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Domain-Specific Deep Neural Network Model for Classification of Abnormalities on Chest Radiographs

Authors : Nkechinyere Joy Olawuyi, Babajide Samuel Afolabi, Bola Ibitoye

Abstract : This study collected a preprocessed dataset of chest radiographs and formulated a deep neural network model for detecting abnormalities. It also evaluated the performance of the formulated model and implemented a prototype of the formulated model. This was with the view to developing a deep neural network model to automatically classify abnormalities in chest radiographs. In order to achieve the overall purpose of this research, a large set of chest x-ray images were sourced for and collected from the CheXpert dataset, which is an online repository of annotated chest radiographs compiled by the Machine Learning Research Group, Stanford University. The chest radiographs were preprocessed into a format that can be fed into a deep neural network. The preprocessing techniques used were standardization and normalization. The classification problem was formulated as a multi-label binary classification model, which used convolutional neural network architecture to make a decision on whether an abnormality was present or not in the chest radiographs. The classification model was evaluated using specificity, sensitivity, and Area Under Curve (AUC) score as the parameter. A prototype of the classification model was implemented using Keras Open source deep learning framework in Python Programming Language. The AUC ROC curve of the model was able to classify Atelestasis, Support devices, Pleural effusion, Pneumonia, A normal CXR (no finding), Pneumothorax, and Consolidation. However, Lung opacity and Cardiomegaly had a probability of less than 0.5 and thus were classified as absent. Precision, recall, and F1 score values were 0.78; this implies that the number of False Positive and False Negative is the same, revealing some measure of label imbalance in the dataset. The study concluded that the developed model is sufficient to classify abnormalities present in chest radiographs into present or absent.

Keywords : transfer learning, convolutional neural network, radiograph, classification, multi-label
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