Automated Detection of Tumor Budding in Colorectal Cancer

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Technology description

The Need

Colorectal cancer is the third most commonly diagnosed cancer in the United States. With a survival rate of less than 65%, early detection and treatment are key factors in survival. Tumor budding, associated with higher tumor stage, lymph node metastasis, and decreased disease-free survival, has emerged as an important adverse prognostic factor in a multitude of cancer types, including colorectal cancer. A growing number of institutions, including The Ohio State University Medical Center, are including tumor budding counts as an essential part of their colorectal cancer screening protocol.

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Tumor bud identification by manual methods using H&E stained tissue sections is a time intensive task for routine pathologic evaluation of colorectal cancer and alternative techniques have been developed, such as staining with pan-cytokeratin (AE 1/3). However, with AE 1/3 the costs to produce slides and obtain the counts are typically prohibitive. In addition, AE 1/3 staining is not routinely used in evaluation of colorectal cancer and only H&E staining is recommended by the College of American Pathologists for scoring of tumor budding.

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Computer analysis of tumor budding has been proposed to relieve the high cost burden and subjectivity of manual analysis but little or no success has been demonstrated with routine H&E stained slides. Such a solution, directed to H&E staining, will improve colorectal cancer screening and diagnostic effectiveness, and will help centers comply with recent CAP recommendations.

The Technology

Researchers at The Ohio State University have developed an automated system for identifying tumor buds in a digitized, whole slide image of an H&E stained section of a tumor. A machine learning classifier is employed comprising three stages: color deconvolution, textural and shape analysis,and statistical analysis. After training with H&E stained images, the classifier is used for tumor bud identification. The reliability of the automated system was initially demonstrated using cases from the Ohio Colorectal Cancer Prevention Initiative cohort. Overall, sensitivity of 92.6% and specificity of 84.3%

against ground truth were achieved, demonstrating system reliability. Predictive models are under development that will associate clinically relevant outcomes such as time to tumor recurrence and time to progression with tumor budding scores generated by the automated system.
A non-invasive and automated tumor budding image analysis system for colorectal cancer. This program can detect tumor buds in traditional H&E stained sections without the need for manual assessment.

Application area

Cancer histopathology
Medical research

Advantages

Improved staging of colorectal cancer
Better surgical margins through detection of tumor bud presence and location
Objective and time-saving procedure that can decrease cost and time of cancer diagnoses
Can be applied to other cancer types
Head and neck squamous cell carcinoma
Breast cancer
Cervical cancer
Gastric cancer

Institution

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