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Impact of Deep Learning Assistance on the Histopathologic Review of Lymph Nodes for Metastatic Breast Cancer

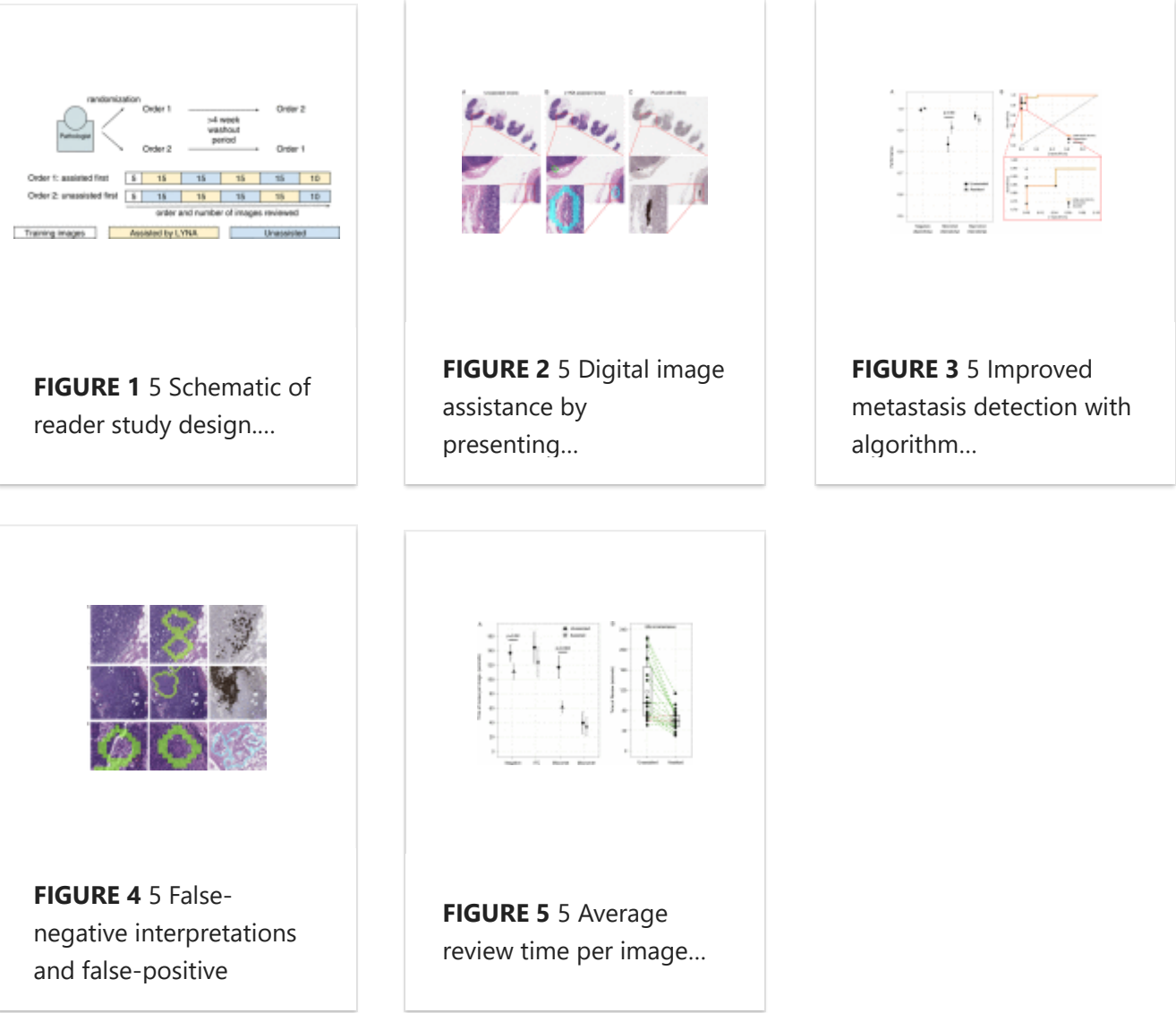
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Abstract

Advances in the quality of whole-slide images have set the stage for the clinical use of digital images in anatomic pathology. Along with advances in computer image analysis, this raises the possibility for computer-assisted diagnostics in pathology to improve histopathologic interpretation and clinical care. To evaluate the potential impact of digital assistance on interpretation of digitized slides, we conducted a multireader multicase study utilizing our deep learning algorithm for the detection of breast cancer metastasis in lymph nodes. Six pathologists reviewed 70 digitized slides from lymph node sections in 2 reader modes, unassisted and assisted, with a wash-out period between sessions. In the assisted mode, the deep learning algorithm was used to identify and outline regions with high likelihood of containing tumor. Algorithm-assisted pathologists demonstrated higher accuracy than either the algorithm or the pathologist alone. In particular, algorithm assistance significantly increased the sensitivity of detection for micrometastases (91% vs. 83%, P=0.02). In addition, average review time per image was significantly shorter with assistance than without assistance for both micrometastases (61 vs. 116 s, P=0.002) and negative images (111 vs. 137 s, P=0.018). Lastly, pathologists were asked to provide a numeric score regarding the difficulty of each image classification. On the basis of this score, pathologists considered the image review of micrometastases to be significantly easier when interpreted with assistance (P=0.0005). Utilizing a proof of concept assistant tool, this study demonstrates the potential of a deep learning algorithm to improve pathologist accuracy and efficiency in a digital pathology workflow.

Figures



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