**CS 577 – Project Proposal**

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**Project Topic:**

* Image Classification to predict pneumonia on chest X-Ray images using CNN

# Reference Paper(s):

# “Diagnosis of Pneumonia from Chest X-Ray Images Using Deep Learning.”

# Published by: Enes Ayan and Halil Murat Unver.

# The paper was published in “IEEE.org” in 2019 at the conference in Istanbul, Turkey.

# Enes Ayan and Halil Unverhave used a dataset from Kermany et al and have 5856 frontal chest X-ray images. There dataset consisted of varying image resolution from 712x439 to 2338x2025. They labelled their data into 0 and 1, with 1 representing pneumonia cases and 0 with normal cases. Enes and Halil have shown that using Xception CNN an accuracy of 87% can be achieved rather than using Vgg16 which gave an accuracy of 82%. For data pre-processing they have used data augmentation to avoid overfitting and improve the overall accuracy. Techniques like zooming, angle rotation and transfer learning were used. Finally, the architecture they used was Convolutional Neural Network CNN Xception and Vgg16.

# “Deep Learning Applications in Medical Image Analysis”

# Submitted by: Justin Ker, Lipo Wang, Jai Rao and Tchoyoson Lim.

# Published in: IEEE.org in 2017.

# The paper published by Justin Ker, Lipo Wang and Jai Rao predict a binary classification of an image having a brain tumour or not. They have used Convolutional Neural networks to define their model and further used RNN’s to avoid vanishing gradient problem on back propagation. Constraints such as Autoencoders were added for better results and predictions. Their model has vast applications in the medical field and can predict brain tumour at early stages.

# Problem Question / Statement:

# The objective of the project is to predict if the given image of an individual has Pneumonia or not. The evaluation metric of the model will be the final overall accuracy to predict if the given input image has pneumonia or not. A model will be trained using training data set consisting of more than 1000 images with two known labels: pneumonia or not. We will use Convolutional Neural Networks (CNN) to train our model and predict an overall accuracy that will be tested on the test dataset. Once the objective has been met, further processes like ImageNet can be used to train and test a model to evaluate and compare the accuracy predicted by the new model with the earlier one. Once tested, this model can be further used by medical professionals and experts to evaluate and predict pneumonia cases in their early stages.

# Project Outline / Approach:

# The first step towards the model involves gathering of useful data and information. Kaggle.com provides useful and relevant datasets which are used in our training and testing datasets. We expect to perform an extensive descriptive analysis for understanding and exploring the data. This helps us understand the feature inputs and the corresponding labels better.

# Next, the team will go through the data and perform data augmentation steps to ensure the model is not overfit since we have a limited number of images (less than 100,000). For instance, measures like zooming, contrast increase and angle rotation will ensure the train model is not overfit and predicts a good accuracy for the train and the test set. The images will be divided into a value of 0 and 1, with 0 being normal conditions and 1 being cases with pneumonia.

# Finally, the model will be built using CNN with the train set and accuracy being the output metric. Hyper tuning steps like addition of dense layers, number of weights and optimizers will ensure a high accuracy for the train and test sets. The output would predict if the given input image has pneumonia or not with an optimum accuracy.

# Data Source(s):

# Chest X-Ray Images (Pneumonia): Kaggle.com

# The Chest X-Ray image data set consists of 5,863 images with 2 categories and total size of 1 GB. The categories include: Normal Chest x-ray images and Pneumonia chest x-ray images.

# The dataset includes three folders: train, val and test. Each folder has a sub category that includes Normal / Pneumonia images. All the images are in JPEG format. These images have been selected from children between 1 – 5 years of age from the Guangzhou region, China. Low quality, low resolution images were discarded while preparing the dataset on Kaggle.

**Reference resources:**

* Mooney, Paul. “Chest X-Ray Images (Pneumonia).” Kaggle, March 24, 2018.

<https://www.kaggle.com/paultimothymooney/chest-xray-pneumonia/metadata>

* E. Ayan and H. M. Ünver, "Diagnosis of Pneumonia from Chest X-Ray Images Using Deep Learning," 2019 Scientific Meeting on Electrical-Electronics & Biomedical Engineering and Computer Science (EBBT), Istanbul, Turkey, 2019, pp. 1-5.

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* J. Ker, L. Wang, J. Rao and T. Lim, "Deep Learning Applications in Medical Image Analysis," in IEEE Access, vol. 6, pp. 9375-9389, 2018.

<https://ieeexplore.ieee.org/abstract/document/8241753>

* Pneumonia Statistics 2019 [online]:

<https://www.cdc.gov/pneumonia/prevention.html>.

* S.-H. Tsang Review: Xception—With Depthwise Separable Convolution Better Than Inception-v3 2018 [online]:

[https://towardsdatascience.com/review-xception-with-depthwise-separable-convolution-better-than-inception-v3-image-dc967dd42568](https://towardsdatascience.com/review-xception-with-depthwise-separable-).