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Title: Convolutional Neural Network for Chest X-ray Pneumonia Detection

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Summary

This article introduces an innovative approach for classifying Chest X-ray by leveraging the potential of a Convolutional Neural Network (CNN) models. The study focus on identifying pneumonias in Chest X-ray images. CNNs are renowned for their ability to extract intricate features from large images and approximate complex non-linear functions. Deep learning using CNNs has emerged as the most widely used approach for shape recognition and image analysis. The article emphasizes the effectiveness of CNNs in assisting radiologists by automating the process of pneumonia detection from chest X-ray images, thereby providing more precision and faster results in the classification of medical images.

The CNN architecture utilized consisted of convolution layers to identify image parameters and preserve image structure, followed by rectified linear unit (ReLU) layers to introduce non-linearity. Subsequently, pooling layers were used to reduce image size and control overfitting. After several convolution and pooling layers, a fully connected layer allowed information propagation through the network.

The article used the Chest X-ray data from Rajpurkar et al. [2017], which included a convolutional neural network (CNN) architecture comprising 121 layers. The CNN was developed using the CXR14 dataset, consisting of over 100,000 front view X-rays labeled with 14 disease categories. In addition, the study utilized Kermany et al.'s [2018] dataset, which contained 5,856 chest X-ray images categorized into pneumonia (bacterial and viral) and normal cases.

For the preprocessing and data augmentation the article looked to address the problem of overfitting. In the article study, they employed well-established data augmentation techniques described in the literature [Roth et al. 2014]. The image preprocessing involved rescaling, random rotations, horizontal and vertical shifts, random zooming, and horizontal flipping. These augmentation techniques were utilized to enhance the diversity and variability of the training data, enabling the model to learn robust and generalizable features.  
The proposed model is a convolutional neural network (CNN) designed to classify normal and abnormal lung images depicting different pneumonia manifestations. It consists of two main blocks: the feature extraction block, comprising three input and three output layers with ReLU activation, MaxPooling, and Batch Normalization; and the classification block, comprising three fully connected layers with 512, 256, and 128 neurons respectively, followed by a Sigmoid output layer. Dropout layers are incorporated to prevent overfitting. The model is trained and evaluated on a dataset of 5,840 chest X-ray images, with 5,216 used for training over 70 epochs.

The model was evaluated using accuracy, sensitivity, specificity, and F-measure on 250 x 250 x 3 images. Compared to Kermany et al. [2018], the model achieved better results with an average accuracy of 93.24%, 95% sensitivity, 91.4% specificity, and an impressive F-measure of 92.96%.

The article introduces a deep learning approach using convolutional neural networks (CNN) to accelerate pneumonia diagnosis from chest X-rays. The proposed model prioritizes parameter criteria and training time, distinguishing it from other methods relying on transfer learning or complex architectures. By generating and testing different CNN models, the results demonstrate remarkable accuracy, sensitivity, and specificity, outperforming existing datasets with lower computational requirements. Future improvements aim to utilize segmented images for enhanced efficiency in feature extraction.