

Camera-based pedestrian detection – challenges, applications in visible and FIR spectra, evaluation methods

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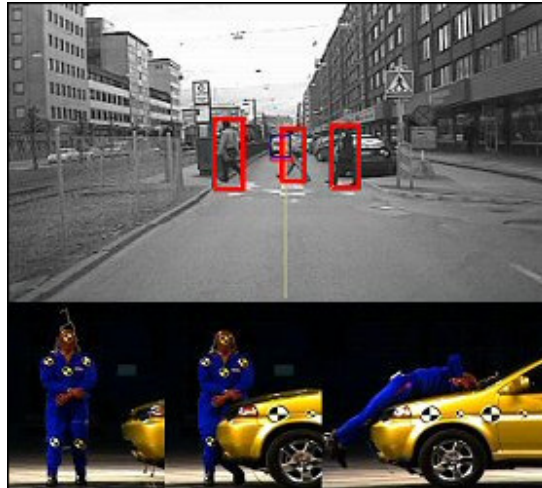
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Passenger cars are still most contributing to the statistics of fatal traffic accidents with pedestrians worldwide. While car passengers could increasingly profit from active and passive safety developments in last years, every eighth person who dies on roads today is a pedestrian.

Car manufacturers and authorities recently agreed on countermeasures to efficiently improve the safety of pedestrians in traffic environments. In the next car generations, passive and contact-active safety systems will thus aim on reducing the risk of serious injuries in the event of a collision with a pedestrian. But key technology solutions have furthermore to be investigated to prevent the pedestrians from accidents with vehicles. The trend goes to pre-crash safety systems.



In this context, more and more attention is given to image processing approaches supported by optical sensors. While the first camera applications were dedicated to provide driving relevant information to the driver, cameras tend to establish themselves in the automotive industry as a new sensor family for computational vision. This evolution could enable revolutionary improvements in pre-crash safety systems, which could be automatically deployed for a most efficient pedestrian protection.

Among the manifold of different camera technologies, from the FIR-cameras to the

more classical CMOS-cameras, the BMW Group aims on identifying the most suitable system for dedicated application environments.

Because of the significant high risk of pedestrian accidents while driving at night camera-based systems dedicated to the far zone are of first importance. An already existing far zone application is the BMW Night Vision system based on FIR. The BMW Night Vision system uses the Far InfraRed electromagnetic spectrum to provide a clear-sighted view under almost all environmental conditions at night. This offers the customer more safety and an increasing sovereignty.

The system shows a view of the surrounding over 200 m without the need of any active light source just using the heat radiation given by every object. Especially pedestrians with a typical temperature of 309 Kelvin are well distinguishable from the surrounding thanks to system optimization for this temperature range. In comparison to Visible or Near InfraRed systems there are no malfunctions by glare effects due to vehicles with high beams or NIR sources.

The image is shown in the display in the middle of the instrument cluster, which should help the drivers to prevent from imminent dangers.



In the case of camera-based pedestrian detection dedicated to pre-crash applications in near zone, the challenge is double. In addition to the realisation of a pedestrian detection with high-fault safe stage, an impact prediction application has to be achieved based on the exact localisation of the pedestrian, his speed and his moving direction.

Different methods are investigated at the BMW Group for the evaluation of camerabased pedestrian detection systems. More especially, their 3D performance is under analysis. One approach consists in referencing videos recorded under application specific test conditions using differential GPS systems, so that the relative positions of the pedestrian to the vehicle can be calculated and compared in real time.