Tumor Budding T-cell Graphs: Assessing the Need for Resection in pT1 Colorectal Cancer Patients

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Abstract

Colon resection is often the treatment of choice for colorectal cancer (CRC) patients. However, especially for minimally invasive cancer, such as pT1, simply removing the polyps may be enough to stop future cancer growth. Different histopathological risk factors such as tumor grade and invasion depth currently found the basis for the need for colon resection in pT1 CRC patients. Here, we investigate two additional risk factors, tumor budding and lymphocyte infiltration at the invasive front, which are known to be clinically relevant. We capture the spatial layout of tumor buds and T-cells and use graph-based deep learning to investigate them as potential risk predictors. Our pT1 Hotspot Tumor Budding T-cell Graph (pT1-HBTG) dataset consists of 626 tumor budding hotspots from 575 patients. We propose and compare three different graph structures, as well as combinations of the node labels. The best-performing Graph Neural Network architecture is able to increase the average recall by 8.2% compared to the currently recommended risk stratification based on histopathological risk factors. We believe that using a graph-based analysis can help to assist pathologists in making risk assessments for pT1 CRC patients, and thus decrease the number of patients undergoing potentially unnecessary surgery. Both the code and dataset are made publicly available.

Keywords: Digital Pathology, Graph Neural Networks, Colorectal Cancer

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