Infomatics

Improving Augmented Human Intelligence to Distinguish Burkitt Lymphoma From Diffuse Large B-Cell Lymphoma Cases

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Introduction: Our objective is to improve the assistive role of a deep, densely connected convolutional neural network (CNN) to hematopathologists in differentiating histologic images of Burkitt lymphoma (BL) from diffuse large B-cell lymphoma (DLBCL). We hypothesized that for the majority of cases, a CNN would accurately differentiate BL from DLBCL and attempted to identify design and input variables to improve performance.
Methods and Materials: In total, 3608 images of BL were collected from 18 cases and 2,071 images of DLBCL were collected from 20 cases using Aperio Image Scope (Leica Biosystems, Buffalo Grove, IL). Cases were randomized into training and unknowns, and three separate CNNs were trained and applied to unknown images. Networks differed by either the size in pixels of the images (network 1 used 32 × 32 while networks 2 and 3 used 224 × 224) or absence of color (in network 2). Decreased numbers of training images were used to evaluate network 3.
Results: Network 3 performed the best with 17 of 19 (89%) cases classified correctly, 10 with 100% of images correct. Overall, network 3 had 88% accuracy, 80% precision, 81% recall, and an F1 score of 0.81. Receiver operating characteristic (ROC) curve analysis showed an area under the curve (AUC) of 0.89 for DLBCL and 0.88 for BL. Networks 1 and 2 performed more poorly with F1 scores of 0.63 and 0.39, respectively. Decreasing training images by one-half and one-fourth resulted in decreased F1 scores of 0.63 and 0.60, respectively.
Conclusions: CNNs are promising augmented human intelligence tools for differentiating DLBCL from BL cases and potentially could contribute to improved workflow in the laboratory. More training images, larger image size, and color significantly improved performance of the CNN because of the added information available to the network. More research is under way to optimize the performance of CNNs' lymphoma application.

Frozen Sections of Sentinel Lymph Nodes From Breast Cancer Patients Who Undergo Neoadjuvant Therapy Are Accurately Diagnosed Using Telepathology

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Objectives: Telepathology enables histologic diagnosis to be made from a scanned slide visualized on a computer. Frozen sections (FSs) can be performed at remote locations and read by a pathologist at a central site. At our institution, qualifying breast cancer patients are enrolled in clinical trials that require FS on sentinel lymph nodes (SLNs) after neoadjuvant therapy (NAT), including chemotherapy or endocrine therapy. In this setting, histology is complicated by treatment effect and biopsy site changes. Others have reported good accuracy of FSs on SLNs after NAT. We investigated whether pathologists are accurate in diagnosing SLN FSs for such cases while using telepathology. To our knowledge, this has not been reported previously.
Methods: SLNs were entirely submitted and serially sectioned (2-mm thickness). At least two levels were cut. All FSs were submitted for formalin-fixed, paraffin-embedded permanent sections. A pathology assistant at the remote location prepared the FSs and scanned slides using the VisionTek M6 digital microscope ecosystem (East Dundee, IL). Cases were interpreted by board-certified pathologists who completed training on the VisionTek system. For this study, diagnoses from FSs and permanents were compared.
Results: Forty-five SLNs from 19 breast neoadjuvant cases were read by VisionTek from March 2017 to January 2019. Forty-three cases (96%) called negative by FSs were confirmed negative (on permanents). One hundred percent called positive by FSs were positive. Four SLN called atypical on FSs were positive. Three of these were neoadjuvant endocrine cases for invasive lobular carcinoma. Two cases called atypical were negative. One of these, called atypical/suspicious, resulted in axillary dissection. This case was reviewed by three pathologists at the time of surgery. It had abundant treatment effect, mimicking carcinoma.
Conclusion: While pitfalls exist, overall, the diagnostic accuracy of frozen section analysis by telepathology of SLNs from breast cases after neoadjuvant therapy is high.

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