# BE EXTC Project Presentation

# Detection of Pneumonia in Chest X-Ray using Transfer Learning based approach

Zuber Ansari, Gaurav Bavdane, Neha Bhujbal, Nameera Shaikh, Ms. Pallavi Patil

**Project Group No. 3**

## Introduction

Pneumonia is a life-threatening infectious disease affecting one or both lungs in humans. According to the World Health Organization (WHO), one in three deaths in India is caused due to pneumonia. This is because the task at hand of examining the chest X-rays is challenging even for expert radiologists. Also the availability of these specialists in rural areas is scarce. So, there is a need to improve the diagnosis accuracy and its accessibility. To achieve this we need a technique to classify chest X-ray images, CNN is widely used for image classification. Thus, training a large CNN architecture (ResNet50) over the large ImageNet Dataset, transferring the weights of initial layer and fine-tuning the last layers has been proposed. This will result in a higher precision and recall and faster performance in terms of execution time as compared to existing methods.

### Problem Statement Objective

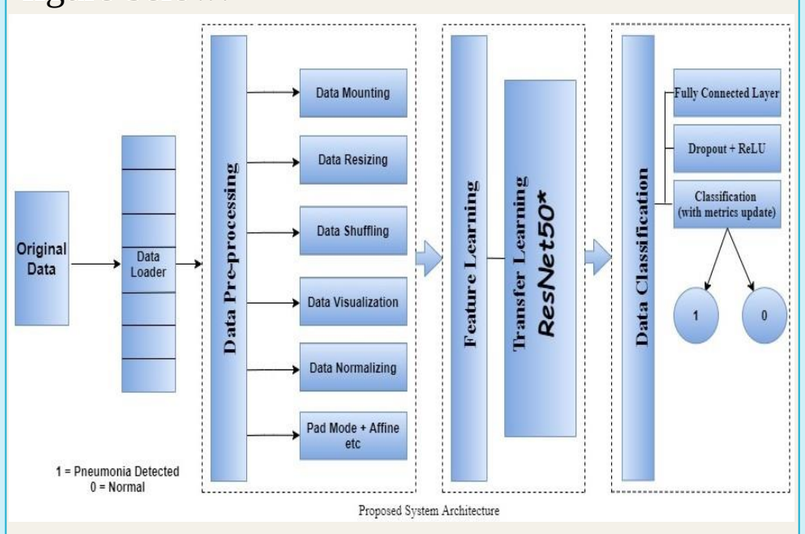
Detection of pneumonia with transfer learning using fine-tuning will serve a multi-prong solution as it does not require data from same feature space making it fit for real world applications where uncertainty is common syndrome.

### Dataset Used

Chest X-Ray Images (Pneumonia) dataset accessed from Kaggle which is originally published by Mendeley Data in association with Elsevier.

## Proposed Methodology

The system architecture is presented in the figure below:

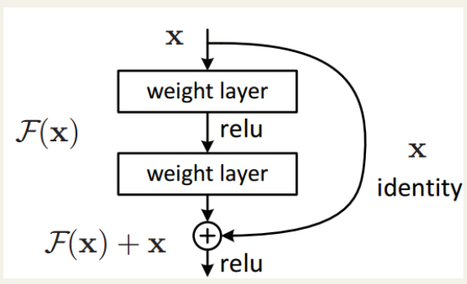



Proposed System Architecture

### Technique used- ResNet50 + Transfer Learning

- ResNet50 architecture is robust.
- Transfer learning using fine tuning over pre-trained ResNet50 from ImageNet.

### Skip Connection: The Strength of ResNets

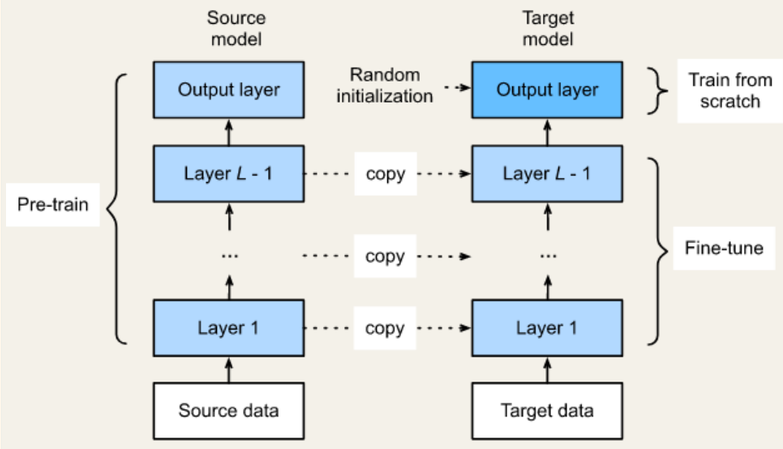



- Gives state-of-the-art results.
- Reduces time & computational complexities.

### Transfer Learning

- Provides faster and easier learning as compared to training network from scratch.
- an optimization technique as it acts as a shortcut to save training time along with giving better performance.

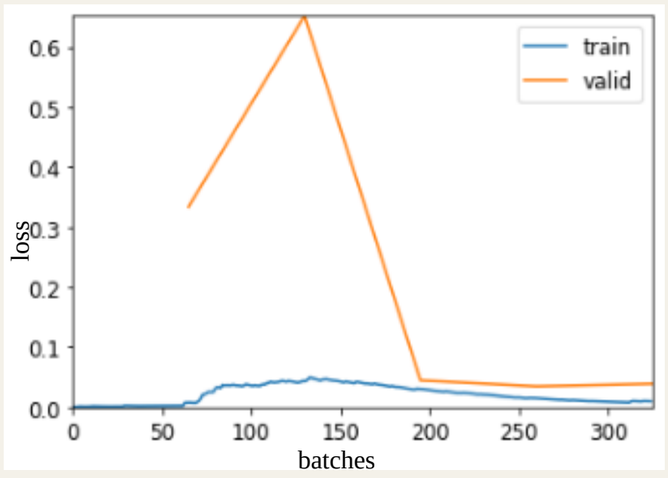
### Transfer Learning using Fine-Tuning




This aids to achieve meaningful improvements by incrementally adapting the pre-trained features to new data.

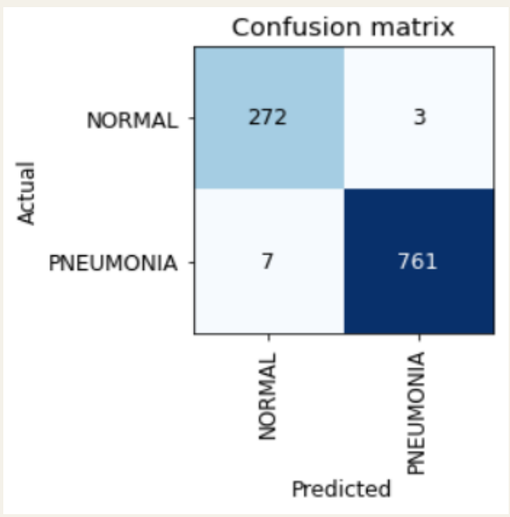
## Results and Discussion

In order to judge the goodness of fit of the trained model, the plot of train vs validation loss (below) is examined.




The loss function used is cross-entropy. The graph converges which indicates the authenticity of the model.

In order to derive deeper insights from the classification results a cleaner and unambiguous way of presenting the results of a classifier is by using the Confusion Matrix.




Performance evaluation has been done not just in a general sense (accuracy) but also in terms of other metrics listed in Table 1

| Metric | Score |
|---|---|
| **Error Rate (ER)** = (FN+ FP)/Total | **0.0096** |
| **Accuracy** = 1 - ER | **0.9904** |
| **Precision (P)** = TP/(TP + FP) | **0.9961** |
| **Recall (R)** = TP/(TP + FN) | **0.9909** |
| **F1 Score** = 2PR/(P + R) | **0.9935** |

Table 1

The value attained for F-1 score is 0.9935 where a 1.0 is indicative of best performance.

## Conclusion

- An efficient model for classifying the pneumonia infected chest x-ray images with high level of classification accuracy has been designed. To increase the robustness of the classifier, transfer learning of the powerful ResNet-50 CNN pretrained on ImageNet has been employed.
- Indeed, the proposed work provides a comprehensive model for medical image processing/classification from input layer to the output layer.
- The development of algorithms in the healthcare domain can be highly effective for providing better services as well as help to prevent adverse consequences (even death) in extreme cases.

## Future Work

Expecting to see more pre-trained models and innovative case studies which leverage this concept and methodology for:

- Detecting sub-classes of pneumonia.
- End-to-end deployment for easy accessibility and diagnosis.

## References

[1] Dimpy Varshni, Kartik Thakral, Lucky Agarwal, Rahul Nijhawan, Ankush Mittal, “Pneumonia Detection Using CNN based Feature Extraction” IEEE Int. Conf. Elec., Comp., Comm. Technology Coimbatore, India, 2019

[2] Mohammad Tariqul Islam, Md Abdul Aowal, Ahmed Tahseen Minhaz, Khalid Ashraf “Abnormality Detection and Localization in Chest X-Rays using Deep Convolutional Neural Networks”, Comp Vision, Pattern Recognition, Cornell University, 2017

[3] Sinno Jialin Pan, Qiang Yang Fellow, “A Survey on Transfer Learning”, IEEE Trans., Knowledge, Data Engg, Vol 22, Issue 10, 2010

[4] Muneeb ul Hassan, “ResNet (34, 50, 101): Residual CNNs for Image Classification Tasks”, Jan 2019