Simultaneous Segmentation and Malignancy Classification of Gastric Lesions Using Deep Learning

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Abstract:

The precise detection, segmentation, and diagnosis of gastric lesions in endoscopic imagery are critical for early clinical intervention and improved patient outcomes. However, accurate diagnosis remains a challenging task in clinical practice due to the subtle visual characteristics of lesions—such as irregular textures and ambiguous shapes—and the high inter-class similarity between benign and malignant pathologies, which often leads to observer variability. To address these limitations, we propose a unified Artificial Intelligence (AI) framework capable of simultaneously segmenting gastric lesions and classifying their malignancy. A distinguishing feature of this work is the construction of a large-scale, high-quality dataset comprising 3,700 endoscopic images, meticulously annotated with both pixel-level segmentation masks and histopathologically confirmed diagnostic labels. Leveraging this extensive dataset, our deep learning model effectively learns discriminative feature representations to overcome the visual ambiguity of gastric neoplasms. Experimental results on the test set demonstrate the robustness of our approach, achieving a Dice Similarity Coefficient (DSC) of 0.765 for lesion segmentation. Furthermore, the classification module attained an accuracy of 92.4% in distinguishing malignant lesions from benign ones. These findings suggest that our proposed system offers high diagnostic precision and holds promising potential as an effective clinical decision support tool for gastroenterologists.

Keywords:

Gastric Endoscopy, Deep Learning, Computer-Aided Diagnosis, Lesion Segmentation, Malignancy Classification.