

Bleeding Classification and Segmentation in Capsule Endoscopy Images using Deep Learning

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Abstract: *Gastrointestinal (GI) bleeding is a common and potentially serious condition that requires timely and accurate diagnosis. Wireless Capsule Endoscopy (WCE) has emerged as a valuable tool for capturing images of the digestive tract without the need for invasive procedures. However, the manual review of these images is time-consuming and depends on the expertise of medical professionals. To improve efficiency and accuracy, we propose an automated deep learning-based approach for detecting and segmenting bleeding in WCE images. Our method leverages Swin Transformer for classifying bleeding and non-bleeding cases and employs UNet++ for precise segmentation of bleeding areas. We evaluate our approach using the WCEBleedGen dataset, achieving high accuracy in classification and precise segmentation in segmentation tasks. The integration of deep learning significantly boosts accuracy and efficiency, revolutionizing medical image analysis. Providing clear visualizations of bleeding regions, this method minimizes human error and streamlines the diagnostic process. The results demonstrate the potential of artificial intelligence in healthcare, making medical diagnostics more reliable and effective. Future research should focus on expanding the dataset diversity and integrating real-time processing capabilities to further enhance the system's reliability and speed. Continuous improvements in AI-driven methodologies will contribute to the evolution of automated GI diagnostics, offering even greater support to healthcare professionals in disease detection and treatment planning..*

Keywords: Wireless Capsule Endoscopy (WCE), Bleeding Detection, Deep Learning, Swin Transformer, Swin-Unet, UNet++, Medical Image Segmentation, Vision Transformers, AI in Healthcare

