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Visual Inspection of Road Conditions Using Deep Convolutional Neural Networks

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Abstract : This paper focuses on the problem of visually inspecting and recognizing the road conditions in front of moving vehicles, targeting automotive scenarios. The goal of road inspection is to identify whether the road is slippery or not, as well as to detect possible anomalies on the road surface like potholes or body bumps/humps. Our work is based on an artificial intelligence methodology for real-time monitoring of road conditions in autonomous driving scenarios, using state-of-the-art deep convolutional neural network (CNN) techniques. Initially, the road and ego lane are segmented within the field of view of the camera that is integrated into the front part of the vehicle. A novel classification CNN is utilized to identify among plain and slippery road textures (e.g., wet, snow, etc.). Simultaneously, a robust detection CNN identifies severe surface anomalies within the ego lane, such as potholes and speed bumps/humps, within a distance of 5 to 25 meters. The overall methodology is illustrated under the scope of an integrated application (or system), which can be integrated into complete Advanced Driver-Assistance Systems (ADAS) systems that provide a full range of functionalities. The outcome of the proposed techniques present state-of-the-art detection and classification results and real-time performance running on AI accelerator devices like Intel's Myriad 2/X Vision Processing Unit (VPU).

Keywords : deep learning, convolutional neural networks, road condition classification, embedded systems
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