A HYBRID APPROACH FOR A VISION BASED DRIVER ASSISTANCE SYSTEM WITH DE-WEATHERING

Achala Chathuranga Aponso and Naomi Krishnarajah
Department of Computing
Informatics Institute of Technology
University of Westminster
Colombo, Sri Lanka.
Email: ach.chathuranga@gmail.com; naomi@iit.ac.lk

ABSTRACT

Most of the driver assistance systems do not produce accurate results in poor weather conditions. Poor visibility is considered to be a main reason for accidents. The researchers have paid attention on developing various driver assistance systems in order to assure road safety. Image degradation is a severe problem in computer vision applications such as driver assistance systems, terrain classification and video surveillance. Therefore, it is essential to remove weather effects from images in order to make the vision systems more reliable.

The aim of this paper is to prove that the accuracy of the driver assistance systems can be improved when it is integrated with image de-weathering. Various image enhancement methods and vanishing point estimation methods are analysed in order to find the best approach for the proposed system.

Index Terms - Image de-weathering, vision enhancement, Computer vision, Image de-noising;

1. INTRODUCTION

The mission of intelligent vehicles is to assist the driver in decision making. The researchers have paid attention on developing various driver assistance systems in order to assure road safety. Images of outdoor scenes captured in bad weather are severely degraded. Most of the outdoor vision applications require robust detection of image features. In bad weather, the radiance from a scene point is significantly altered due to atmospheric scattering [1]. The quality of the image depends on the weather and the time of the day. Due to the scattering of the light the degradations of an image is proportional to the distance from the point where the image was taken. It is caused due to following reasons[2]. 1) Light reflected from the object surface is attenuated due to the scattering by aerosol particle; 2) some direct light flux is scattered toward to camera. Scattering of the light is caused by refraction. When light passes from one media to another, the speed is changed and it is the main reason for deflection. The whole process is called as "refraction". Apostoloff, [3] believes that the human driver is the most unreliable component of the driving process. If responsibility is taken away from the human driver, the safety of the overall system will be increased.

2. BACKGROUND STUDY

Poor visibility on the roads is regarded as the main cause for many accidents in the world. The existing driver assistance systems consist of many features such as Forward Collision Warning (FCW), Lane Departure Warning (LDW), Headway Monitoring and Warning (HMW) etc…"Mobileye" is recognized as the leader in vision-based Driver Assistance Systems (DAS), and has been selected by a wide range of global automotive companies for their production vehicles. But "Mobileye" products are developed for clear weather conditions. The available features in driver assistance systems would track pedestrians, vehicles but will not provide a clear image by removing weather effects (de-weathering). If the road is damaged and the driver cannot get a clear view due to bad weather, the available driver assistance systems do not have the ability to assist the drivers in that type of scenarios.

Narasimhan and Nayar, [1] have proposed an image enhancement technique based on an atmospheric scattering model. Three interactive algorithms are developed to remove weather effects. 1) Dichromatic colour transfer 2) De-weathering using depth heuristics 3) Restoration using planar depth segments. These algorithms require the interaction of the user. Yi-Shu and Xiao-Ming, [4] discuss a fog degraded image enhancement algorithm based on a moving mask. It is assumed that the pixels in a mask have the same scene depth. Over enhancement is avoided by segmenting the sky region. Guo et al., [5] propose simple and effective method for visibility restoration from a single image. This method does not require the interaction of the user. So, it can be used in practical real time applications.