Detection of Tumor-Infiltrating Lymphocytes in Digital Oral Pathology Based on Computer Vision

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Abstract

Oral cancer, with its rising incidence and mortality rates globally, represents a significant public health concern, making early diagnosis and effective treatment vital. Generally, Tumor-Infiltrating Lymphocytes (TILs) are critical immune cells that infiltrate tumors and are widely recognized as important biomarkers of tumor behavior and patient prognosis in oral cancer. However, despite their potential as a prognostic tool, the manual assessment of TILs remains a complex, labor-intensive process that is highly dependent on subjective judgment of pathologists. Considering these challenges, there has been a growing interest in utilizing computer vision algorithms to automate the quantification of TILs. Recent studies suggest that computer vision approach can offer a more objective and reproducible means of evaluating TILs, with the potential to provide real-time insights that could guide clinical decision-making. This study proposes a computer vision framework for the detection and analysis TILs in oral pathology, incorporating convolutional neural networks (CNNs). Firstly, the whole slide images (WSIs) were segmented into smaller patches using DenseNet169 to classify the tumor and non-tumor region. Then, U-Net and K-Net methods were applied for the TILs detection. The findings underscore the potential of automated TILs analysis to reduce diagnostic workload and improve prognostic assessments in oral cancer.

Keywords

CNN, Deep Learning, Object Detection, Image.