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DETECTION OF COVID-19 LESIONS IN LUNG CT USING ADVANCED CNN MODELS

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ABSTRACT_ The scarcity of labelled pictures makes developing an automated system for reliable COVID-19 diagnosis and evaluation from CT problematic. We offer a label-free method for segmenting COVID-19 lesions in CT using voxel-level anomaly modelling that leverages important knowledge from normal CT lung images to reduce data annotation time. The discovery that regions of the tracheae and veins in the high-intensity range, where lesions are visible, exhibit different patterns encouraged our modelling. We produce training pairs by synthesising 'lesions' and inserting them into normal CT lung scans, from which we build a normalcy-recognizing network (NormNet), which recognises normal tissues at the voxel level. A variety of unsupervised anomaly detection techniques are outperformed by NormNet.

1.INTRODUCTION

Machine learning is an area of AI and computer science that focuses on using data and algorithms to mimic how humans learn in order to increase accuracy over time. Machine learning is an important part of data science, which is rapidly evolving. In data mining activities, algorithms are trained to provide classifications or predictions using statistical methodologies, exposing key insights. These insights are then used to drive decision-making within applications and businesses, with the purpose of influencing key growth KPIs. As big data expands and grows, the demand for data scientists will also increase, who will be needed to help uncover the most relevant business issues and, as a result, the data needed to answer them.

Figure 2.1: The life cycle of Machine learning.

2.LITERATURE SURVEY

2.1 TITLE: "Label-Free Segmentation of COVID-19 Lesions in Lung CT"

AUTHORS: Qingsong Yao ,Li Xiao, Peihang Liu , and S. Kevin Zhou

"The proposed work in the paper isNormNet is a voxel-level anomaly modelling network that is designed to distinguish normal voxels from probable anomalies. Studies with the help of a total 3 different COVID-19 datasets verified the NormNet's efficacy. Even though our methods outperformed existing unsupervised anomaly detection systems, they fell short of supervised methods like nnU-Net. For a upper hand on performance on Covid-19 segmentation, we recommend improving our technique to address the above weaknesses, namely in the following three areas: 1) Investigating a better methodology to model low-intensity normal voxels by decreasing the influence of noise using a range of denoising methods; and 2) Investigating a better strategy to model low-intensity normal voxels by reducing the influence of noise using a variety of denoising methods. 4) Looking at metric learning concepts, such as Deep SVDD, to provide a more exact decision boundary."

2.2 TITLE: "Novel Feature Selection and Voting Classifier Algorithms for COVID-19 Classification in CT Images"

AUTHORS: EL-SAYED-M. EL-KENAWY, ABDELHAMEED-IBRAHIM, SEYEDALI-MIRJALILI, MARWA-METWALLY EID, & SHERIF E. HUSSEIN

"In Coronavirus research, diagnosis is a vital preventive step because the symptoms

are similar to those of other kinds of pneumonia. CT scans and X-rays are useful tools in this regard. Processing of the chest CT images and using them to reliably diagnose COVID-19, on the other hand, is computationally intensive. Machine Learning techniques may be able to assist in the resolution of this issue. Two COVID-19 feature selection and classification optimization strategies are presented in this work. There are three steps to the proposed framework. To begin, AlexNet, a Convolutional Neural Network, is used to extract characteristics from CT images (CNN). Second, the Guided Whale Optimization Algorithm (Guided WOA), The proposed features selection approach is based on Stochastic Fractal Search (SFS), and the selected features are then balanced. A voting classifier based on Particle Swarm Optimization (PSO) dubbed Guided WOA combines the predictions of various classifiers to determine which is the most popular. As a result, individual classifiers like Support Vector Machines (SVM), Neural Networks (NN), k-Nearest Neighbour (KNN), and Decision Trees (DT) are more likely to uncover substantial differences. The proposed model is tested using two datasets: CT images with clinical findings of positive COVID-19 and CT images with clinical findings of negative COVID-19. The suggested feature selection technique (SFS-Guided WOA) is compared to various optimization algorithms commonly used in recent research to validate its efficiency. In terms of performance, the proposed voting classifier (PSO-Guided-WOA) achieved an AUC of 0.995, which is significantly higher than previous voting classifiers. Wilcoxon rank-sum, ANOVA, and T-test statistical tests are utilised to evaluate the suggested algorithms quality."

2.3 TITLE: "CovTANet: A Hybrid Tri-Level Attention-Based Network for Lesion Segmentation, Diagnosis, and Severity Prediction of COVID-19 Chest CT Scans"

AUTHORS: Tanvir-Mahmud, Md. Jahin-Alam, Sakib-Chowdhury, Shams Nafisa Ali , Md. Maisoon Rahman, Shaikh Anowarul Fattah and Mohammad Saquib

"Rapid and precise diagnosis is one of the most pressing concerns confronting the international community in the fight against COVID-19. In this research, the CovTANet hybrid neural network is proposed as an end-to-end clinical diagnostic tool for COVID-19 early diagnosis, lesion segmentation, and severity prediction

utilising chest CT scans. For addressing the challenges of difficult diagnosis at an early stage of infection, a multiphase optimization strategy is introduced, in which an efficient lesion segmentation network is first optimised, then the feature improvement of contaminated regions is included into For diagnosis and severity prediction tasks, a mixed optimization framework has been developed. Moreover, for addressing the challenges posed by COVID's dispersed, fuzzy, and variable-shaped edges. Rapid and precise diagnosis is one of the most pressing concerns confronting the international community in the fight against COVID-19. In this research, the CovTANet hybrid neural network is proposed as an end-to-end clinical diagnostic tool for COVID-19 early diagnosis, lesion segmentation, and severity prediction utilising chest CT scans. For addressing the challenges of difficult diagnosis at an early stage of infection, a multiphase optimization strategy is introduced, in which an efficient lesion segmentation network is first optimised, which was then integrated into a combined optimization system for diagnosis and severity prediction tasks, enhancing infected regions' features."

3.PRPOSED WORK

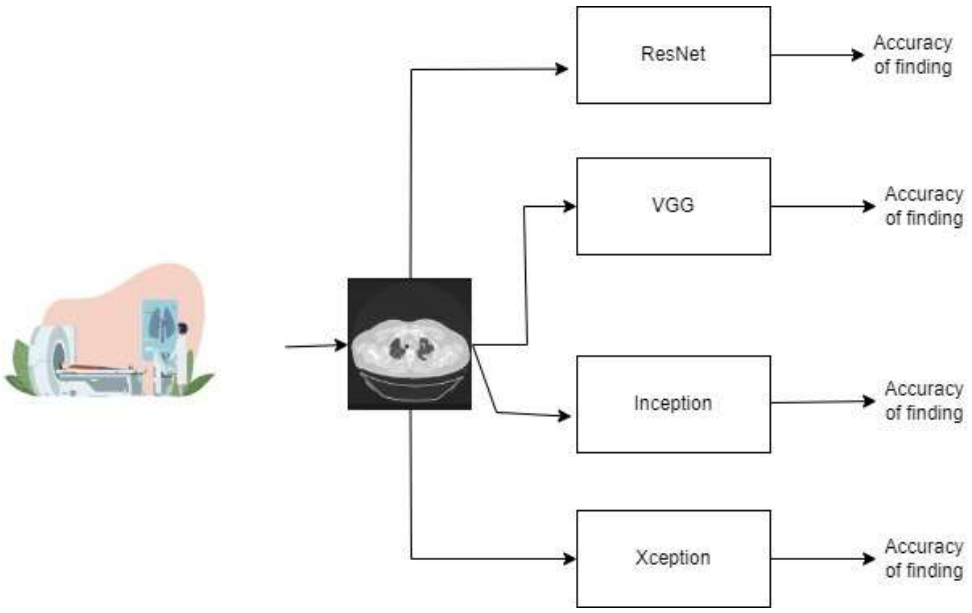


Fig 2:Architecture

As shown in Figure, our proposed deep learning-based COVID-19 detection contains five phases.

The phases are summarized in the following five steps:

Step 1: Collect the chest CT Scan images for the dataset from COVID-19 patients

and healthy persons.

Step 2: Using data augmentation, create chest CT scan images.

Step 3: With the help of deep learning, represent the images in a feature.

Step 4: Split of dataset into two sets: a training set and a validation set.

Step 5: Evaluating the validation dataset, the detector's performance .

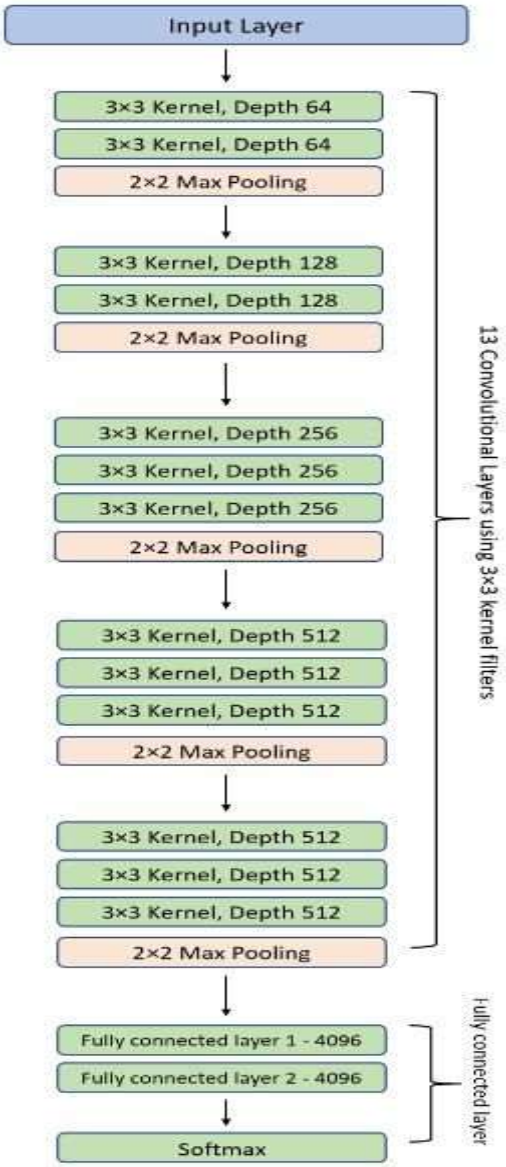
3.1 IMPLEMENTATION

3.1.1 DATASET

The efficacy of the dataset used in this work was confirmed by a notable radiologist at Tongji Hospital in Wuhan, China, who diagnosed and treated a large number of COVID-19 patients during the disease's outbreak.The dataset was created using images from COVID19-related papers published in medRxiv, bioRxiv, NEJM, JAMA, Lancet, and other journals. Patients of diverse ages, including one who are 76 years old, have CT scans taken. The CT scan dataset includes 349 CT scans from 216 individuals having COVID-19 clinical findings, as well as 379 non-COVID-CT scan images.

3.1.2 VGG

Visual Geometry Group (VGG) is a deep Convolutional Neural Network (CNN) architecture with several layers. The number of layers might range from 16 to 19. There are two variations of this model: VGG-16 and VGG-19, with 16 and 19 layers, respectively. In today's world, VGG is the most extensively utilised image recognition architecture.



4.RESULTS AND DISCUSSION

With the above proposed models for the detection of COVID lesions in lung CT, the models gave the following accuracies:

	Inception V3	VGG16	ResNet50	Xception
Accu	93%	93	80%	95%

racy of findi ng		%		

With the available data set, and available time, the trained model could predict whether the uploaded CT scan has the presence of COVID lesion or not. Out of the four models Xception has better accuracy and then comes Inception and VGG.

The following images are the accuracies of findings of a unknown CT scan:

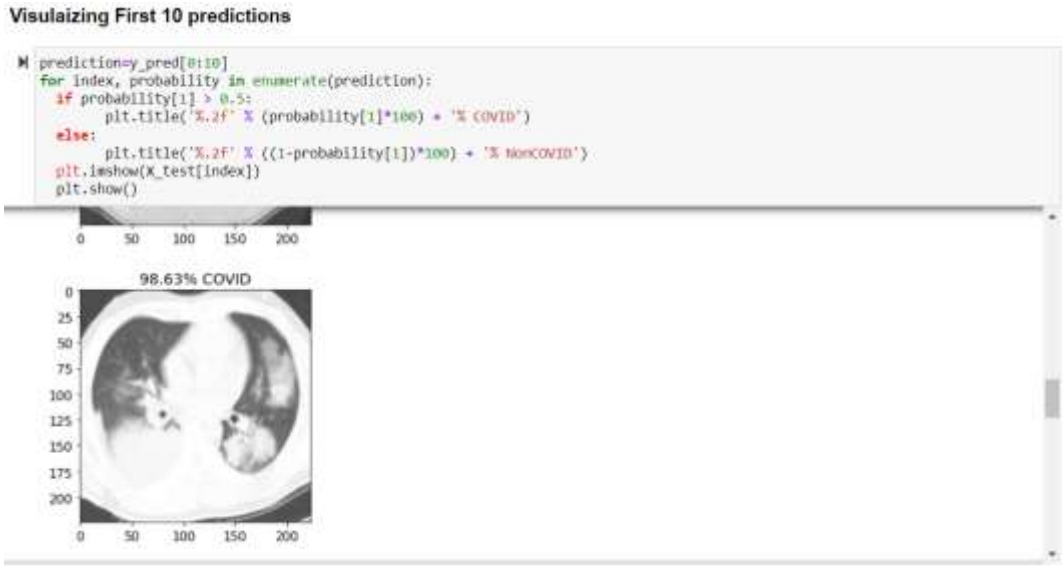


Fig 3:

Fig 4:

4.CONCLUSION AND FUTURE SCOPE

The models may work at a higher accuracy with the help of other data sets , despite the fact that they were trained with a small dataset. There are numerous other data sets that contain images of various CT-scans of various ages and patients from which more features could be retrieved, resulting in more accurate findings. On the other hand, with the use of more advanced GPU technologies in general, the time required to train models with the data set might be drastically reduced. This will aid the research by allowing more time to investigate various feature extraction approaches

REFERENCES

A. Journals/Articles

- Qingsong Yao , Student Member, IEEE, Li Xiao , Member, IEEE, Peihang Liu , and S. Kevin Zhou , Fellow, IEEE. “Label-Free Segmentation of COVID-19 Lesions in Lung CT”
- EL-SAYED M. EL-KENAWY (Member, IEEE), ABDELHAMEED IBRAHIM (Member, IEEE), SEYEDALI MIRJALILI (Senior Member, IEEE), MARWA METWALLY EID, AND SHERIF E. HUSSEIN (Member, IEEE). “Novel Feature Selection and Voting Classifier Algorithms for COVID-19 Classification in CT Images”

- Tanvir Mahmud , Md. Jahin Alam , Sakib Chowdhury , Shams Nafisa Ali , Md. Maisoon Rahman , Shaikh Anowarul Fattah , Senior Member, IEEE, and Mohammad Saquib , Senior Member, IEEE. “: CovTANet: A Hybrid Tri-Level Attention-Based Network for Lesion Segmentation, Diagnosis, and Severity Prediction of COVID-19 Chest CT Scans”

B. E-websites/Downloads

- https://www.toolbox.com/tech/artificial-intelligence/tech-101/what-is-machine-learning-definition-types-applications-and-examples/#_003
- https://www.narayanahealth.org/blog/know-about-coronavirus/
- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7147210/