T.Y. BTech.

Artificial Intelligence and Expert Systems

Mini Project

On

Covid-19 Detection Using Convolutional Neural Networks

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Introduction

With an exponential growth rate and an ill-defined transmission mechanism, COVID-19 has spread globally. Artificial intelligence (AI) methods may be useful for the identification or characterisation of COVID-19 in imaging. Large global X-ray datasets for deep learning could produce automated and repeatable biomarkers for COVID-19 illness categorization and quantification. There may be a potential for artificial intelligence (AI) technologies for the identification or characterisation of COVID-19 on imaging given the sharp rise in the number of new and suspected instances of the disease. X-rays offer a quick and easy way to observe this process, and deep learning of massive amounts of international X-ray data may be able to produce automated and repeatable biomarkers for categorization and quantification of COVID-19 disease.

Hospitals and doctors suffer from increased workloads that make it harder for them to classify and hospitalise suspected patients during serious infectious disease outbreaks. According to earlier reports, some patients with early coronaviral infection tested negative for CT 10, which makes it more difficult for radiologists to conclusively rule out disease. If insufficient resources are used to distinguish positive patients from other suspected cases, the infected individuals may spread the virus to close contacts while waiting 4-48 hours for RT-PCR confirmation of SARS-CoV-2 coronavirus. Ital-acquired infection was suggested in one study in about 40% of patients. It is critical to swiftly validate patients' COVID-19 status because early false negative instances could raise the likelihood of the virus spreading.

At different levels of the healthcare system, including diagnosis, public health, clinical decision-making, and treatments, artificial intelligence (AI) has been implemented. Particularly during the present epidemic, the use of AI algorithms is crucial for the quick detection of COVID-19 patients. In 2020, the number of studies employing AI to diagnose COVID-19 grew quickly. The majority of reviews describe COVID-19 diagnosis using chest CT scans utilising AI technology. As a result, we will thoroughly examine the applications of AI for quick diagnosis of COVID-19 with various medical studies and explore their difficulties and potential in COVID-19. It is primarily composed of two parts, machine learning (ML) and deep learning (DL), including electronic medical records.

About the Project

Covid-19 had become a global pandemic after spreading from Saudi Arabia to the United States in July 2019. As of September 9th, Covid-19 had killed at least 61 people and infected over 460. Scientists have been working around the clock to identify possible treatments for the disease and its symptoms. The RT-PCR tests used by scientists to diagnose Covid-19 are not 100% accurate and involved a waiting time of 3-5 days to get the results, so researchers have turned to machine learning to try to identify the disease more quickly and more accurately.

Using machine learning techniques, researchers have been able to develop new strategies for detecting the presence of the virus in the human body. In this project, one such attempt at detecting Covid-19 with the help of chest x-rays has been made.

With the help of a CNN model, we can distinguish between a normal human chest and a chest x-ray containing Covid-19. The x-ray of a healthy person shows the lungs with clean white areas and a dark background. However, the x-ray of a Covid-19 patient shows different colours for the different areas in the lung. A CNN was used to train the model on a set of images taken from normal patients and images from the chest x-rays of patients diagnosed with Covid-19.

The dataset used contains 284 images, divided in an 80%: 20% ratio of training and validation data set to train the model. The model was trained using the Keras framework and convolutional neural network architecture. Once the model was trained, it was tested on the validation set of images and the results were compared with those from the training set.

The image submodule from the Keras' preprocessing module is used for image processing and generating batches of tensor image data. The images are rescaled to [0-1] pixel values for normalization with an image target size of (224, 224) and batch size of 32 as the input for the first layer.

The model is designed with a combination of Conv2D layers (for spatial convolution over images), Maxpooling layers (for dimensionality reduction in order to reduce the computation), Dropout layers (in order to avoid overfitting), Dense layers and Flatten layer (to flatten the multidimensional input in order to feed it into the dense layer).

The last layer is a Dense layer with a sigmoid activation function which gives a classification input, i.e., either Covid or Normal.

The model was trained on the training set for 15 epochs, 7 steps per epoch and 2 validation steps with the validation dataset images as the validation data for accuracy and loss calculation.

Link to the Project: https://colab.research.google.com/drive/1l89YxT3YUxxZE3PX7a59-Mw4XlgXb6E2?usp=sharing

Implementation

Steps:

STEP 1: Upload an X-ray image to test

STEP 2: Resize and convert the image to an array

STEP 3: Pass it into the model and predict

STEP 4: Display the predicted Ouptut

STEP 5: Output format: Original Image Original Label Predicted Label

Execution

1. **Generation of data from images**
   Using the image submodule from Keras preprocessing module

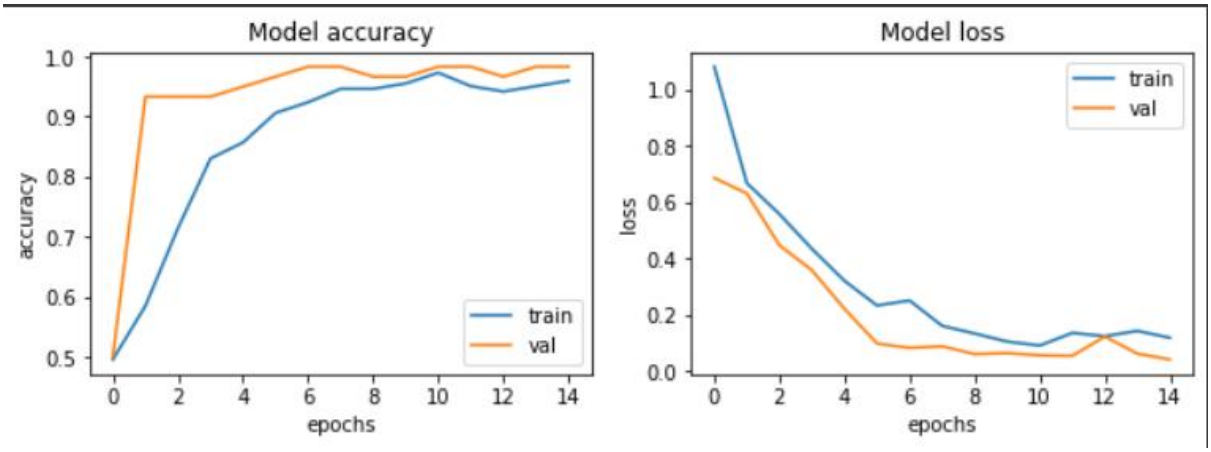
2. **Training the model**
   Using 80% of the available data

3. **Validation of the trained model**
   Using 20% of the available data

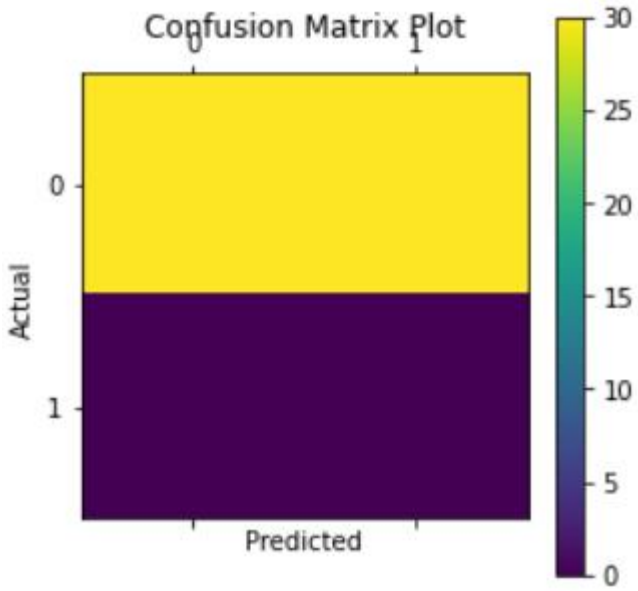
4. **Comparing accuracies and losses**
   Plotting the graphs of accuracies and losses using matplotlib

5. **Predicting the output for new test data**
   Uploading a new image and testing the model

Results

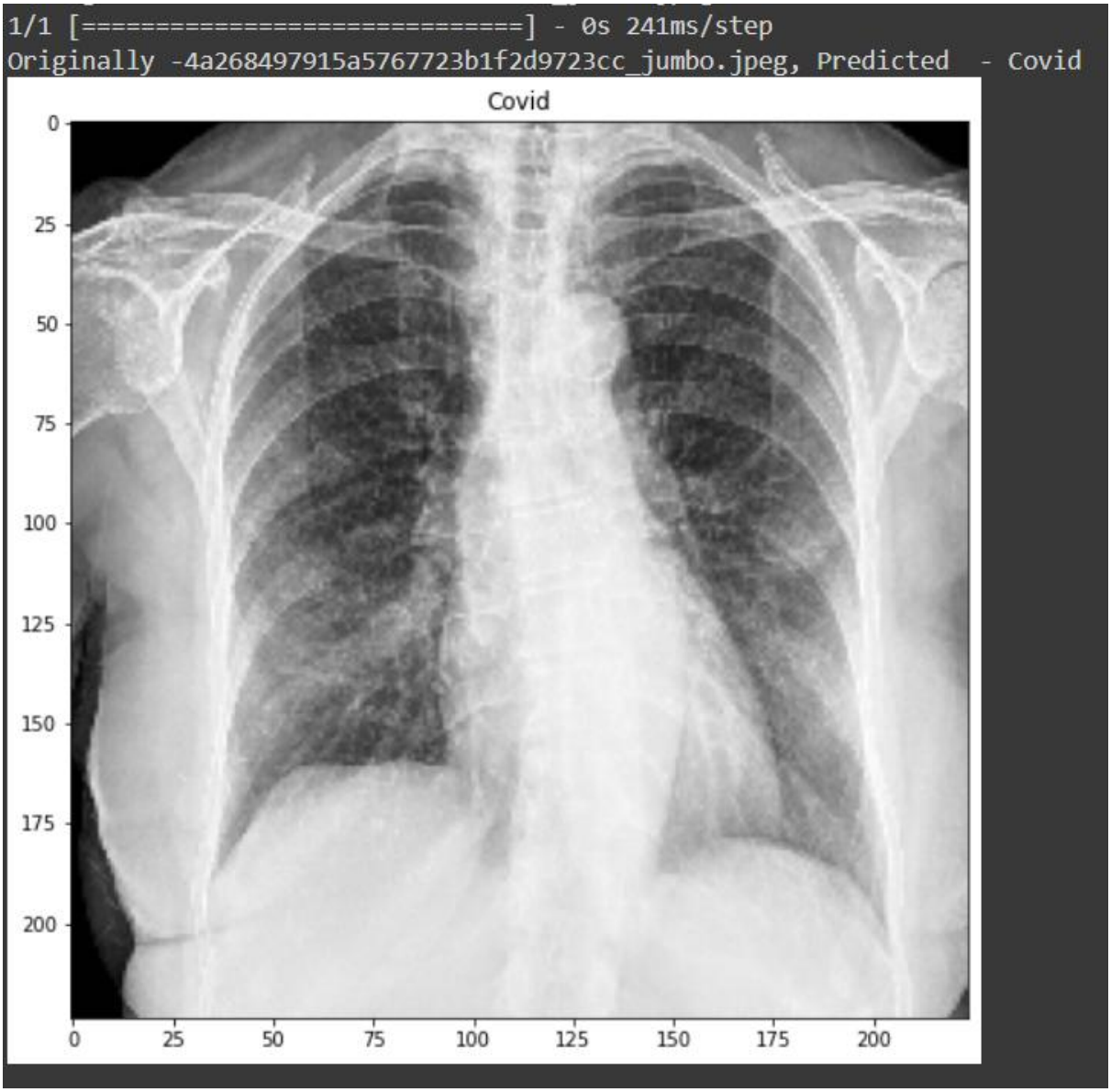


1. The model accuracy was found to be 96%.
2. The model had a loss of 6%.
3. The training accuracy was found to be 0.9598214030265808.
4. The validation accuracy was found to be 0.9666666388511658.
5. Confusion Matrix for the model is:



Conclusion

1. This model can be used for rapid and reliable diagnosis of COVID-19.
2. The final accuracy level of deep learning model is recorded as 0.96 and loss is recorded as 0.06.
3. The model answers nearly 0.96 of chest x-ray images of patients correctly and distinguishes between infected and non-infected lungs.
4. The following image shows the output for a random Covid-19 positive X-ray image from the internet



Future Scopes

1. This work can further be extended for non-Covid patients suffering with other Pneumonia diseases.
2. The general structure of convolutional neural networks can be restructured so that it will be able to analyze images in more detail.
3. Similarly, we can also use it to predict disorders that x-ray pictures can identify.
4. This can also be used as a base framework for any unexpected epidemics.

Limitations

1. The model may fail at detecting the differences in a pneumonia patient's X-ray and a Covid positive X-ray.
2. As a result of a lack of data, noisy social media and outlier data, big data hubris, and algorithmic dynamics, AI forecasts of the spread of COVID-19 are not yet very accurate or reliable.

References

1. https://link.springer.com/article/10.1007/s10916-020-01645-z
2. http://www.softcomputing.net/ijcisim_1.pdf
3. https://en.wikipedia.org/wiki/COVID-19
4. https://ejrnm.springeropen.com/articles/10.1186/s43055-020-00296-x