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Efficient Residual Road Condition Segmentation Network Based On Reconstructed Images

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Abstract : This paper focuses on the application of real-time semantic segmentation technology in complex road condition recognition, aiming to address the critical issue of how to improve segmentation accuracy while ensuring real-time performance. Semantic segmentation technology has broad application prospects in fields such as autonomous vehicle navigation and remote sensing image recognition. However, current real-time semantic segmentation networks face significant technical challenges and optimization gaps in balancing speed and accuracy. To tackle this problem, this paper conducts an in-depth study and proposes an innovative Guided Image Reconstruction Module. By resampling high-resolution images into a set of low-resolution images, this module effectively reduces computational complexity, allowing the network to more efficiently extract features within limited resources, thereby improving the performance of real-time segmentation tasks. In addition, a dual-branch network structure is designed in this paper to fully leverage the advantages of different feature layers. A novel Hybrid Attention Mechanism is also introduced, which can dynamically capture multi-scale contextual information and effectively enhance the focus on important features, thus improving the segmentation accuracy of the network in complex road condition. Compared with traditional methods, the proposed model achieves a better balance between accuracy and real-time performance and demonstrates competitive results in road condition segmentation tasks, showcasing its superiority. Experimental results show that this method not only significantly improves segmentation accuracy while maintaining real-time performance, but also remains stable across diverse and complex road conditions, making it highly applicable in practical scenarios. By incorporating the Guided Image Reconstruction Module, dual-branch structure, and Hybrid Attention Mechanism, this paper presents a novel approach to real-time semantic segmentation tasks, which is expected to further advance the development of this field.

Keywords : hybrid attention mechanism, image reconstruction, real-time, road status recognition
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