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Architectural Adaptation for Road Humps Detection in Adverse Light Scenario

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Abstract : Road hump is a semi-cylindrical elevation on the road made across specific locations of the road. The vehicle needs to maneuver the hump by reducing the speed to avoid car damage and pass over the road hump safely. Road Humps on road surfaces, if identified in advance, help to maintain the security and stability of vehicles, especially in adverse visibility conditions, viz. night scenarios. We have proposed a deep learning architecture adaptation by implementing the MISH activation function and developing a new classification loss function called "Effective Focal Loss" for Indian road humps detection in adverse light scenarios. We captured images comprising of marked and unmarked road humps from two different types of cameras across South India to build a heterogeneous dataset. A heterogeneous dataset enabled the algorithm to train and improve the accuracy of detection. The images were pre-processed, annotated for two classes viz, marked hump and unmarked hump. The dataset from these images was used to train the single-stage object detection algorithm. We utilised an algorithm to synthetically generate reduced visible road humps scenarios. We observed that our proposed framework effectively detected the marked and unmarked hump in the images in clear and ad-verse light environments. This architectural adaptation sets up an option for early detection of Indian road humps in reduced visibility conditions, thereby enhancing the autonomous driving technology to handle a wider range of real-world scenarios.

Keywords : Indian road hump, reduced visibility condition, low light condition, adverse light condition, marked hump, unmarked hump, YOLOv9
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