Seeing Clearly and Farther: Augmented Perception for Safe Driving in Adverse Weather and Reduced Visibility Conditions

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Adverse weather such as fog, rain, snow, and severe haze can greatly decrease visibility, making it difficult for drivers to perceive traffic information. Such reduced visibility increases the risk of road accidents, especially when driving on highways. This project aims to provide drivers with clearer and farther perception of road scenes in adverse weather and reduced visibility conditions. A novel four-step methodology was designed to achieve this goal: 1) A fast defogging algorithm was developed to process the visual information obtained from an in-car camera, generating clearer live images to enhance the visibility of road scene. It is much more efficient and has higher fidelity compared with other algorithms. 2) A method for detection and tracking of traffic participants was designed based on the fusion of sensor data. Compared with other methods, it significantly increases detection accuracy during reduced visibility conditions, and it has much better real time performance when running on embedded computing platforms. 3) The trajectory fitting of frontal vehicles was conducted to warn of curved lanes in the distance, and these lanes might not be seen due to adverse weather. 4) A mixed reality interface was designed to present augmented composite scenes, and multi-modal warnings were provided. Results demonstrate that this system robustly and reliably increases both accuracy and range of vision during reduced visibility conditions. Overall, this system assists drivers to see through blurred scenes and provides them with early warnings of potential dangers, greatly enhancing driving safety in adverse weather and reduced visibility conditions.

Awards Won:
Intel ISEF Best of Category Award of $5,000
First Award of $5,000
Association for Computing Machinery: Fourth Award of $500
NASA: Honorable Mention