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A CONVOLUTIONAL NEURAL NETWORK APPROACH FOR COVID-19 DETECTION IN CHEST X-RAY IMAGES

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ABSTRACT— The COVID-19 virus has spread globally, wreaking havoc on people's lives, economies, and healthcare systems.The best strategy to stop the spread of COVID-19 is by rapid and accurate diagnosis, hence many different methods have been used. Pulmonary collapse and lung damage are potential complications of COVID-19. Consequently, chest X-ray has evolved into one of the dependable diagnostic technologies coupled with AI methods that may be used to verify physicians' assessments. Our study suggested two models for COVID-19 detection from chest X-ray images: one based on deep learning's Convolutional Neural Network (CNN), and the other on transfer learning's InceptionV3. This study draws from many datasets totaling 1553 Chest X-ray pictures. Our suggested CNN architecture, based on deep learning, has the greatest training accuracy (79.74%) and validation accuracy (84.92%). In contrast, InceptionV3's transfer learning-based architecture had the greatest training and validation accuracy at 85.41% and 85.94%, respectively.

INTRODUCTION

In November of 2019, researchers in Wuhan, Hubei Province, China, announced a coronavirus epidemic. After its discovery, the World Health Organization (WHO) dubbed the newly identified virus severe acute respiratory syndrome coronavirus 2 (also called SARS and the illness it causes coronavirus disease 19 (COVID-19) on February 11, 2020 [1,2]. The coronavirus genus includes a collection of related RNA viruses with a positive-sense, single-stranded RNA genome ranging in size from 26.4 to 31.7 kilobases [3]. According to the

World Health Organization (WHO), high fever, coughing, and lung infection are all signs of a severe acute respiratory illness caused by the virus in 2019 [4].Several members of the family Coronaviridae have been identified, but only seven are known to propagate among humans: 229E, NL63, OC43, HKU1, MERS-CoV, SARS-CoV, and SARS-CoV-2 (COVID-19) [5]. Spread from camels to people, MERS-CoV was first discovered in Saudi Arabia in September 2012 [6]. However, at least 8000 individuals in 29 countries were infected with SARS-CoV because of bats [7].

Although COVID-19 has genetic similarities with the coronavirus that caused the SARS epidemic in 2003, it is not the same virus [4]. COVID-19 may be transmitted from humans to animals and vice versa. Wuhan's Huanan Fish and Live Animal Markets was linked to the first COVID-19 outbreak[8]. Camel, bat, cat, and dog transmission has all been documented [9]. Coronavirus is often disseminated by interpersonal interaction [10]. The virus has interrupted our everyday lives, slowed economic progress, prevented us from watching important athletic and political developments, and most importantly, put our lives in peril. With 118,000 confirmed cases and 4,000 fatalities, the World Health Organization declared COVID-19 an international epidemic on March 11, 2020 [11]. As of April 24, 2021, the cumulative death toll from COVID-19 was 30,79,390, with a total case count of 145,216,414 [12]. Italy, the United States, and India have seen the greatest increases in the total amount of covid cases since the dissemination of COVID-19. As of 2019, many methods, including reverse transcription-polymerase chain reaction (RT-PCR), antigen test, chest X-ray, computed tomography, or CT, scan, etc., have been utilized to detect COVID-19. The gold standard for identifying SARS-CoV-2 is RT-PCR [13], which amplifies a little amount of genetic viral material present in the sample. According to official Chinese reports, RT-PCR was used to positively identify COVID-19. Additionally, a CT scan was utilized to identify COVID-19 in China [15]. Since RT-PCR has a significant false-negative case and poor sensitivity, infected individuals may be disregarded as negative [16]. CT scans, on the other hand, are accurate and have a high Negative Prediction Value (NPV), but they are time-consuming and need skilled radiologists. In October 2020, chest imaging will be recommended by the WHO for the identification of COVID-19 afflicted and recovered individuals [17]. Since chest X-rays don't need a catheter and are commonly accessible in developing nations, they are preferred over CT Scan pictures for the identification of COVID-19. Furthermore, CT Scan pictures are costly, time-consuming, and potentially harmful to youngsters and pregnant women due to their high radiation levels [18]. In this study, we present a method for detecting COVID-19 in chest X-rays by combining the Convolutional Neural Network, or CNN, architecture from Deep Learning with the InceptionV3 architecture from Transfer Learning. One of the distinctive features of

this paper is its comparison of the CNN as well as the InceptionV3 is model for the diagnosis of Covid-19; another is that our deep learning-powered CNN model uses only two layers of convolution for a simpler and quicker experiment result and is as successful as other utilized CNN as well as deep CNN based models.Nonetheless, enough testing had been done to draw meaningful conclusions about the relative efficacy of the various deep learning model types described above.

RELATED WORK

It's conceivable that COVID-19 will transfer from humans to animals and back again.

This research examines the potential for the 2019 coronavirus illness (COVID-19) to transmit from people to their domesticated animals and then from those animals to wild species.Articles published in academic journals between November 2019 and August 2020 were subjected to a comprehensive literature review and meta-analysis. The current investigation addressed critical questions about the transmission of COVID-19 from animals to people and back again.Important and vital preventative measures were emphasized in order to shield pets from illness.

The most important findings from the experiments and investigations were emphasized. We investigated the measures needed to stop the transmission of disease inside and between species.Challenges and Possible Solutions to the Growing Number of Social Engineering-Based Cyber-Attacks/Threats During the Current COVID-19 Pandemic

"Impacts on society from the new coronavirus (COVID-19) pandemic have been large and long-lasting."

a global economic influence and significance. It has presented several cybersecurity concerns that must be addressed quickly to safeguard victims and essential infrastructure, in addition to other possible challenges across multiple domains. Cyberattacks and threats based on social engineering are a common way to sow discord. notably by assaulting essential services like healthcare facilities. Targets of social engineering-based cyberattacks are manipulated by a combination of psychological and methodical means. This study aims to examine the most recent and cutting-edge social engineering-based methodologies, attack methods, and venues used in the commission of such cyberthreats. Since the advent of the COVID-19 pandemic, there has been an increase in social engineering-based cyber-attacks and threats, thus we do a methodically guided Multivocal review of literature (MLR) on the topic.52 primary papers were chosen from the academic and grey literature after being evaluated using these standards. This study found that the most common socio-technical approach to launching successful cyber-attacks throughout the COVID-19 pandemic was the use of bogus emails, websites, and mobile apps as weapon platforms—a combination of phishing, scamming, spamming, smishing, and vishing. Historically, ransomware, which

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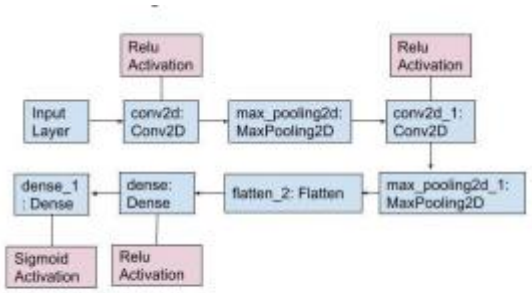
trojans, and bots have been the most common forms of malicious software used to abuse systems and resources.During the COVID-19 epidemic, we also highlighted the economic cost of cyber-attacks conducted on various enterprises and vital infrastructure, with hospitals and healthcare among the most targeted infrastructures. Using state-of-the-art tools like artificial intelligence, blockchain technology, and big data analytics, we then pinpointed the lingering problems, broad suggestions, and potential approaches for further study from the scholar and practitioner groups.

METHODOLOGY

Here, we'll provide a high-level overview of the approach we're proposing. For the purpose of detecting COVID-19, we will show how Deep Learning (DL) Convolutional Neural Network (CNN) architecture and the Transfer Learning (TL) InceptionV3 architecture operate in practice. The A. Neural Learning-Based CNN Architecture There are 15755425 trainable parameters in our CNN method that is based on deep learning. All data pictures have the dimensions (225,225,3). The convolution layer employs 32 nodes and a 'Relu Activation' function with a pool size of (2,2). In the fully linked layer, the 'Sigmoid Activation' function is utilized to determine the best method for detecting COVID-19.



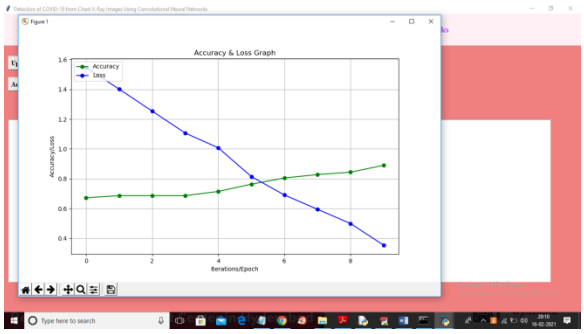
Proposed Model with Two Convolutional Layer using Deep learning-based CNN architecture

Two convolutional layers may be seen in our deep learning-based CNN architecture.Each layer uses convolutional2D. The 'Relu Activation' is used in the convolutional layers in both of these networks. For complete connectivity, we employed two thick layers. 'Relu Activation' is employed in the initial dense layer, while 'Sigmoid Activation' is used in the second.There is also an input layer and several hidden layers underneath them. In addition, the pooling layer is a 'MaxPooling2D'. The output of max pooling has less pixels, which decreases the pictures' dimensionality. Here is a picture of our suggested CNN architecture, which is based on deep learning.

RESULT AND DISCUSSION

In order to foretell cases of Covid-19 illness, the author of this article used a Convolution Neural Network trained on data derived from chest X-rays. Because it outperforms more conventional machine learning algorithms like SVM and Random Forest in making predictions, CNN is finding widespread use.

Blue-colored lettering on top of the screen indicates an illness has been found.



The green line in the above graph denotes precision, whereas the blue line denotes loss.To construct CNN, I used 10 iterations, which is shown in the following graph on the x-axis, with the loss of accuracy values decreasing as the number of iterations increased.

CONCLUSION

This research provides a clear analysis of COVID-19 identification from Chest X-ray pictures that may be utilized to validate the findings of specialists. In this research, the authors suggest two models—a Convolutional Neural Networks, strategy informed by deep learning and a transfer learning-informed InceptionV3 model—to differentiate between Covid-19 situations and typical cases.

The people of developing and least developed nations may profit greatly from this study since it allows them to quickly and cheaply distinguish between Covid-19 instances and normal cases utilizing pictures of the chest X-ray. According to our findings, the InceptionV3 design, which is based on transfer learning, outperforms the CNN architecture, which is based on deep learning. Therefore, InceptionV3 is the superior model in this case. We want to increase the amount of training photos for our model in subsequent iterations. We plan to continue working to enhance the precision of both models. Moreover, we will construct several deep learning models and conduct a comparative study of these variants.

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