Image Anomaly Detection on chest X-rays

Contents

Introduction 2
Buisness Scenario 2
Business Requirement 2
Proposed System 2
Technologies used 3
Risks and challenges 3
Results/ Output 4
Conclusion 4
Future Enhancements 5

Introduction

X-ray imaging is the most commonly employed procedure in a radiology department. Chest radiographs are frequently utilised for the detection and differentiation of pathologies and the detection of forge in bodies. Even for experienced radiologists, the identification and discrimination of these diseases is a non-trivial tasks, and decision support systems provide promising option for an optimised radiology workflow and an improved quality of care.

Business Scenario

Machine learning works effectively in the presence of huge data. Medical science is yielding large amount of data daily from research and development (R&D), physicians and clinics, patients, caregivers etc. These data can be used as synchronizing the information and using it to improve healthcare infrastructure and treatments. This has potential to help so many people, to save lives and money. As per a research, big data and machine learning in pharma and medicine could generate a value of up to $100B (INR10000cr)annually, based on better decision-making, optimized innovation, improved efficiency of research/clinical trials, and new tool creation for physicians, consumers, insurers and regulators.

Business Requirement

The aim of this project is to investigate and develop techniques for the analysis of chest radiographs with a special focus on Deep Learning techniques like Convolutional Neural Networks (CNN). Our objective is to apply deep learning methods to high-resolution medical x-ray images. We are pursuing the goal to employ deep learning methods in order to find patterns between medical reports and medical x-ray images that will help to push the state-of-the-art in computer-aided diagnosis for chest x-ray images.

Proposed System

1. Analysing the Dataset (chest x-ray)

All image processing steps were carried out using the python scikitimage library. To take advantage of our large dataset, we implemented basic data augmentation techniques to prevent over fitting in our model while still making use of all the data available.

2. Organizing Data

The dataset is organized into 2 folders for each image category (Infected/Normal). There are 5,863 X-Ray images (JPEG) and 2 categories either Infected or Normal. A data frame for each image, labelled with 0 or 1 depending on its folder, and shuffled them all together.

3. Classify Images: CNN Model

Developed convolutional neural network model (CNN) for image classification with data. Loaded the CNN model and used in the Keras deep learning library. Used it as a model to directly for classifying images.

4. Training and Testing the Network

The network has some random weights and zeroes bias. These parameters will be influence the network's decision on whether an image is one of a infected scan or not. Once the input data is processed through the network using these weights and biases, it will use an activation function which will return either a 0 (normal) or a 1 (infection detected).Then I compared the prediction made with the actual using loss function to calculate the margin of error on said prediction. Then went through back propagation which will adjust the network's weights and biases to make better predictions. Iterating until the most accurate result is obtained.

Technologies Used

- Python
- AI and Deep learning
- OpenCV
- Yolo V2
- Histogram equalisation

Risks and Challenges

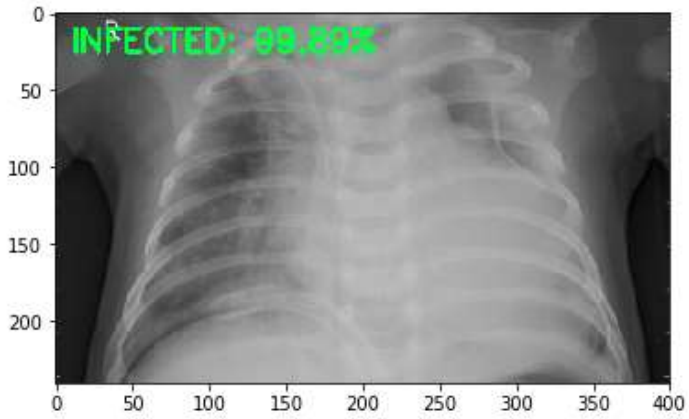
Below are the risk identified for implementing proposed system;

1. Main challenge is to determine the appropriate categories of the features and extract them in a robust way
2. Quality of the image which affects the accuracy of the output
3. Time consumption for training
4. Need of high system configuration like GPU for image processing during training

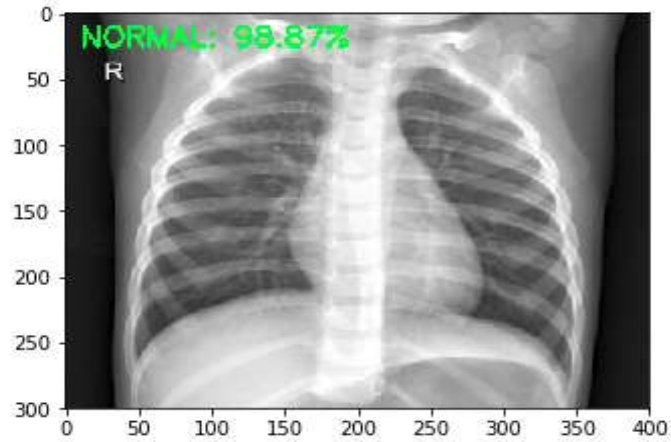
Results/ Output

Figure 1 Anomaly identification from chest x-ray image

```
[INFO] loading network...
xray INFECTED: 99.89%
```




```
[INFO] loading network...
xray NORMAL: 98.87%
```



Conclusion

These proposed system hence predicts the anomalies in the x-rays. Computerized automatic chest radiography analysis systems for medical use save time and manual costs and avoid problems caused by intra-and inter-observations e.g. due to fatigue, stress or different levels of experience.

Future Enhancements

More types of neural networks and architectures should be tested in future research and a better method might be obtained to improve the anomaly detection results. Also in order to help doctor we can add an extra feature to diagnose further problems and prescribe a treatment as a suggestion.