Foreign Object Detection and Localization in Chest X-rays using Deep Learning

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Abstract

✧ Computer scientists together with medical experts have designed and reported automated screening systems for chest X-ray (CXR) images [1–4] to facilitate detecting diseases like Tuberculosis, pneumonia, cancer and pulmonary edema.

✧ However, presence of circle-like foreign objects (that can be buttons in gown and coins (mistakenly swallowed)) can be confused with nodules, which is one of the primary indicators of the Tuberculosis.

✧ Therefore, in a n automated screening process, foreign elements need to be separated.

Quick Overview

- In the literature, we found a few works attempted to detect foreign elements [5-7], and that are based on conventional machine learning and feature based techniques.
- In our study, we employ deep learning method: a faster R-CNN (Regional convolutional Neural Network).
- We have validated our models on a publicly available CXR (Chest-X Rays) dataset hosted by LHNCBC, U.S National Library of Medicine (NLM), National Institutes of Health (NIH).
- We have achieved more than 90% accuracy, which is encouraging.

Network Architecture

✧ Method used: Faster R-CNN.

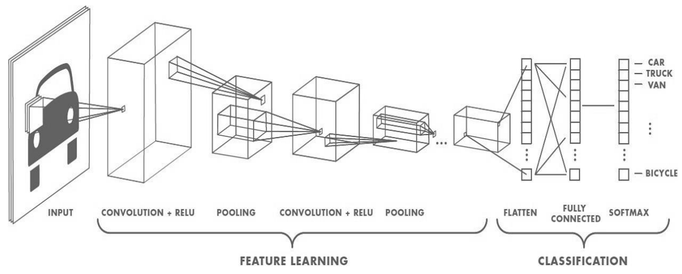
✧ Input layer: Input size: [32 32 3].

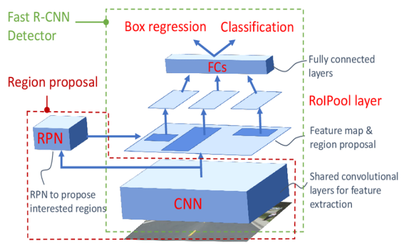
✧ Middle layer: 3 repeated blocks of convolutional, ReLU, and max pooling layers.

✧ Filter bank size: 32 5×5×3 and 64 5×5×3.

✧ Output layer: consists of 5 layers – 64 fully connected layers, ReLU, 10 fully connected layers, softmax loss layer and classification layer (crossentropyex).

✧ Weight update method: Stochastic gradient descent with momentum (SGDM) optimizer.





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Datasets and Results

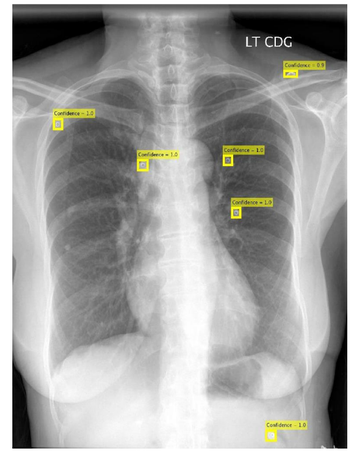
Dataset 175 training images and 225 testing images.

Without Lung Segmentation

Test	225
GT	717
Detect	721
TP	660
FP	68
FN	57
Precision	0.906
Recall	0.92
F1 score	0.913

With Lung Segmentation

Test	225
GT	717
Detect	721
TP	660
FP	68
FN	57
Precision	0.906
Recall	0.92
F1 score	0.913



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