Chapter 10
Optimization Techniques for Influenza Prediction in Biological Expert Systems

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ABSTRACT

Currently, the biggest challenge in the world is the detection of viral infection in various diseases, as par to the rapid spread of the disease. According to recent statistics, the number of people diagnosed with the Influenza virus is exponentially increasing day by day, with more than 2.5 million confirmed cases. The model proposed here analyses the Influenza virus by comparing different deep learning algorithms to bring out the best in terms of accuracy for detection and prediction. The models are trained using CT scan dataset comprising of both Influenza positive patients and negative patients. The results of algorithms are compared based on parameters such as train accuracy, test loss, etc. Some of the best models after training were, DenseNet-121 with accuracy of 96.28%, VGG-16 with accuracy of 95.75%, ResNet-50 with accuracy of 94.18%, etc. in detecting the virus from the CT scan dataset with the proposed ACDL algorithm. Thus, these models will be helpful and useful to the government and communities to initiate proper measures to control the outbreak of the Influenza virus in time.

1. INTRODUCTION

The human influenza A virus was discovered in 1933 soon after Shope succeeded in isolating swine influenza A virus in 1931. Since the discovery studies in the

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influenza have made immense progress and have contributed greatly to not only virology but also immunology and molecular biology. The virus which is very similar to Influenza is the Corona virus. The SARS-CoV-2 originates from Wuhan, China, and got spread worldwide. This disease was identified as an epidemic by the World Health Organization on 03-11-20. The coronavirus is globally increasing at a very fast rate. As of now worldwide, there are 155,192,083 confirmed cases, 132,633,409 recoveries and 3,244,581 deaths. The ground-level symptoms include common cold, fever, tiredness, and feeling difficulty breathing. As per the World health organization, the pandemic is divided into different stages. The primary stage depicts cases of people who've been to already affected areas. The secondary stage depicts cases of people from the same family or place. The third stage is the most difficult one as the cases reported remains untraceable as it will be already spread to be public by the time. Such a scenario has only one solution which is the process of lockdown in both the cases and social distancing to decrease the spreading of the virus and control the virus among the public.

Normally, the RT-PCR test is done to spot or detect the presence of the virus and is treated as a standard test for the detection of the Influenza virus. Also, reports show that RT-PCR tests show variable sensitivity and may not be available in some regions, so currently, RT-PCR tests are not a prominent option for detection. Nowadays, X-rays and CT scans are used to detect the Influenza virus and for evaluating the disease from cases from different hospitals.

Also, CADx tools or Automated computer-aided diagnostic tools are being used to detect and segregate COVID-19 related differences from CXR and CT scans. Hence, this paper aims in doing a comparative study on different deep learning algorithms for the detection and prediction of the Influenza virus from CT scans. Firstly, all the algorithms are implemented by training and testing with the desired dataset and once it is done, the accuracy of all the algorithms can be computed. Hence, based on such parameters the comparison and prediction of the best models for Influenza analysis can be done.

2. RELATED WORK

Wang et al. (2020) used transfer learning and model integration based on the COVID-net model by Darwin-AL for identifying the COVID virus from Chest X-RAY images, the methodologies were implemented using ResNet-101 and ResNet-152 neural networks. Rajaraman et al. (2020) used iterative pruning for identifying pulmonary signs of the virus, for this they came up with a CNN and set of pre-trained models that have undergone training and evaluation based on Chest X-rays to learn about feature representations concerning modality. Hassan et al. (2020) came