A New Night Visionary Pedestrian Detection and Warning Systems

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In order to offer more security and safety for pedestrians and drivers at night, it is becoming more and more important to extend a driver's night vision capability, especially for older drivers or drivers with visual limitations. For this purpose, several night vision systems have been developed relying on infrared cameras, which detect heat from objects and are calibrated to be sensitive to the wavelength of humans and animals, giving the advantage of a broader and longer view than conventional headlights. Usually, such systems have separated display screens that display infrared image views (as in Figure18) when night vision systems are turned on at night.

Fig. 18: Infrared Image at night

Fig. 19: Processed Infrared Image Edge corresponding to Fig.18.

Current systems require that a driver's attention has to switch between normal view through a windshield and an infrared display screen, which leads to the following disadvantages. First of all, it is unnatural for drivers, and it is hard for drivers to combine the infrared display screen information with normal view. Second, switching attention back and forth is not safe when driving. Finally, it is still possible for drivers to ignore potential danger without a special warning aid because current night vision systems do not provide reliable collision warning functions.

Our projects are expected to overcome the disadvantages of current night vision systems. Instead of forcing drivers to look for extra information provided by infrared sensors, our systems will automatically project the information onto the windshield. It is important to reliably detect pedestrians at night. However, it is more difficult to detect pedestrians than vehicles because of vehicles' headlights. Therefore, our focus is to successfully detect extra pedestrians whom a driver might hardly see under limited night lighting conditions, and to project the extra pedestrian information onto the windshield. Therefore, drivers can see as if they were driving under normal lighting situations. Pedestrian information can be accentuated in the format of bounded boxes or detailed contour (as in Figure 19) on the windshield screen. The improved windshield view will offer drivers clearer driving situations for their better judgment. In this way, drivers can easily recognize the potential obstacle without changing their driving habits.

For traditional optical camera systems, pedestrian detection is not an easy task and usually depends on machine learning algorithms, such as neural network, wavelet, support vector machine, etc., which are computationally heavy. For night driving situations, pedestrian detection becomes even harder. By introducing infrared images and systematically fusing both types of information, our scheme has the potential to provide better perception ability, decrease drivers' tiredness, and reduce the loss caused by potential collisions.