(Pt24)Macro Texture Detection Method for Road Surface based on Machine Vision

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***(Pt9)Abstract*—Road surface macro texture, characterized by surface irregularities with wavelengths ranging from 0.5 mm to 50 mm, plays a vital role in determining pavement performance and overall roadway safety. It significantly affects key functional aspects such as skid resistance, drainage capability, tire–pavement interaction, and noise emission. Conventional measurement techniques, including the sand patch test and laser profilometry, although precise, are limited by high operational costs, intensive labor requirements, and restricted spatial coverage. To address these limitations, this study investigates the application of machine vision as a non-contact and fully automated approach for quantitative macro texture evaluation. The proposed framework combines high-resolution imaging, advanced preprocessing methods, and machine learning algorithms, particularly convolutional neural networks (CNNs), to enable reliable extraction and classification of texture features from both two-dimensional and three-dimensional data sources. The integration of LiDAR and inertial measurement sensors further enhances measurement precision and system stability under varying environmental conditions. The results highlight the potential of such systems for real-time, vehicle-mounted surface inspection, offering superior scalability and cost-effectiveness compared to traditional methods. Despite persistent challenges related to environmental variability, data annotation, and computational complexity, machine vision–based solutions represent a promising advancement toward intelligent, data-driven, and sustainable management of road infrastructure.**

***(Pt9)Keyword*—Macro texture, Machine vision, Road surface analysis, Cost-Effectiveness, Detection**

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