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Capturing the Image of Occupants Inside the Car by using Inside-Car Camera during Vehicle Collision

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Abstract

The safety concern in means of transport has been considerably increased in last few decades. Distinct Sensory systems have been applied inside and outside vehicles in order to save lives. In this regard, imaging and vision system are used for capturing the static position of the passengers inside the vehicle during collision. There are many approaches to capture an image concatenation from a camera and to analyze them. The image of the passengers is captured during rear end vehicle collision by an inside car camera which is fixed on the left top of front windshield and an event parsing algorithm identifies the collision that has occurred. The decomposing of the collision activity is classified into three activity and uses the Or-And Graph (OAG) to compose the compositions of the temporal relationship among the collision detection. An online parsing (OP) algorithm for OAG formed from Earle's parser is employed to parse the image and identify the passenger's condition. This technique could be used as an enhancement for the safety of the passengers and to provide immediate assistance during vehicle collision.

Keywords: Inside-Car Camera, Or-And Graph (OAG), Sensory Systems, Static Position, Vehicle Collision

1. Introduction

Many surveys have reported that nearly 80% of severe accidents are due to rear end collision. Hence consequently more successful and automatic supervising techniques were required to identify the condition of the passengers inside the vehicle during collision. Distinct sensory systems have been implemented in several means of transport and a strenuous attempt is taking place during last few decades to enhance the security and comfort zone of the passengers.

In this way, vision and imaging systems has appeared in distinct trading vehicles such as ultrasonic wave sensors for parking, GPS tracking for a clear route, infrared cameras for displaying clearer images on the windshield during night or cloudy days, etc. The AdaBoost algorithm and color of skin is used to detect the passenger's body condition. Although, as the vehicle is in kinetic motion or collapsed, the scenario remains complex; it is common to obtain multiple transformed background in the image. To prevail this issue, the Or-And Graph (OAG), is implemented which constitutes the compositions of the activities and the temporal relationships among the activity that are implemented.

An event parsing algorithm is implemented to find the condition of the passengers during collision. The Inside-car cameras can be used without deviation for capturing the image of the passengers. The image captured by the Inside-car camera will be sent to the processor, and the system will transfer the image to predefined emergency numbers for assistance.

2. OAG Compositions

The Or-And Graph (OAG) was first instigated for computer vision and sensing by Hayun et al.,[8] and has been employed to determine video and camera functions. OAG consist of Link-And, Link-OR, Links-Leaf and

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temporal relations among the links. Link-And constitute the structure and concatenation of their sub-links. Link-OR constitute every alternatives to accomplish this link and all the alternative has a possibility, that represents for the occurrence of the alternative. Link-Leaf constitute the atomic activity, that cannot be furthermore degraded.

The parallel connection among the links support for the temporal relations among the links from surveying the collision detection. OAG activity is shown in Figure 1. Here the temporal constraints are reduced such that: the time duration of A, B and C which satisfies defined constraint.

P is constitutes the determined graph of the detection activity

vt(P){a1 ,….. an}

v(or)(P)={v1…vn(or)}

R(P)={T1,….Tn}

$$E(P)=\sum_{ai\in V(P)} E(ai)+\sum_{vi\in V(or)P} -\log P(vi)+\sum_{Ti\in V(or)} -\log P(vi)$$

The initial phase represents the power of identified leaf links (atomic activity). Where E(a) = log P(a) is the power of atomic activity *a.*

The next phase represents how constantly all Or-link degrades in a definite path. Generally, **vi** constitutes the Or-link and *p(vi)* is **vi** probability is characterized on the demonstrating data. The final phase represents for the temporal relations among the links in *P*.

The probability of *P* is determined as

$$p(P)=\frac{1}{Z}\exp\{-E(p)\}$$

Where *Z* is the normalization factor and is summarized over all as

$$p \; as \; Z=\Sigma p \; \exp\{-E(P)\}$$

3. Crash Phase Detection

3.1 Car Crashing into Something

The technique of employing AdaBoost learning algorithm was implemented for cascading body detector which was suggested by Viola et al[9]. The AdaBoost learning algorithm determines simple key attributes from a considerable set of attributes to construct a most efficient classifier. DA represents for the detection activity A, B and C represents the activities of crashing into something, people inside car crashes into car's interior, and passenger's physical harm.

The parallel connection among A, B and C represents for the enduring duration of every technique to place these individual classifiers in collaboration to produce more complex classifier. The detection activity is demonstrated on 2100 positives and 2100 negatives. The positive detections are measured to a resolution of 24 by 24 pixels and the negative detections do not have image. The color of skin model is initiated on the HSV color space. After detecting the collision, the bounding box of the image is stretched to left and right, to get clear image. There are three kinds of activities in the detection activity. The area apart from the face is used to establish whether the part of neck is becoming smaller and smaller in the consistent frames.

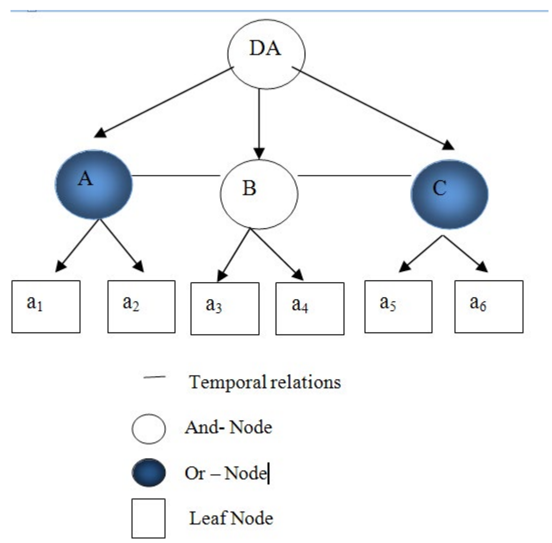

Figure 1. Detection activity.

3.2 Occupant Crashes within the Car Interior

The occupant inside the car crashes into the car's interior and is detected at the time of rear end collision. The use SVM (Support Vector Machine) Implemented by Stein et al[6]. to make the classification of collision inside the vehicle. The attribute specified is the Histograms of OG (Oriented Gradients). To delete the disturbed impact of scenario, the skinless pixels in the demonstrating images is set to black. The interval from sample point to the optimal hyper-plane is measured using the formula.

The confidence of the detection result is

$$P(x) = exp\left(\frac{-1}{|d(x|)}\right)$$

3.3 Image Capturing using Fisher Transformation

According to the crash detection there are possibilities that the Inside–car camera may have blurred vision. To overcome this issue, Fisher transformation introduced by Hom et al.,[4] is used which enhances the focus point to locate the image precisely. Here Red Exclusion technique (black) and (purple) elements are chosen as the two dimensional input vector of Fisher transformation. In order to check the adjustability of the Fisher classifier, the distinct samples are taken indistinct vision conditions and distinct collision states as demonstrating data. Apart from skin and lip color, dark areas such as eye, eyebrow, nostril and so on. They will affect the detection results. Therefore constraint Fisher transformation formula is implemented.

$Y = w^T X$

$x \quad \varepsilon_l$ or $x \quad \varepsilon_s$

or

$Y = w^T m_1$ else

where ε_l represents for range

ε_s represents for attitude

m_1 represents for average

Finally, the ratio of the detection activity is calculated. If the ratio is larger than a characterized threshold, then it will be applied to fisher transformation, the crash is labeled as the detection state, otherwise as the typical state.

4. Activity Detections in Image Concatenations

An online parsing algorithm is implemented for OAG formed from Earley's parser to trigger determined graphs related to the input data. Earley's algorithm studies terminal notations in a series, generating a set of every uncertain derivation (states) that is accurate with the input up to the present input terminal notation. Specified the following input notation, the event parsing algorithm computationally performs one of three prime functions (prediction, scanning and completion) for every state in the present state.

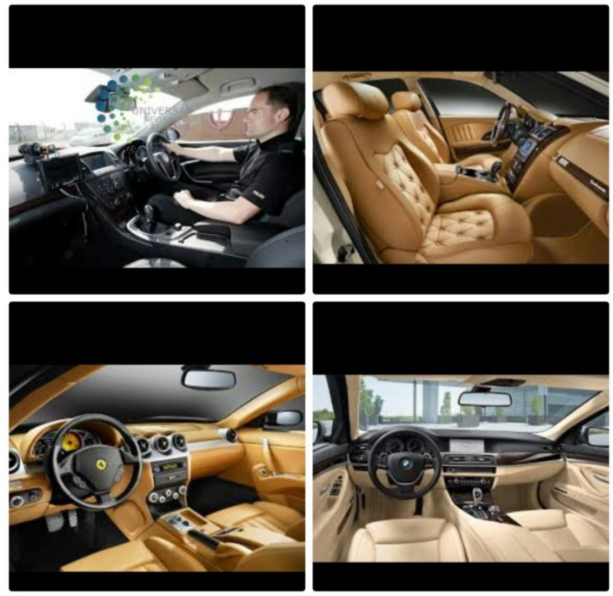

Figure 2. In- car camera mounted inside vehicle.

5. Experiments

The camera was mounted on left side of driver's seat to taking the passenger's image with a 640*640 pixel resolution at 40 fps. The forty percent frames of every video are considered as the demonstrating data, and the enduring frames as testing or sample data. The fifty samplings of detection activity are considered as the testing data. The OAG composition is initiated as shown in Figure 1, and the demonstrating data represents the parameters of OAG.

Hence the result of the required Fisher transformation is on the reinforcement in the leaping box; the lowest line is the binary datas acquired from Otsu's method (named after Nobuyuki Otsu) adaptive automatic threshold division. From Table 1, the collision rates of the three techniques are identical while the false collision rates are utmost distinct. In the fifty detection activity sampling, there are some detection which could not be found. However there is still much false detection as the color of the scenario by making the detected gesture identical to the unfold state. By adjoining the constraint, those false detections can be detached. Additionally, by adding temporal constraint, extra false detections, such as the driver touching his head and hitting something, can be detached.

Table 1. The results of three detection techniques

Technique	Collision Rate	False Collision Rate
By Detection Activity	93%	33.1%
By OAG with absence of temporal Constraint	90%	12%
By OAG with presence of temporal Constraints	95.1%	10%

6. Conclusions

In this paper, a technique to provide the safety of the passenger by capturing the image by an Inside-car camera and that image has to be taken only during collision of the vehicle and sent to predefined and emergency alert has been proposed. OAG used is to model the detecting activity and implemented an event parsing algorithm to figure out the detection activity during collision of vehicle. This is the first study to detect occupant's condition inside the car by computer version aspect. The forthcoming specialization is to enhance additional constraints, equally as the global tracking system to send the exact location of the vehicle to predefined emergency numbers for assistance.

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