LITERATURE SURVEY

JAY WALKING DETECTION

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PAPERS

	TITLE	***SOURCE***
PAPER 1	**METHOD AND SYSTEM FOR DETECTING JAY WALKING OF VULNERABLE ROAD USERS**	United States Patent and Trademark Office
PAPER 2	**THE JAYWALKER DETECTION BASED ON MOTION PATH ANALYSIS**	ICTE 2011 International Conference on Transportation Engineering.
PAPER 3	**INVESTIGATION OF PEDESTRIAN JAYWALKING BEHAVIOUR AT MID-BLOCK LOCATIONS USING ARTIFICIAL NEURAL NETWORKS**	ELSEVIER
PAPER 4	**VISIBLE AND THERMAL CAMERA-BASED JAYWALKING ESTIMATION USING A HIERARCHICAL DEEP LEARNING FRAMEWORK**	SPRINGER LINK
PAPER 5	**CONVOLUTIONAL NEURAL NETWORK-BASED JAYWALKING DATA GENERATION AND CLASSIFICATION**	IEEE
PAPER 6	**VISION BASED DRIVER ASSISTANCE FOR NEAR RANGE OBSTACLE SENSING UNDER UNSTRUCTURED TRAFFIC ENVIRONMENT**	IEEE

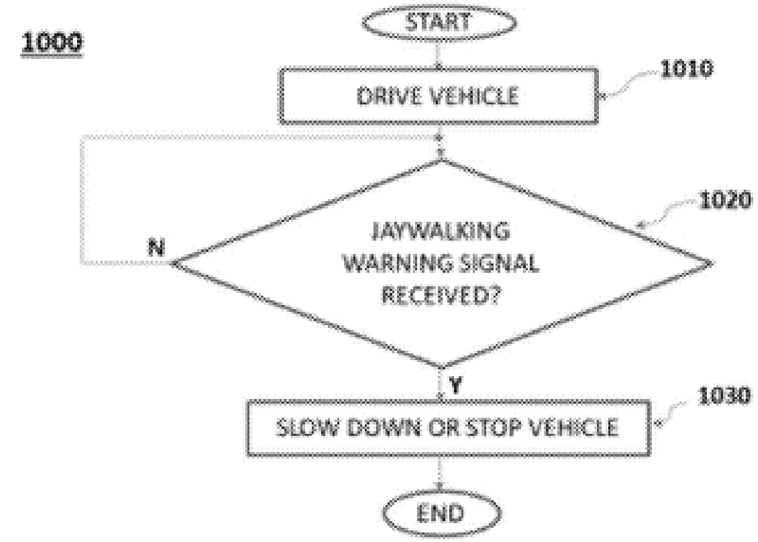
ABSTRACT

This application relates to a method and a system for automatically detecting jaywalking of vulnerable road users (VRUS). In one aspect, the method includes first determining whether a detected current trajectory of the first VRU substantially matches a first path infrequently taken by the plurality of VRUS. The method also includes second deter mining whether a predicted trajectory of a selected VRU crosses a second path frequently taken by a plurality of vehicles based on the past trajectory data of the plurality of vehicles.

PAPER 1

INFERENCE

FIG. 11



- a memory device configured to store past trajectory data of a plurality of vehicles and a plurality of VRUs;
- a processor device comprising a computing device configured to:
  - detect a current trajectory of a first one of the plurality of VRUs, each of the plurality of VRUs and each of the plurality of vehicles configured to be linked to a long-term evolution (LTE)-capable user equipment (UE) terminal;
  - first determine whether the detected current trajectory of the first VRU substantially matches a first path infrequently taken by the plurality of VRUs based on the past trajectory data of the plurality of VRUs;
  - in response to the detected current trajectory of the first VRU substantially matching the first path, tag the first VRU as a selected VRU;
  - obtain a predicted trajectory of the selected VRU;
  - second determine whether the predicted trajectory of the selected VRU crosses a second path frequently taken by the plurality of vehicles, the second path different from the first path;
  - third determine whether the predicted trajectory of the selected VRU is substantially distal to a third path marked for VRU use; and
  - fourth determine whether the selected VRU is jaywalking based on one or more of the first determining, the second determining, and the third determining.

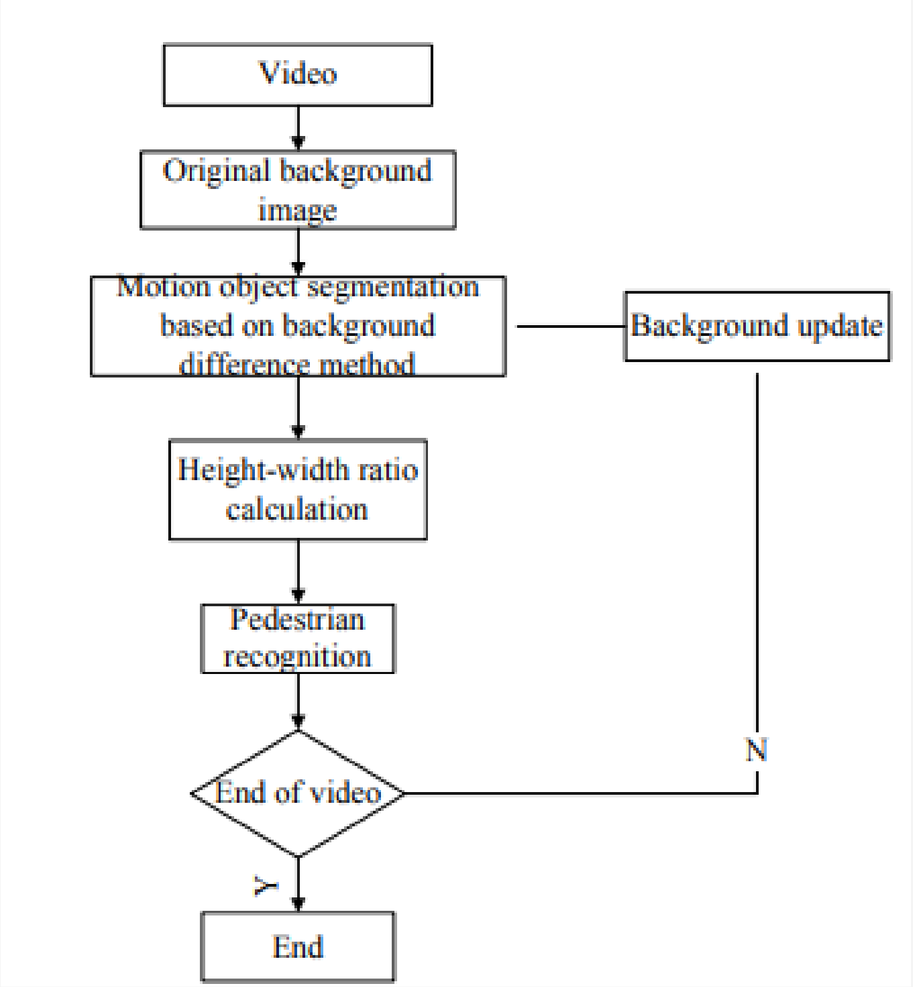
ABSTRACT

The method analyses and
detects jaywalker's abnormal behavior against traffic rules. Firstly, the motion object is segmented based on the background difference method, and pedestrian is recognized from vehicle according the **height-width ratio**. Secondly, the pedestrian's motion path is obtained through the **linear predictive tracking algorithm**. Then the pedestrian motion path is simplified to the line set through linear fitting, and the motion direction is calculated. Finally, the jaywalker is detected according the angle between the pedestrian's motion direction and road direction.

PAPER 2

INFERENCE

- First, the pedestrian motion path is obtained through the motion object segmentation, pedestrian recognition and pedestrian tracking.
- Second, the pedestrian's motion direction is obtained through linear fitting.
- Finally, the jaywalker is detected according the angle between the pedestrian's motion direction and road direction



ABSTRACT

This research presents a framework based on artificial neural networks (ANNs) to predict jaywalker's trajectory while crossing the road. The dataset comprises of 2504 samples which is collected under non-lane based heterogeneous traffic conditions. The optimal ANN architecture comprises of 9 input nodes, 10 hidden nodes and 1 output node. This study also determines the microscopic variables, i.e., speed, flow and density, associated with jaywalking. The results indicate that the average speed of male jaywalkers is higher than female jaywalkers.

In addition, this research develops jaywalker trajectories in order to understand their position shifting strategies. Findings suggest that 'median to sidewalk' movement trajectories tend to move closer to the foot-over bridge, whereas, the 'sidewalk to median' movement trajectories tend to move further away from foot-over bridge.

PAPER 3

Step 1: Jaywalker's position at present, gender, walking/running, threats, vehicle presence, etc. are set as input layer in the ANN model

Step 2: Through the process of forwarding propagation, using the various layers the ANN model calculates the cost function, which is the difference between the actual x-y co-ordinates of jaywalker and the predicted x-y co-ordinates of jaywalker after 1 s. The model with the least amount of cost is considered the best fit to represent jaywalking behavior.

Step 3: After calculating the cost function, the model calculates the gradient descent/slope for all the connections between the nodes. (reducing the cost/loss) **backward propagation.**

Step 4: The trained model accuracy can be evaluated and then used to predict the test data

ABSTRACT

In this research paper a two-step hierarchical deep learning formulation using visible and thermal camera is proposed to address these challenges.
The two steps are comprised of a deep learning-based scene classifier and two scene-specific semantic segmentation frameworks.
The two scene-specific segmentation frameworks estimate the normal pedestrians and jaywalking pedestrians. The two segmentation frameworks are individually trained on the legal or illegal crossing scenes. The proposed framework is validated on the FLIR public dataset and compared with baseline algorithms.

PAPER 4

METHOD

The **sensor fusion of the thermal and visible camera**
address the challenges associated with the visible camera such as illumination variations and sensor noise

The **hierarchical framework** is comprised of a classification step and a semantic segmentation step. The classification step is formulated using a single deep learning based scene classifier which classifies the driving scene into a legal pedestrian crossing

The **hierarchical framework** is formulated to reduce the following pedestrian behavior estimation errors:

a) appearance similarities between jaywalking pedestrians and pedestrians in legal crossing scenes

ALGORITHM

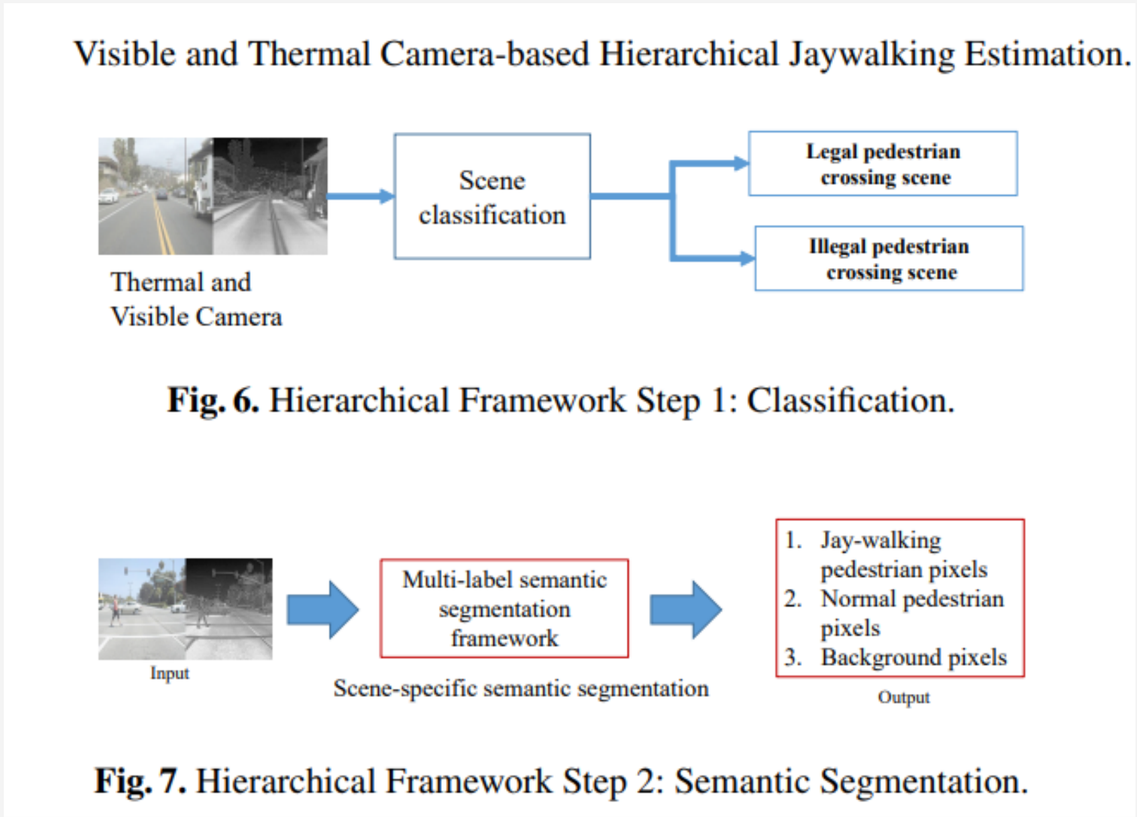
Classification Step

The architecture comprises of feature extraction, classification and output layers.

Semantic Segmentation Step

two multi-class semantic segmentation networks

encoder-decoder architecture



COMPARISONS

Table 3. Comparative analysis of the proposed hierarchical framework with different estimation approaches.

Proposed Algo.	Pixel Acc.%		IOU (Unit Scale)		Time (ms)
	Normal Ped	Jaywalk Ped.	Normal Ped	Jaywalk Ped.	
Proposed Hier.	**80.05**	**82.75**	**0.71**	**0.73**	47
End-to-End Seg.	78.99	71.58	0.70	0.64	36
Hier. Single Encoder	60.04	32.23	0.50	0.29	50

ABSTRACT

This paper proposes a novel method to generate jaywalking images. To perform this, A CNN model is trained in-order to detect the vehicle drivable areas. The model segments the existing people in the image and places them in the detected vehicle drivable areas to create a jaywalking image.

The experiment results show that the jaywalking classifier trained with both generated synthetic dataset and the untouched natural dataset has a high accuracy of 0.96, which is 0.08 higher than the accuracy using only the untouched natural dataset on the same model.

PAPER 5

SYSTEM

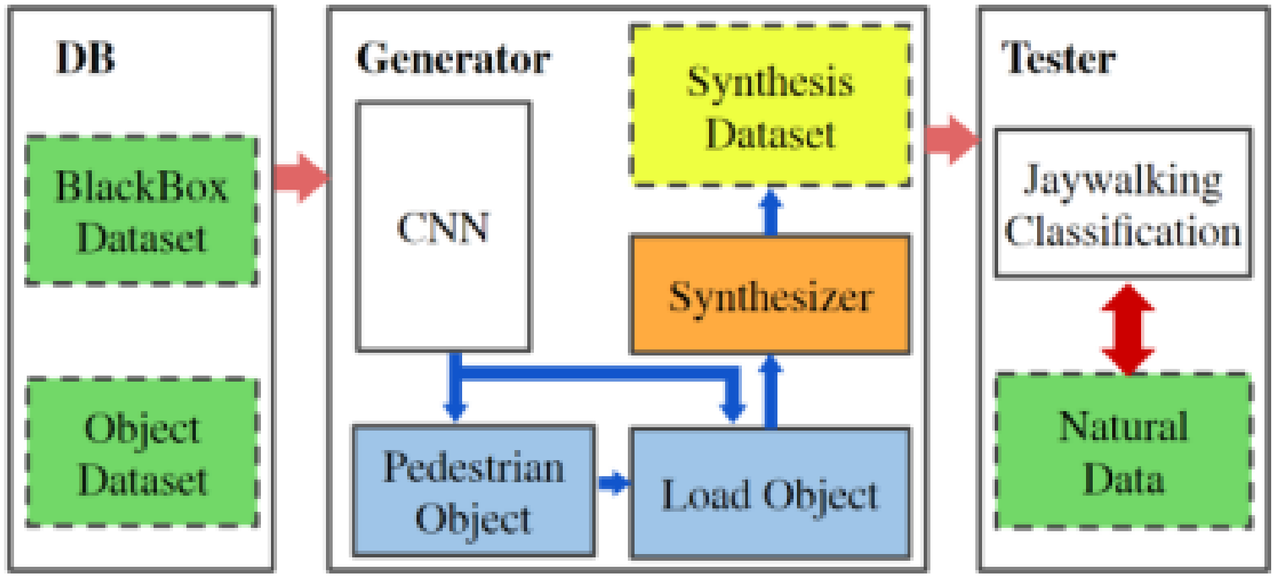
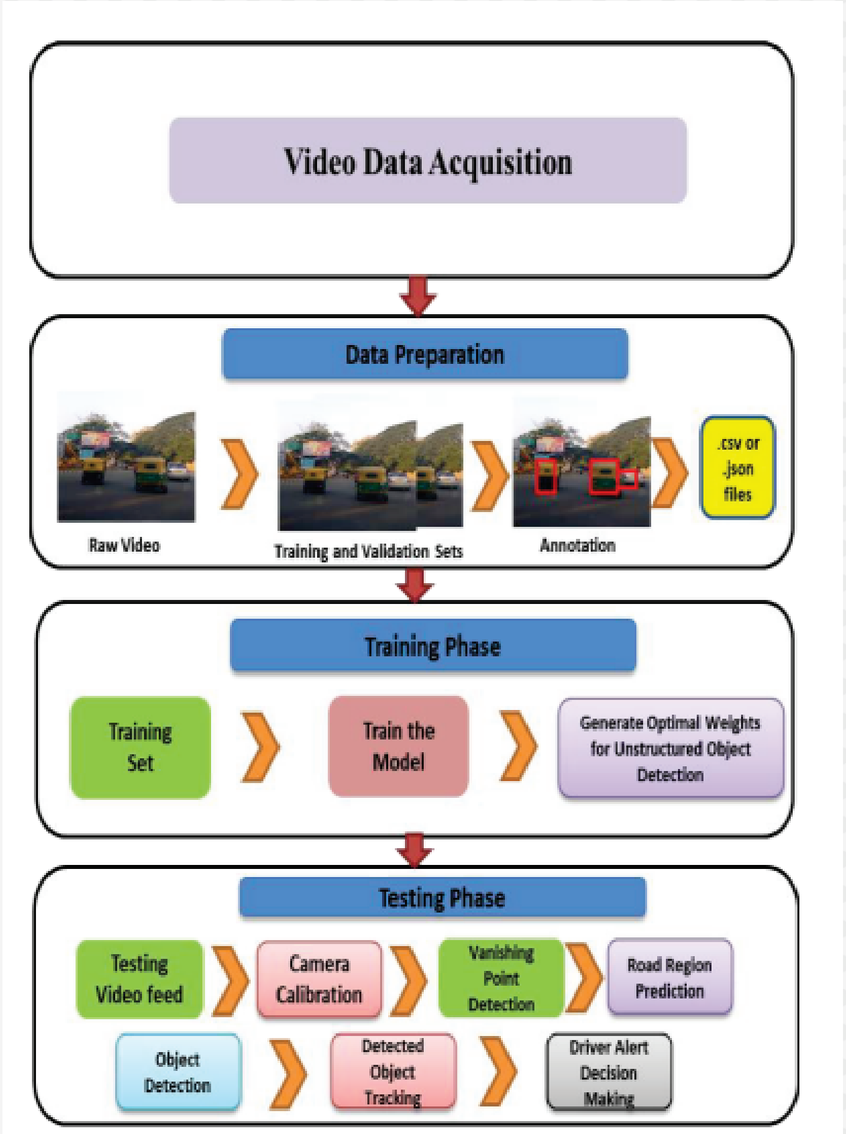


Figure 2. The overall architecture of proposed system

ABSTRACT

In this paper, if any obstacle is
entering the drive region or in the drive region within 15
meters. To improve real time performance of deep learning
model, proposed methodology first predicts the drive region on
road using monocular camera based on vanishing point (VP). YOLO (You Look At Once) darknet v3 detector is integrated with tracking algorithm SORT (Deep simple online and real time tracking) and multilevel perceptron neural network does early predication to alert the driver based on spatial information of detected obstacle. A visual alert will display the type of obstacle entering or within the drive region.

PAPER 6



The proposed method only gives the driver a visual alert which might not be noticed by the driver. To overcome this drawback, the visual alert system can be interfaced with a Controller Area Network (CAN) signal to take necessary actions.