# Pedestrian Detection by Fusing 3D Points and Color Images

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## Abstract

*In this project, a fusing approach of a 3D sensor and a camera are used to improve the reliability of pedestrian detection. The proposed pedestrian detecting system adopts DBSCAN to cluster 3D points and projects the candidate clusters onto images as region of interest (ROI). Those ROIs are detected by HOG (histograms of oriented gradients) pedestrian detector. Because the DBSCAN groups together 3D points and rejects outlier points correctly, the proposed system has a low false detection rate. The performance is also improved since the proposed system only detects the ROI instead of the whole color image. Recently, many approaches of pedestrian detection are proposed because the technology is widely used in many applications, e.g., surveillance system, door control system, driving assistant system and home care system. The pedestrian detection systems usually use variant perceptions which may be single sensor or multisensor systems. Generally, the acquired information from those sensors can be categorized as 2D information and 3D information. Some existing detection algorithms use only single type information to recognize pedestrians, e.g., camera. The most advantage of the color image based pedestrian detection is cheap because only a camera is needed. But, the main drawback is too false alarms caused by shadows or occlusion because of lacking depth information. Unlike the color image based pedestrian detection, the 3D information based pedestrian detection systems have more accuracy information which can be used to separate objects more exactly. But, recognition of high dimensional features takes more computation time. Furthermore, a Lidar is more expensive than a camera.*

**Keyword : -** *3D Sensor, Pedestrian Detection System, Surveillance System, Door Control System, Driving Assistant System.*

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**1. Introduction**

Our performance evaluation focused on demonstrating the relative improvements arising the reduction of false positives at constant sensitivity. after the classification module and by a factor of the tracker, trajectory-level system performance of approximately 80% sensitivity. However, this perceived performance gap, for the most part, stems from the exceeding difficulty of our test
sequence (undulating roads, bridges, speed bumps, and very complex urban scenery),which was specifically chosen as a challenging test bed for the proposed road profiling module. In this paper, does not heavily optimize the feature sets with regard to the different modalities. Instead, we transferred general knowledge and experience from the behavior of features and classifiers from the intensity domain to the depth domain. In this project does not particularly focus on processing time constraints in this project. However, we do expect that software optimization and hardware implementation (e.g., digital signal processor and field-programmable gate array) can result in real-time applicability of the proposed algorithms. Future work includes dealing with partially occluded pedestrians explicitly and integrating into the current system.

**2. Literature Survey:**

The existing multi-sensor approaches of pedestrian detection usually use two or more different sensors to avoid mutual interference. The Lidar is often used for sensing the depth information of the environment. Basically, the Lidar has two types, single-layer Lidar and multi-layer Lidar. In inglelayer LIDAR approaches, the 3D scan data on a same horizontal plane is used for detecting and segmenting objects. In the range information and visual information are considered together in the CRF classification. In two monocular color cameras for line and vehicle detection and a LIDAR for tracking are used. A local and a global tracking approaches were proposed for on-road object detection. These approach provided ROIs for visual detection system. In multi-layer LIDAR approaches, the 3D scan data of the whole environment can obtained to provides more features for recognition. Thus, the multi-layer information is not only to provide the candidates of objects, but also their features are meaningful for object recognition. However, the main drawback is time-consuming because high dimensional features take more time to classify. In Spinello and Siegwart used a multi-layer LIDAR to detect the object's position and the HOG-SVM classifier based on monocular color images to classify the detected objects as pedestrian or nonpedestrian. In a method based on tracking and vision score–based likelihood is proposed. In the approach used a convolutional NN classifier based on monocular gray-scale images to detect pedestrians.

**3. System Architecture:**

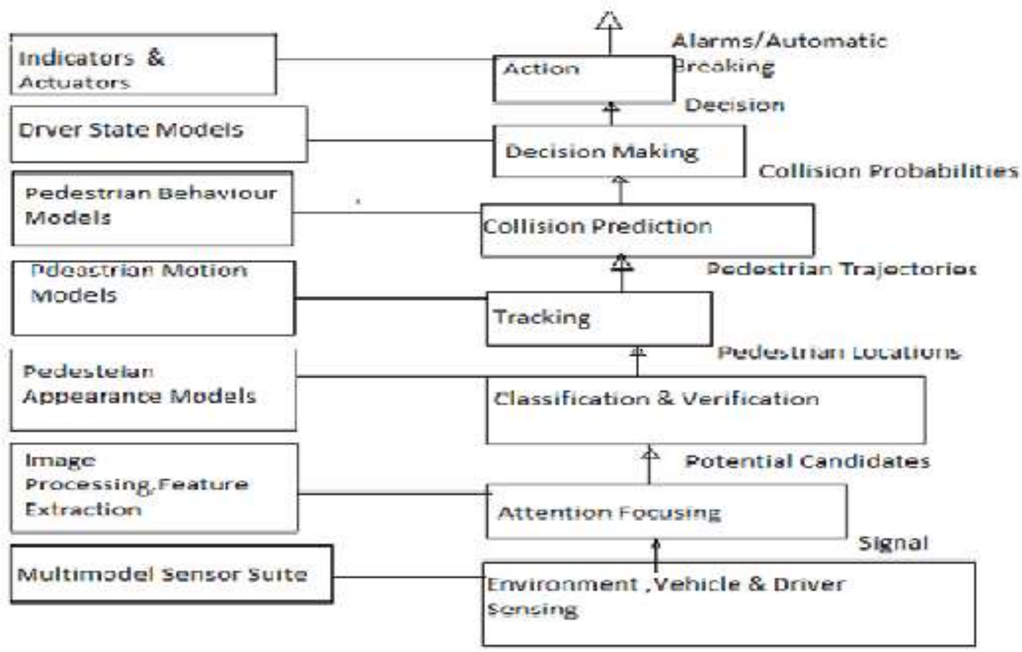


Fig: System Architecture

**4. Objective And Scope Of Proposed System:**

1. Acquiring 3D point and color image.
2. clustering the 3D point by DBSCAN.
3. The candidates of 3D points are mapped to the candidate pixel of the image and the rectangle including this pixel are selected as the ROIs.
4. 4.HOG discriptors are extractd within the ROIs and the trained SVM classifier is used to detect the edestrians

**5.Software,Hardware &Test Data Requirements:**

**5.1Hardware Requirement:**

1.Camera

2.Monitor

3.Key Board

4.Mouse

**5.2Software Requirements:**

1.Operating System:Windows

2.Coding Language: Java , NetBin

## 6. Conclusion:

A fusing approach of a 3D sensor and a camera are used to improve the reliability of pedestrian detection. The false alarm rate is reduced significantly. However, since some pedestrians with less than three Lidar points are ignored in our approach, the detection rate is decreased a little bit. Furthermore, the proposed algorithm is also more efficient because it only detects the ROIs instead of the whole image. Every frame can be detected within 0.75 second. In the experimental results, the true positive rate (TPR) of the proposed system is up to 71.7% and the false positive rate is 13%.

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