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Covid Medical Imaging Trial: Utilising Artificial Intelligence to Identify Changes on Chest X-Ray of COVID

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Abstract : Investigation into the use of artificial intelligence in radiology continues to develop at a rapid rate. During the coronavirus pandemic, the combination of an exponential increase in chest x-rays and unpredictable staff shortages resulted in a huge strain on the department's workload. There is a World Health Organisation estimate that two-thirds of the global population does not have access to diagnostic radiology. Therefore, there could be demand for a program that could detect acute changes in imaging compatible with infection to assist with screening. We generated a conventional neural network and tested its efficacy in recognizing changes compatible with coronavirus infection. Following ethics approval, a deidentified set of 77 normal and 77 abnormal chest x-rays in patients with confirmed coronavirus infection were used to generate an algorithm that could train, validate and then test itself. DICOM and PNG image formats were selected due to their lossless file format. The model was trained with 100 images (50 positive, 50 negative), validated against 28 samples (14 positive, 14 negative), and tested against 26 samples (13 positive, 13 negative). The initial training of the model involved training a conventional neural network in what constituted a normal study and changes on the x-rays compatible with coronavirus infection. The weightings were then modified, and the model was executed again. The training samples were in batch sizes of 8 and underwent 25 epochs of training. The results trended towards an 85.71% true positive/true negative detection rate and an area under the curve trending towards 0.95, indicating approximately 95% accuracy in detecting changes on chest X-rays compatible with coronavirus infection. Study limitations include access to only a small dataset and no specificity in the diagnosis. Following a discussion with our programmer, there are areas where modifications in the weighting of the algorithm can be made in order to improve the detection rates. Given the high detection rate of the program, and the potential ease of implementation, this would be effective in assisting staff that is not trained in radiology in detecting otherwise subtle changes that might not be appreciated on imaging. Limitations include the lack of a differential diagnosis and application of the appropriate clinical history, although this may be less of a problem in day-to-day clinical practice. It is nonetheless our belief that implementing this program and widening its scope to detecting multiple pathologies such as lung masses will greatly assist both the radiology department and our colleagues in increasing workflow and detection rate.

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