**Naga Ravi, Nistala Venkata Varaha (Ravi Nistala)**

**Classification of X-Ray images for Pneumonia detection**

**Project Summary**

The goal of this project is to classify x-ray images into Normal x-ray’s vs x-rays for Pneumonia patients using

Convolutional Neural Networks (CNN).

Classification is compared between 3 models: manually created model, pretrained VGG19 and VGG16 keras models.

We applied **sigmoid** activations for new model and **softmax** for pretrained models. We used **categorical\_crossentropy** as loss functions. The learning rate is 0.0001 for all the 3 models. After performing classification we pick up the optimal model and add l2 regularization (0.00001) and the perform classification again on that model. We describe the results with CNN performance and by plotting accuracy and confusion matrix graphs.

**Technology Overview**

* Deep learning using CNN using Python as the platform , keras (2.1.0) with backend TensorFlow(1.5.0)

**Data Set**

* It is available on Kaggle at

<https://data.mendeley.com/datasets/rscbjbr9sj/2>

**Data size**: 1.2G **Data format**:jpeg

* Pretrained VGG16 and VGG 19 models at <https://keras.io/applications/>

**Overview of steps**

* Install conda version 4.5.1 for Python 3.6. This included TensorFlow. Keras and other packages were installed on top of conda.
* Download the dataset from the link given above.
* Load data and separated data into training, Test and Validation. Perform **reshaping** and **normalization** while loading it. Training and Test is used for training the model. Test and Validation used for validating the model.
* Built a model from scratch. Perform training and validation. Generate output.
* Load pretrained VGG19 model, update it by adding new top layer. Perform training and validation. Generate output.
* Load pretrained VGG16 model, update it by adding new top layer. Perform training and validation. Generate output.
* Evaluate and analyze all the outputs for accuracy, loss and confusion matrix
* Make changes to the optimal models defined above by adding the **l2 reguralization** parameter.
* Again perform training and validation on the new updated model. Generate output.
* Again analyze accuracy, loss and confusion matrix of the output with previous models

**Hardware**

* 11vCPU on Google Cloud Platform (GCP)

**Software**

* Python 3.6.4 and related packages
* Tensorflow 1.5.0 and its related packages
* Keras 2.1.4 with Tensor Flow backend and its related packages

**References & Acknowledgements**

* <https://medium.com/@taposhdr/medical-image-analysis-with-deep-learning-ii-166532e964e6>
* https://www.kaggle.com/paultimothymooney/detecting-pneumonia-in-x-ray-images/data

**Conclusion**

* Models developed **manually** performed slightly better than **VGG19** and **VGG16** performed very well in classifying x-ray’s with Pneumonia
* This could provide as a template for further analysis of other similar data like MRI images etc

**Lessons Learned**

* Performance is not dependent on Model complexity
* Simple models with correct hyper parameters perform very well than complex models like VGG19.

**Youtube URL’s**

[2 minute video](https://youtu.be/XhuIrH38s8U)  [15 minute video](https://youtu.be/tOpAcWNr6cQ)