagram showing the blurred images at different scales, and the computation of the difference-of-Gaussian images[6]

2. Locating keypoints

The key stride, additionally the initial phase in the acknowledgment of articles utilizing the SIFT strategy is to produce stable features. We can discover that in the event that we need to discover and portray the SIFT work focuses, we should take after these means:

(1) The position of a picture differs from [0, 1].
(2) Use a Gaussian variable bit G scale (x, y, σ) to make the scale space L (x, y, σ).
(3) Calculate the distinction of Gaussian capacity as standard Laplacian estimation. Since the reviews have demonstrated that standardized laplacine is invariant of scale.
(4) Determine the greatest or least estimation of the Gaussian distinction work by contrasting one of the pixels and past, current and lower 3 × 3 locales.
(5) exact position purposes of point focuses dismisses underneath a foreordained esteem.

The extremes of various gaussian twists are imperative along the edges, can be decreased by checking

\[ \frac{Tr(H)^2}{Det(H)} < \frac{(r + 1)^2}{r} \]

Clearly, H is a framework of 2 × 2 Hessian matrix, r is the proportion between the biggest and littlest magitud.
For the invariance by revolution, extent angle $m \ (x, y)$ and introduction $\theta \ (x, y)$, the accompanying conditions are pre-computed.

$$m \ (x, y) = \sqrt{(L(x + 1, y) - L(x - 1, y))^2 + \left(L(x, y + 1) - L(x, y - 1)\right)^2}$$

$$\theta \ (x, y) = \tan^{-1}\left(\frac{L(x + 1, y) - L(x - 1, y)}{L(x, y + 1) - L(x, y - 1)}\right)$$

(8) Take a component and its 16 x 16 neighbors around him. At that point partition into 4 x 4 sub-districts, each sub-area histogram with 8 boxes.

3. SIFT feature representation

In the wake of choosing an orientation of the key focuses, the feature descriptor is figured as an arrangement of introduction histograms of 4 x 4 pixels. The orientation histograms are identified with the introduction of the key focuses, the orientation information gotten from the Gaussian scale nearest to the key point scale[23-29]. As some time recently, the commitment of every pixel is weighted by the greatness of the inclination and by a Gaussian with $\sigma$ 1: 5 times the size of the key point.

4. Orientation assignment

In this progression, so as to acquire the invariance to revolution of the picture, the key purposes of the descriptor is spoken to as for this introduction[30-32]. For each of the tested focuses Gaussian sharp are chosen in areas around the noteworthy point are ascertainment and the greatness $m$ and introductions $\theta$ From the inclination.

5. Keypoint matching

The subsequent stage is to apply these SIFT video frame arrangements to object tracking. Filter components are removed by info video groupings and put away utilizing key point descriptors. 4 doles out each key information parameter, which is 2D position, introduction, and scale. Each protest is followed in another video grouping by consecutively sequencing each point found in the new video outline successions to the question. The Euclidean separation is embedded as a measure of resemblance likenesses of the character. Applicants can be kept up when the Euclidean separation of the two capacities is more prominent than the above indicated limit. So as well as can be expected be chosen from the estimation of the parameters the other way, the consistency of their position, introduction, and scale.

C.2 RANSAC Algorithm

The following stage is to apply these SIFT video frame sequences for tracking objects. The SIFT elements are removed from the information video streams and are put away utilizing the key descriptor focuses. 4 assigns out each key information parameter, which is the position in 2D (y-coordinates Y coordinates), orientation and scale. Each object is tracked in a new video sequence consecutively by sequencing all points of the character found in the new video frame sequences to the object. Euclidean separation is presented as a measure of closeness like character. Hopefuls can be kept up when the Euclidean separation of the two capacities is more prominent than the edge indicated previously. So as well as can be expected be chosen by the estimation of the parameters the other way, with the consistency of their position, orientation and scale.

1) Select the minimum number of points needed to determine model parameters.
2) Resolve model parameters.
3) Determine how many points of the set of all points with a predetermined tolerance form #.
4) If the fraction inlier number of the total number of points in the set exceeds a predetermined threshold $\tau$, re-estimate the model parameters using all identified inliers and ends.
5) If not, repeat steps 1 through 4 (maximum N times).

RANSAC can be applied to control whether a group of points is set on a geometric pattern. From the combined points obtained using the SIFT method, three pairs of points are randomly selected to create a transform matrix that is set to a 2D plan. Then set a threshold, the distance of the real point position of the previous point position is calculated by the transformation matrix. RANSAC achieves its goal by selecting iteratively a random subset of the original data. These data are hypothetical. This theory was then tried as takes after:

(1) A model is mounted on theoretical inliers, i.e all free parameters of the model are recreated from the informational index[33].
(2) All other information were then tested according to the assembled model. In the event that a point is extremely appropriate for the estimated model, it is additionally viewed as a speculatively idle.
(3) The evaluated model is sensibly great if an adequate number of focuses were delegated hypothetical inlier.
(4) The model is audited by every hypothetical inlier in light of the fact that the model was assessed just toward the start of the arrangement of hypothetical inlier.
(5) Finally, the model is assessed by evaluating the injector mistake concerning the model. This strategy rehashes a settled number of times, creating a model that is rejected in light of the fact that excessively few focuses are evaluated as injectors or a refined model alongside a relating mistake measure each time. In the last case, we keep up the refined model if its blunder is not as much as the past spared format[34].

IV. HARDWARE IMPLEMENTATION
A. Raspberry Pi Board

Raspberry Pi is a charge card estimate PC grew just in the UK by the Raspberry Pi Foundation with the point of invigorating the instructing of essential software engineering in schools. It has two models; The model has 256 MB of RAM, a USB port, and a system association. Model B has 512 MB of RAM, two USB ports, and an Ethernet port. The Broadcom BCM2835 has a framework on a chip that incorporates an ARM176JZF-S 700MHz, Core Video GPU IV and a SD card processor. The GPU is fit for Blu-beam playback quality by utilizing H.264 40MBits/s. It has a quick 3D center to get to utilizing the OpenGL ES2.0 and Open VG libraries gave. The chip particularly gives HDMI and VGA support[35]. The establishment gives Debian ARM and Arch Linux and Python conveys as the fundamental programming dialect with support for BBC BASIC, C and Perl, the nitty gritty depiction of the Raspberry Pi board was in Fig.3 (Raspberry Pi User Guide). Python has been picked as the fundamental programming dialect since it is by and large acknowledged to be anything but difficult to learn and full title programming dialect appropriate for genuine applications. With the expansion of Numpy, SciPy, Matplotlib, PyLab IPython and Python can be utilized both for computational arithmetic to investigate information frameworks or exploratory control. Because of the interesting favorable circumstances of Raspberry Pi framework, this innovation is exceptionally encouraging to convey creating arrangements. The most unmistakable element of the raspberry Pi if utilized for instructive reasons for existing is the GPIO module[36].

B. Power supply

The energy of Raspberry Pi is very basic. This framework utilizes a small scale USB association for power and miniaturized scale USB association capacities to give no less than 700mA at 5V. It is likely that the costs of general cell phones are proper and don't attempt to encourage the raspberry pi from a USB port of another PC or a center point since they are frequently not able to give the fundamental current.

V. EXPECTED OUTPUT

The first part of function is to read the video clip, which is stored in database and convert that video into number of frames. By using following algorithm, we will count the vehicle count and it should be display on common window.

VI. CONCLUSION

Scale Invariant Feature Transform (SIFT) and Random Sample Consensus Algorithm (RANSAC) are utilized for vehicle arrangement and checking is finished by class of vehicle is portrayed. With the assistance of SIFT and RANSAC calculation, extraction invariant picture includes, that are steady over picture interpretation, revolution, scaling, camera perspective and to some degree invariant to changes in the brightening will be conceivable. Therefore, This venture proposes a successful Scale Invariant Feature change (SIFT) and Random Sample Consensus Algorithm (RANSAC) discovery and coordinating control focuses venture, because of its great properties. This will enhance productivity and dependability of vehicle classification and counting system.
REFERENCE:
36. Lakshmi C., Ponnavaikko M., Sundararajan M., Improved kernel common vector method for face recognition varying in background conditions, Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), V-6026 LNCS, PP-175-186, 2010


