Chest X-Ray Classification and Localization of Common Thorax Diseases

Problem Statement

An entry level task of diagnosing and reading Chest X-ray for radiologist but they ought to require a good knowledge and careful observation of anatomical principles, pathology and physiology for this complex reasonings. Eight common thoracic disease such as (Atelectasis, cardiomegaly, effusion, infiltration, mass, nodule, pneumonia and pneumothorax)in fig 1. observed in chest X-rays that validate a challenging task of fully-automated diagnosis that consider the difficulties of developing an automated and consistent techniques by above factors while simultaneously reading a Chest X-Ray. The ChestX-ray8 dataset is a main application that present a pathology localization framework and multi-label unified weakly-supervised image classification that can perceive the occurrence of afterward generation of bounding box around the consistentand multiple pathologies. Due to considering of large image capacity we adapt Deep Convolutional Neural Network (DCNN) architecture for weakly-supervised object localization, different pooling strategies and various multi-label CNN losses.

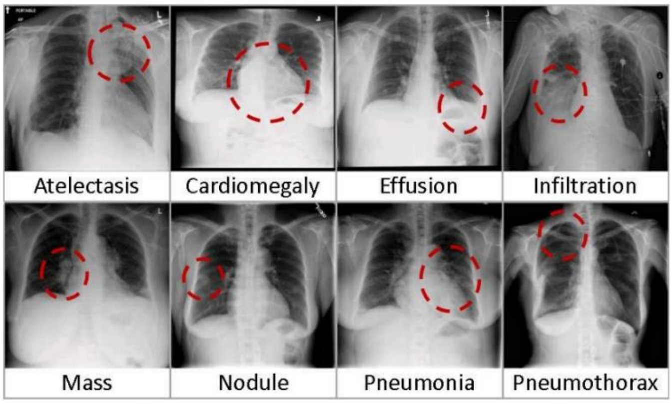


Figure 1. *Eight common thoracic diseases observed in chest X-rays that validate a challenging task of fully-automated diagnosis.*

Background

In the epoch of deep learning in computer vision, various annotated image dataset is built by research efforts with diverse features plays essential role on betterment of forthcoming problems, technological progresses and challenges definitions. The joint learning and relationship of images (chest X-rays) and text (X-ray reports) we basically focus on it and previous generation caption utilizes Flickr8K, MS COCO and Flickr30K to represent images that's hold dataset of 8000,31000 and 123000 respectively. The image is annotated by the five sentences through Amazon Mechanical Turk.

To address this difficulty, we verify and formulate the disease localization and weakly-supervised multi-label image classification. The VQA technique and all image captioning is depended on ImageNet a pre-trained DCNN model that always perform well in large number of object and for a good baseline it serves a model fine-tuning. The medical diagnosis domain cannot be applied on this situation. While constructing the weakly labelled medical image database we have a knowledge of deep image localization and recognition.

The chest X-ray database is created named “Chestx-ray8” that embraces 108,948 frontal-view of 32,717 unique patients X-ray images with a labelled of eight text-mind common disease from text radiology reports through NLP techniques to tackle these issues. These thoracic common diseases can be spatial located and detected through unified weakly-supervised multi-label image classification and localization formulation.

Methodology

We can locate the presence of one or multiple pathologies in X-ray image by using weights and extraction from the network. The multi-label DCNN classification model is trained to tackle this problem. The previous weakly supervised method of object localization is adapted by the DCNN architecture severally. The pre-trained model (using ImageNet) can be perform network surgery on AlexNet, GoogLeNet, VGGNet and ResNetby leaving out final classification layer and fully-connected layer.Instead we insert a transition layer, a global pooling layer, a prediction layer and a loss layer in the end (after the last convolutional layer). The plausible spatial location of diseases can be enable by the weights of prediction inner-product layer and combination of deep activations from transaction layer.

Experiment

Stage 1 data collection

The unified disease localization and classification framework is evaluated and validated using the ChestX-ray8 database.

Stage 2 Multi-level setup

There are the various choices of multi-label classification loss function and image-label representation. The 8-dimentional label vector y = [y1, ..., yc, ..., yC], yc∈ {0, 1}, C = 8 for each image is defined. Due to this problem of multi-label classification definition transit into a regression-like loss setting.

Stage 3 Constructing model

In this stage, some pretrained models like AlexNet, GoogLeNet, VGGNet and ResNet.

Stage 4 Disease Localization

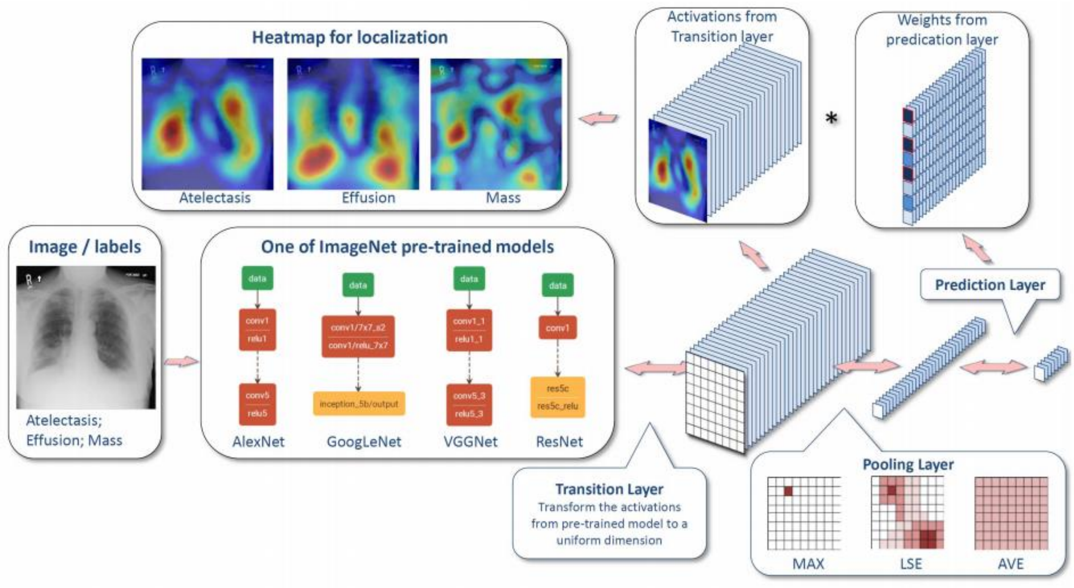
Due to use of activations from transition and weight from prediction layer we can calculate the heatmap, and also produce the B-Box for apiece pathology candidate.

B-Box (Bounding Box) Generation

Multi-label classification framework produces the heatmap which indicates the approximate spatial location of particular thoracic disease class each time.

Stage 5 Training and Experimentation

The overview of unified DCNN framework and disease localization process is given below:



Experimental Design

Dataset

Predicting Pathologies in X-Ray Imagesdataset URL:
https://www.kaggle.com/paultimothymooney/predicting-pathologies-in-x-ray-images/notebook

Software and Hardware Requirements

The project will be implemented and experimented using anaconda python libraries.

Software:

- Anaconda
- Python
- Tensorflow
- keras
- Matplotlib

Hardware:

Training will be conducted on16 GB of RAM, and NVIDIA GTX 1070 GPU 8 GB is used for training

References

1. http://openaccess.thecvf.com/content_cvpr_2017/papers/Wang_ChestXray8_HospitalScale_Chest_CVPR_2017_paper.pdf