Real Time Static Glare Identification in ITS

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Abstract: Video-based Automatic Incident Detection (AID) systems are widely used for the detection of traffic incidents. Unfortunately, the accuracy of AID is influenced by environmental factors such as glare, shadows, snow, and rain. This paper presents a method of glare detection that improves the performance and reliability of video-based AID systems.

Keyword: ITS, AID, Glare Detection

I. Introduction

As modern cities grow today, they face worsening congestion due to the increased volume of traffic on roads. Video-based automatic incident detection (AID) systems have emerged as an increasingly popular way to detect stopped vehicles on roads and help make decisions that would resolve traffic congestion.

However, as with any new technology, there are problems associated with video based incident detection. The most critical problem with such systems is the rate of false alarms generated by these video based AID systems, which can be up to 80% of total alarms [2]. These false alarms arise due to the use of AID systems in uncontrolled outdoor environments where the weather has a huge impact on the reliability of the alarms generated by the AID system. In many cases, environmental factors such as the presence of glare, shadows, snow or rain are likely to trigger a false alarm. A literature review of available glare detection techniques [2] revealed that there are almost no available glare algorithms for this novel problem, leading to the development of a new algorithm suitable for detecting glare in real-time traffic video streams.

The remainder of this paper is organized as follows. Section 2 describes the problem of glare in AID systems. Section 3 presents a description of the proposed algorithm and example results for detecting glare. Finally section 4 presents the conclusions and future work of this paper.

II. The Problem of Glare in AID Systems

Glare is a significant problem that generates many false alarms in video based AID systems. Glare can be cast by different reflective sources including wet roads, puddles, and road signs. In the example shown in Figure 1, turning on street lights in the evening with a wet road underneath caused an instance of false incident detection.

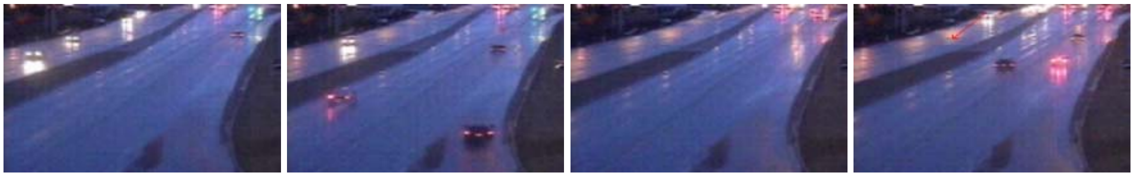

Figure 1: False alarm caused by glare on a wet road

III. The Proposed Glare Detection Algorithm

There are two types of glare: static glare that appears on the road and moving glare caused by headlights. Since AID systems only generate false alarms due to static glare, the aim of the proposed algorithm is to detect static glare that does not move. The proposed algorithm has two stages as shown in Figure 2. The first stage uses a moving object detection algorithm [2] to exclude pixels that belong to moving vehicles. The second stage isolates the brightest of the non moving pixels and marks them in the glare map.

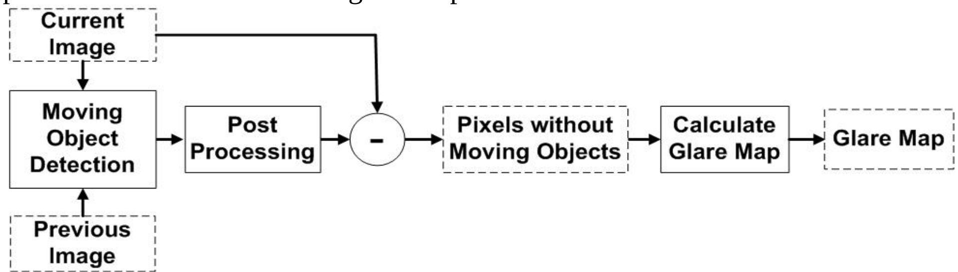

Figure 2: Proposed Glare Detection Algorithm

Moving object detection is used to calculate the difference between grey scale consecutive frames. If the difference of a pixel is greater than a threshold value, then the pixel is categorized as a moving object pixel. In practice, the pre-processing image often has small gaps in the detected moving vehicles. To correct this, post-processing is employed to fill in these gaps. The remaining pixels are then analyzed, the brightest regions are marked in the final glare map by using a lower threshold based on the maximum value in the scene as seen in equation 1:

$$\left|FD_{i,i-1}(x,y)\right| \geq threshold * maxdiff \qquad (1)$$

Where *FD* is the post processing difference image, *maxdiff* is the maximum difference in the difference image, and threshold is an empirically determined value from 0 to 1 which is robust enough to work across many videos. Figure 3 presents the results of glare detection.
An example of the results obtained with the proposed algorithm is shown in Figure 3.

(a) (b) (c) (d)

Figure 3: Results (a: previous frame, b: current frame, c: motion detection, d: glare map)

IV. Conclusion and Future Work

This paper highlighted problems caused by glare in AID systems and proposed an algorithm to solve this problem. The use of the proposed algorithm can lead to an overall enhancement in the reliability of video based systems and hence pave the road for more usage of these systems in the future. The future work includes to integrate the algorithm into the real application of AID systems and to use real-time traffic video to test it.

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