SMARTBRIDGE
Let's Bridge the Gap

INTERNSHIP REPORT APPROVAL FORM

July 1, 2019

With immense pleasure, this is to approve that the students of Sona College of Technology i.,e

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Mogan Raj A(1516106051)

successfully completed their Project and Project Report on **"Pneumonia Prediction using X-RAY images"** under our guidance.

We are highly impressed with the work that they have done and commend them on their quick grasping skills. They have shown good intent to learn and have put the knowledge gained into application in the form of this project. We appreciate the hard work and commitment shown by them.

We, hereby approve that this document is completely checked and accepted by SmartBridge Technical Team. It's been an absolute pleasure to educate and mentor these students. We hope that this document will also serve as a Letter of Recommendation, to whomsover applied.

We wish them success in all future endeavors and a great career ahead.

GD Abhishek

AI Developer

1. Pneumonia Prediction using X-RAY images

1.1-INTRODUCTION

Python:

Python is an interpreted, high-level, general-purpose programming language created by Guido van Rossum and first released in 1991, Python's design philosophy emphasizes code readability with its notable use of significant whitespace. Its language constructs and object-oriented approach aim to help programmers write clear, logical code for small and large-scale projects.

Python is dynamically typed and garbage-collected. It supports multiple programming paradigms, including procedural, object-oriented, and functional programming. Python is often described as a "batteries included" language due to its comprehensive standard library

The language's core philosophy is summarized in the document The Zen of Python (PEP 20), which includes aphorisms such as:

- Beautiful is better than ugly
- Explicit is better than implicit
- Simple is better than complex
- Complex is better than complicated
- Readability counts

Deep Learning:

Deep learning (also known as deep structured learning or hierarchical learning) is part of a broader family of machine learning methods based on artificial neural networks. Learning can be supervised, semi-supervised or unsupervised. Deep learning architectures such as deep neural networks, convolutional neural networks have been applied to fields including computer vision, speech recognition, natural language processing, audio recognition, social network filtering, machine translation, bioinformatics, drug design,medical image analysis.

In neural networks, Convolutional neural network (ConvNets or CNNs) is one of the main categories to do images recognition, images classifications. Objects detections, recognition faces etc., are some of the areas where CNNs are widely used. CNN image classifications takes an input image, process it and classify it under certain categories (Eg. Dog, Cat, Tiger, Lion). Computers sees an input image as array of pixels and it depends on the image resolution. Based on the image resolution, it will see h x w x d (h = Height, w = Width, d = Dimension). Eg. An image of 6 x 6 x 3 array of matrix of RGB (3 refers to RGB values) and an image of 4 x 4 x 1 array of matrix of grayscale image.

1.2 Objectives of Research

The main objective of the project is to help the doctors to predict the pneumonia disease more accurately using our model. The objective is not only to help the doctors but also to the patients to verify whether they have pneumonia or not. By using this model we can precisely predict the pneumonia.

The convolutional neural network model trained from scratch to classify and detect the presence of pneumonia from a collection of chest X-ray image samples. We constructed a convolutional neural network model from scratch to extract features from a given chest X-ray image and classify it to determine if a person is infected with pneumonia. This model could help mitigate the reliability and interpretability challenges often faced when dealing with medical imagery. Unlike other deep learning classification tasks with sufficient image repository, it is difficult to obtain a large amount of pneumonia dataset for this classification task; therefore, we deployed several data augmentation algorithms to improve the validation and classification accuracy of the CNN model and achieved remarkable validation accuracy.

1.3 Problem Statement

The problem statement is Pneumonia prediction using the X-ray images. This image recognition model must contain a user friendly GUI. The model demands a deep learning algorithm such as CNN, which takes the image as an input and then it predicts whether the person has pneumonia or if he is normal. The X-ray images are grey scale images. This problem statement mainly focus to help diagnose the pneumonia disease more accurately. This model servers a great tool for the doctors. As, it helps in predicting the disease more precisely.

2. Review of literature

The existing solution for the given problem is the person goes to the hospital takes an X-ray image waits for the doctor and then the doctor based on seeing the X-ray he decides whether the person has pneumonia or not. The results are not only concluded based on just seeing the X-ray images but further more tests were conducted on the patient to verify the results of the doctor. The process was time consuming and if the patient had a severe pneumonia to detect the problem it took days for the test results to appear. But in recent developments of the artificial intelligence and the computational powers of the computers has increased it helps in predicting the pneumonia by just passing the X-ray image as an input to our model. The model which is trained and tested on huge dataset it helps to accurately classify whether the person has pneumonia or not. Thus this not only increases the accuracy but as decreases the time that the patient has to wait for the pneumonia results. This also reduces the medical expenditure cost done by the patient to undergo several testing for the conformation of the disease.

3. Data Collection

Data Collection was a not a big problem to us because the dataset was readily available in the kaggle repository. The original dataset consists of three main folders (i.e., training, testing, and validation folders) and two subfolders containing pneumonia (P) and normal (N) chest X-ray images, respectively. A total of 5,856 X-ray images of anterior-posterior chests were carefully chosen from retrospective pediatric patients between 1 and 5 years old. The entire chest X-ray imaging was conducted as part of patients' routine medical care. To balance the proportion of data assigned to the training and validation set, the original data category was modified. We rearranged the entire data into training and validation set only. A total of 3,722 images were allocated to the training set and 2,134 images were assigned to the validation set to improve validation accuracy.

We employed several data augmentation methods to artificially increase the size and quality of the dataset. This process helps in solving overfitting problems and enhances the model's generalization ability during training.

The rescale operation represents image reduction or magnification during the augmentation process. The rotation range denotes the range in which the images were randomly rotated during training, i.e., 40 degrees. Width shift is the horizontal translation of the images by 0.2 percent, and height shift is the vertical translation of the images by 0.2 percent. In addition, a shear range of 0.2 percent clips the image angles in a counterclockwise direction. The zoom range randomly zooms the images to the ratio of 0.2 percent, and finally, the images were flipped horizontally.

4. Methodology

4.1 Data Modeling

The algorithm used to create this model is Convolutional Neural Network (CNN).This model is used to extract the important features

The Convolutional Neural Network follows various steps to extract the important features from the images

Step 1: Convolution

Step 2: Max Pooling

Step 3: Flattening

Step 4: Full Connection

4.1.1 Convolution:

In convolution the input image is convoluted with feature detector or filter to get feature map.

The role of Feature Detector is to extract important features from the image by applying convolution operation the size of the image is reduced due that we may lose some information but feature detector helps us to extract main features.

The main feature is the feature that we find to recognize an image. To one single image we will apply number of filters or feature detector to avoid unwanted information and to extract all the important features. That particular group of feature map is called as Convolutional Layer.

4.1.2 Max Pooling

It is a technique in Convolutional Neural Network to avoid over fitting of data and spatial invariance and also distortion in data. In pooling operation very first step is to select a Pool Size by applying Max pooling operation we are neglecting 75 % of the unwanted information / Data. As we are getting the maximum of pictures we are avoiding

distortion, over fitting and spatial invariances. The group of Pooled feature map is known as Pooling Layers

4.1.3 Flattening

It converts the multi-dimensional pooled features map to single dimensional pooled layers. Flattening Layer is the input layer for Artificial Neural network

4.1.4 Full Connection

Here's where artificial neural networks and convolutional neural networks collide as we add the former to our latter. It's here that the process of creating a convolutional neural network begins to take a more complex and sophisticated turn.

We have three layers in the full connection step:

- Input layer
- Fully-connected layer
- Output layer

4.1.5 Implementation of the model

The model is implemented using python. Convolutional, Pooling and flattening layer are all present in keras layer and all imported using Convo2d is the class to add Convolutional Layer to the Neural Network model. The first parameter in the convolutional layer is the number of features to be applied in our model next parameter was (3, 3) which represents the shape of the feature detector to be applied the next parameter is input shape tell us the size of the image for activation we will use relu to remove negative pixels. It helps to avoid non linear

The next one is MaxPooling layer it has pooling size parameter

To make our model have more accurate we want to add more convolutional layer and Pooling Layer. So we have added two Convolutional layers to our model. After implementation of our model we are saving the model in h5 extension. In another python model we are loading the model to create a GUI using tkinter which is present in Python itself by importing it we can create the GUI for our model by this end the implementation of our model comes to an end.

5. References

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

https://keras.io/

https://www.tensorflow.org/tutorials/estimators/cnn

https://medium.com/datadriveninvestor/training-a-cnn-to-detect-pneumonia-c42a44101deb

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6093039/

https://github.com/bitbionic/keras-to-tensorflow/blob/master/k2tf_convert.py

6. Conclusion

The convolutional neural network (CNN) is designed for diagnosis of pneumonia diseases. The designed CNN were trained and tested using the chest X-ray images containing normal and pneumonia diseases. Several experiments were carried out through training of these networks using number of iterations. It was observed that the input image of size 128 × 128 pixels showed good performance and achieved high accuracy rates. After convergence, it was noticed that the CNN was capable of gaining a better generalization power although required computation time and the number of iterations were roughly higher. This outperformance is mainly due to the deep structure of CNN that uses the power of extracting different level features, which resulted in a better generalization capability. Thus this helps in better predictions of the pneumonia and gives a better accuracy rates.