**Using Deep Learning for Transverse Process Detection in Spinal Ultrasounds**

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**Introduction:** Adolescent idiopathic scoliosis is the most common form of scoliosis, affecting between 2-4% of the adolescent population [1]. However, screening and treatment require frequent x-ray procedures, which have been linked to health issues including an increased mortality rate for breast cancer in female patients [2]. This makes spinal ultrasounds an ideal substitute, as it does not expose them to those levels of radiation. However, one of the major issues associated with ultrasound images is the fuzzy border definitions, making it difficult to detect the presence of spinal processes. To overcome this difficulty, we employed a deep learning algorithm using a convolutional neural network to detect the presence of spinal processes. This detection is important as it shows that it is viable to perform an ultrasound scan on the spine.

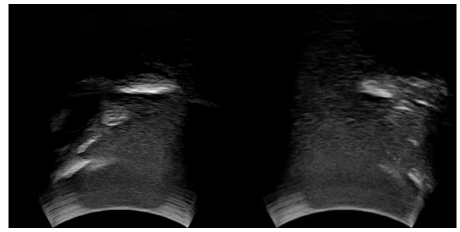

**Figure 1:** Ultrasound scan containing a transverse process (left), and ultrasound scan containing no transverse process (right)

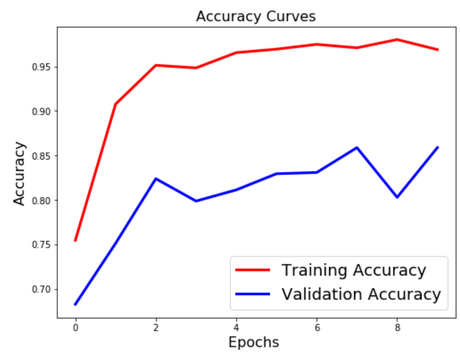


**Figure 2:** Accuracy of classification for training (red) and validation (blue)

**Methods:** Over 2000 ultrasound images were recorded from a spine phantom to train the convolutional neural network. Subsequently, another recording of around 750 images of the phantom was taken to be used as testing images. All the ultrasound images from the scans were then segmented manually, using 3D Slicer. In total, there were around 2000 images used for training, 750 used for validation, and 750 used for testing. Next, the images were fed through a convolutional neural network. The convolutional network used was a modified version of GoogLeNet (Inception v1), with 2 linearly stacked inception models. Typically, Inception can classify over 1000 different classes of images; the ultrasound images only belonged to 2 classes, so a simpler network was created based on the same premises. This network was chosen because it provided a balance between accurate performance, and time efficient computations.

**Results:** Deep learning classification using the Inception model achieved an accuracy of 84% for the phantom scan.

**Conclusions:** The classification model performs with considerable accuracy. Better accuracy needs to be achieved, possibly with more available data and improvements in the classification model.

**Acknowledgements:** G. Fichtinger is supported as a Canada Research Chair in Computer-Integrated Surgery. This work was funded, in part, by NIH/NIBIB and NIH/NIGMS (via grant 1R01EB021396-01A1 - Slicer+PLUS: Point-of-Care Ultrasound) and by CANARIE's Research Software Program.

**References:**

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