On the Assessment of Thermal Cameras and Their Safety Implications for Pedestrian Protection: A Mixed Empirical and Simulation-based Characterization

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Abstract

Multiple sensing technologies exist for advanced driver support and driving automation systems. Car manufacturers combine different solutions to increase the robustness and operational capabilities of driving automation technology perception systems. One sensing method that did not achieve high market penetration with respect to other solutions is the thermal camera. Thermal cameras can operate in low-light and high-contrast conditions as they do not need external sources of illumination. Instead, they are sensitive to the infrared radiation emitted by any surface above 0 K. Thus, thermal cameras can be a suitable candidate to compensate for the weaknesses of visible cameras. To establish the potential benefit of thermal cameras for pedestrian protection, this paper reports on an experiment using state-of-the-art thermal imaging sensors. The authors' scientific effort includes a characterization of the infrared sensor capability to identify pedestrians when coupled with a detection algorithm and provides a simulation-based investigation of the potential safety benefits of thermal camera adoption. The analysis additionally includes a heuristic characterization of the detection capabilities of a passenger car equipped with visible cameras to provide a baseline comparison. Ultimately, the thermal sensors return noteworthy detection capability that could lead to a potentially significant improvement in road safety on rural roads provided that the sensor has sufficient resolution.

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