"We sought to create a deep learning (DL) algorithm to identify vessels, bones, nerves, and tendons on transverse upper extremity (UE) ultrasound (US) images to enable providers new to US-guided peripheral vascular access to identify anatomy" Blaivas et al (2020).

Abstract

OBJECTIVES: We sought to create a deep learning (DL) algorithm to identify vessels, bones, nerves, and tendons on transverse upper extremity (UE) ultrasound (US) images to enable providers new to US-guided peripheral vascular access to identify anatomy. METHODS: We used publicly available DL architecture (YOLOv3) and deidentified transverse US videos of the UE for algorithm development. Vessels, bones, tendons, and nerves were labeled with bounding boxes. A total of 203,966 images were generated from videos, with corresponding label box coordinates in a YOLOv3 format. Training accuracy, losses, and learning curves were tracked. As a final real-world test, 50 randomly selected images from unrelated UE US videos were used to test the DL algorithm. Four different versions of the YOLOv3 algorithm were tested with varied amounts of training and sensitivity settings. The same 50 images were labeled by 2 blinded point-of-care ultrasound (POCUS) experts. The area under the curve (AUC) was calculated for the DL algorithm and POCUS expert performance. RESULTS: The algorithm outperformed POCUS experts in detection of all structures in the UE, with an AUC of 0.78 versus 0.69 and 0.71, respectively. When considering vessels, only one of the POCUS experts attained an AUC of 0.85, just ahead of the DL algorithm, with an AUC of 0.83. CONCLUSIONS: Our DL algorithm proved accurate at identifying 4 common structures on cross-sectional US imaging of the UE, which would allow novice POCUS providers to more

confidently and accurately target vessels for cannulation, avoiding other structures. Overall, the algorithm outperformed 2 blinded POCUS experts.

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Reference:

Blaivas ,M1., Arntfield, R. and White, M. (2020) Creation and Testing of a Deep Learning Algorithm to Automatically Identify and Label Vessels, Nerves, Tendons, and Bones on Cross-sectional Point-of-Care Ultrasound Scans for Peripheral Intravenous Catheter Placement by Novices. Journal of Ultrasound in Medicine. 2020 Mar 17. doi: 10.1002/jum.15270. .

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