CLASSIFICATION OF COVID, PNEUMONIA, OR STANDARD X-RAY IMAGES USING A NEURAL NETWORK

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ABSTRACT: The current global Covid-19 pandemic is linked to SARS-CoV-2, an acute respiratory disease caused by a new coronavirus that is highly contagious and whose evolution is unidentified. More than 1 million cases of Covid-19 infection have been confirmed worldwide using the existing case definition, based on the diagnosis of Pneumonia, and the associated mortality rate has fluctuated around 2%. Current laboratory tests may not be widely available to a growing infected population, but new screening strategies are required. Chest CT as a screening tool has yet to be determined. Recent studies have demonstrated a central role of CT in the early detection and management of Covid-19 pulmonary manifestations. It has shown high sensitivity but limited specificity. We present a Neural Network in TensorFlow and Keras based on Covid-19 and Pneumonia classification. The proposed system is based on CNN using images to classify Covid-19 or Pneumonia in this system using the CNN model. It is predicted that the success of the obtained results will increase if the CNN method is supported by adding different feature extraction methods and images to classify successfully by covid-19 or Pneumonia.

Keywords: Deep Learning, TensorFlow, Keras, CNN

I.INTRODUCTION

The treatments you might get are as follows: drugs that fight viruses Remdesivir and Paxlovid are two examples of antiviral drugs that target the virus. Treatments you might receive include: Antiviral medications: Certain antiviral medications, like remdesivir or Paxlovid, specifically target the virus that causes COVID-19 and help you fight off the infection. Antibiotics: Antibiotics are used to treat bacterial pneumonia. The antiviral medication Remdesivir (Veklury) has Approval from the FDA and is used to treat COVID-19 in hospitalized children and adults. Aged 12 and older in the hospital. In addition, Remdesivir may be prescribed for COVID-19 hospital patients who require oxygen support or are at higher risk of developing severe diseases.

II.RELATED WORK

Data Science: Data science is a study area that is interdisciplinary and combines scientific methodology, methods, strategies, and techniques to extract data and insights from both organized and unstructured data and apply knowledge and valuable insights from data across a wide range of application fields. The phrase "data science" was first used in 1974. Peter Naur suggested it as a different term for computer science. The International Federation of Classification Societies hosted the first conference to address data science in 1996. However, the definition was still in flux.

Data Scientist: Data scientists look at the relevant questions addressed and the sources of the relevant information. They are savvy in business: analytical skills and data mining, cleaning, and presentation skills. Large amounts of unstructured information are sourced, managed, and evaluated by companies using data scientists.

Artificial Intelligence: The replication of human intelligence in machines is known as artificial intelligence (AI). Designed devices that act and think

like humans. Any machine that demonstrates characteristics of a human mind, such as learning and problem-solving, may also be considered a "machine mind." AI refers to intelligence expressed by machines as opposed to the natural intelligence exhibited by people or other creatures. The study of "intelligent agents," or any system that is aware of its surroundings and acts in a manner that enhances the possibility that it will succeed in attaining its objectives, is how leading AI textbooks define the discipline. Machine learning algorithms must be created and trained on specialized hardware and software, which is required for AI. No programming language is inherently associated with AI, but many are, including Python, R, and Java. A vast volume of labeled training data is typically ingested by AI systems, which then examine the data for correlations and patterns before employing these patterns to forecast future states.

Deep Learning: Deep learning, commonly called deep structured learning, is one of several machine learning techniques built on representation learning and artificial neural networks. Education can be supervised, semi-supervised or unsupervised. Deep neural networks are generally interpreted using the universal approximation theorem or probabilistic inference.

A single hidden layer feed-forward neural network of finite size can estimate continuous functions according to the standard universal approximation theorem. In 1989, Kurt Hornik published the first proof by George Cybenko for sigmoid activation functions, which was generalized to feed-forward multilayer architectures in 1991. Recent work also showed that universal approximation holds for activation functions that are not bounded, such as the rectified linear unit.

Deep learning needs data gathering to have many past image data—training and testing this model working and predicting correctly.

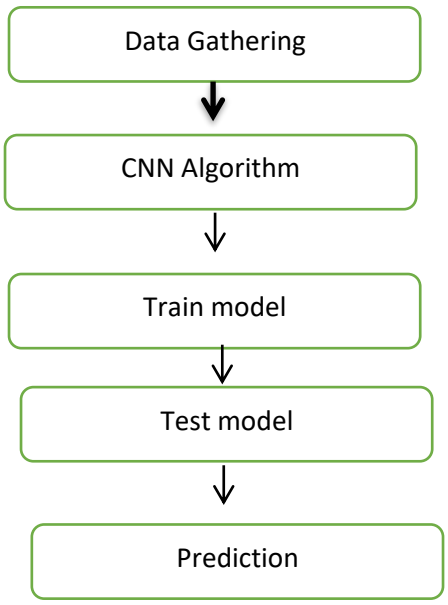


Fig: Steps of a dataflow diagram

III. LITERATURE SURVEY

Title: AI help in screening Viral and COVID-19 pneumonia

Author: Muhammad E. H. Chowdhury1, Tawsifur Rahman

Year: 2021

Coronavirus disease (COVID-19) is a pandemic that has already infected and killed millions of individuals worldwide. Therefore, any technological tool enabling rapid screening of the COVID-19 infection with high accuracy can be crucially helpful to healthcare professionals. The primary clinical tool currently in use, The Reverse Transcription Polymerase Chain Reaction, is used to diagnose COVID-19 (RT-PCR), which is expensive, less sensitive, and requires specialized medical personnel. X-ray imaging is an easily accessible tool that can be an excellent alternative in the COVID-19 diagnosis.

This research investigated the utility of artificial intelligence (AI) in rapidly and accurately detecting COVID-19 from chest X-ray images. This paper proposes a robust technique for automatically detecting COVID-19 pneumonia from digital chest X-ray images by applying pre-trained deep-learning algorithms while maximizing detection accuracy. The authors created a public database by combining several public databases and collecting photos from recently published articles.

Title: Automatic Detection and Diagnosis of Severe Viral Pneumonia CT Images Based on LDAS

Author: Gengfei Ling1, Congcong Cao2

Year: 2019

Pneumonia-type recognition algorithms include the template-matching method and statistical pattern-based recognition method. Statistical pattern-based recognition methods include support vector machines, the

Adaboost algorithm, deep learning methods, and so on. Although there are many algorithms in the field of pneumonia image recognition nowadays, the most widely used one is the statistical-based recognition algorithm. This algorithm must establish a standard sample library and train the classifier by extracting sample features and using machine learning to complete the target recognition. This kind of algorithm has better robustness than the template-matching algorithm. Support Vector Machine (SVM) is a learning algorithm based on minimizing structural risk and VC dimension theory. Its basic model is to find the linear classifier with the most significant classification interval in feature space. That is to say, the learning strategy of SVM is to maximize the gap and can eventually be transformed into aconvex quadratic programming problem to solve it. Kaao uses a support vector machine algorithm to identify lung types and achieve side results by subtracting the texture features of lung LBP.

Furthermore, the Adaboost algorithm affects the solid classifier by combining weak classifiers. It is an iterative algorithm. Its main idea is to train different weak classifiers with the same training set and then combine them according to the weight ratio to form a robust classifier.

Title: Dual-Sampling Attention Network for Diagnosis of COVID-19 from Community-Acquired Pneumonia

Author: Xi Ouyang , Jiayu Huo , Liming Xia , Fei Shan

Year : 2020

This work is supported in part by Wuhan Science and Technology program (2018060401011326), the Hubei Provincial Novel Pneumonia Emergency Science and Technology Project (2020FCA021), Huazhong University of Science and Technology Novel Coronavirus Pneumonia Emergency Science and Technology Project (2020kfyXGYJ014), Novel Coronavirus Special Research Foundation representing the Shanghai Municipal Science and Technology Commission(20441900600), Key Emergency Project of Pneumonia Epidemic of novel coronavirus infection (2020sk3006), Emergency Project of Prevention and Control for COVID19 of Central South University (60260005), National Natural Science Foundation of China (81871337, 6204100022), National Key Research and Development Program of China (2018YFC0116400), and STCSM (19QC1400600, 17411953300)

Title: Trend Prediction of Influenza and the Associated Pneumonia in Taiwan Using Machine Learning

Author: Ting-Chien Weng, Mei-Juan Chen

Year: 2019

Abstract—Trend prediction of influenza and the associated pneumonia can provide information for preventive actions for public health. This paper uses A multilayer perceptron (MLP) to forecast the number of patients with influenza and accompanying pneumonia in the upcoming week by considering meteorological and pollution characteristics and the number of acute upper respiratory infection (AURI) outpatients. Temperature and relative humidity are

used as meteorological variables. In contrast, carbon monoxide and particulate matter 2.5 (PM 2.5) are used as variables for air pollution (CO), and the patient prediction includes outpatients and inpatients. Tertiles classify patients into high, moderate, and low volumes. In the nationwide data analysis, the proposed method using MLP machine learning can reach an accuracy of 81.16% for the elderly population and 77.54% for the overall population in Taiwan. The regional data analyses with various age groups are also provided in this paper.

Title: Deep Regression via Multi-Channel Multi-Modal Learning for Pneumonia Screening

Author: QIULI WANG, DAN YANG, ZHIHUAN LI, XIAO HONG ZHANG, AND CHEN LIU

Year: 2020

Pneumonia screening is one of the most crucial steps in the pneumonia diagnosing system, which can improve the work efficiency of radiologists and prevent delayed treatments. In this paper, we propose a deep regression framework for automatic pneumonia screening, which jointly learns the multi-channel images and multi-modal information (i.e., chief clinical complaints, age, and gender) to simulate the clinical pneumonia screening process. We demonstrate the advantages of the framework in three ways. First, visual features from multi-channel images (Lung Window Images, High Attenuation Images, Low Attenuation Images) can provide more visual features than single image channels and improve the ability to screen pneumonia with severe diseases. Second, the proposed framework treats chest CT scans as short video frames and analyzes them using a Recurrent Convolutional Neural Network, which can automatically extract multiple image features from multi-channel image slices. Third, chief complaints and demographic information can provide valuable prior knowledge enhancing the features of images and further promoting performance. The proposed framework has been extensively validated in 900 clinical cases. Compared to the baseline, the proposed framework improves the accuracy by 2.3% and significantly improves the sensitivity by 3.1%. Based on the large-scale clinical raw dataset, we are the first to screen pneumonia using multi-channel images, multi-modal demographic, and clinical information.

IV. EXISTING SYSTEM

Pneumonia mainly refers to lung infections caused by pathogens, such as bacteria and viruses. Currently, deep learning methods have been applied to identify pneumonia. However, the traditional deep learning methods for pneumonia identification take less account of the influence of the lung X-ray image background on the model's testing effect, which limits the improvement of the model's accuracy. This paper proposes a deep learning method that considers image background factors and analyzes the proposed method with explainable deep learning for explainability. In this paper, we offer a deep learning method that considers the image background factors, and explainable deep understanding is employed to analyze the proposed method understandably. The essential idea is to utilize the existing pre-trained deep learning model, remove the image background, improve the pneumonia recognition accuracy, and apply the Grad-CAM method to obtain an explainable deep learning model for pneumonia identification of X-ray images with high precision and considering the image background.

V. PROPOSED SYSTEM

The proposed method is to train a deep learning algorithm capable of classifying covid-19, pneumonia, and standard images. We organize the photos based on Convolutional Neural Network (CNN) Algorithm. Initially, we analyzed the dataset and implemented the CNN Architectures for training our dataset. It is predicted that the success of the obtained results will increase if the CNN method is supported by adding different feature extraction methods to classify the images successfully. We are using Tensorflow and Keras packages for creating CNN architectures. Most predefined packages are available in python, so we go for the python programming language. More than two architectures were implemented to get different accuracies in different architectures. We compare to select the best architecture by the result of accuracy. Once we get

more accuracy, we can save the model after deploying Django Framework for User Interface purposes.

VI. MODULES

1. Manual Network.
2. Res-Net.
3. VGG-16.
4. Deploying the model.

DESCRIPTION

Manual Network:

We have to import our data set using the Keras preprocessing image data generator function. Also, we create size, rescale, range, zoom range, and horizontal flip. Then we import our image dataset from the folder through the data generator function. Here we set to train, test, and validation. Also, we set target size, batch size, and class mode from this function. Finally, we have to train using our own created network by adding layers of CNN.

Res-Net:

ResNet is the name of a convolutional neural network that has significantly influenced machine learning, specifically in applying deep understanding to machine vision. In addition, resNet was the first convolutional network that used GPU to boost performance. ResNet architecture consists of 5 convolutional layers, three max-pooling layers, two normalization layers, two fully connected layers, and one softmax layer. Convolutional filters and a nonlinear activation function called ReLU make up each convolutional layer. Max pooling is carried out using the pooling layers.

VGG 16:

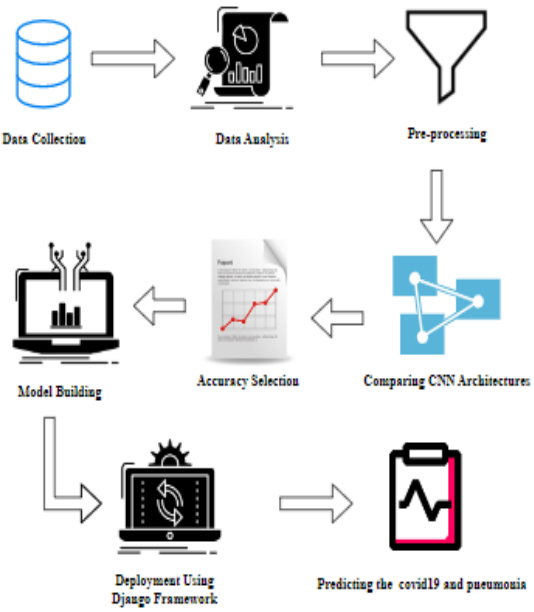
VGG16 is an object detection and classification algorithm which can classify 1000 images of 1000 different categories with 92.7% accuracy. It is one of the popular algorithms for image classification and is easy to use with transfer learning.

The architecture of VGG 16:VGG16 is a convolution neural net (CNN) architecture used to win the ILSVR(Image net) competition in 2014. It is considered one of the most fantastic vision model architecture to date.

Deploying the Model:

In this module, the trained deep learning model is converted into a hierarchical data format file (.h5 file) which is then deployed in our Django framework for providing a better user interface and predicting the output whether the given image is Glioma, Meningioma, No tumor, and Pituitary.

VII. SYSTEM ARCHITECTURE



VIII. FUTURE ENHANCEMENT

Further improvement in the network's accuracy and generalization can be achieved through the following practices. The first one is to use the whole dataset during the optimization. Using batch optimization is more suitable for larger datasets. Another technique is to evaluate covid and pneumonia one by one. This can detect which covid and pneumonia are more challenging to classify. Finally, using a larger dataset for training seems beneficial. However, such a dataset might not exist nowadays. Using several datasets might be a solution, but a careful procedure to normalize them is required. Finally, using the complete dataset for training, pre-training on each

covid pneumonia, and using a larger dataset seems to have the possibility to improve the network's performance. Thus, they should be addressed in future research on this topic.

IX. CONCLUSION

In this project, research was developed to classify covid pneumonia using deep learning algorithms and static facial images. This complex problem has already been approached several times with different styles. While promising results have been achieved using feature engineering, this project focused on feature learning, which is one of DL's promises. While feature engineering is not necessary, image preprocessing boosts classification accuracy. Hence, it reduces noise on the input data. Nowadays, covid pneumonia detection software includes the use of feature engineering. However, a solution based on feature learning does not seem close because of a significant limitation. Thus, covid pneumonia classification could be achieved utilizing deep learning techniques.

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