JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue

JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)

An International Scholarly Open Access, Peer-reviewed, Refereed Journal

COVID DISEASE DIAGNOSIS USING DEEP LEARNING

Subhaa.S [1] ,Gunasundari.S[2]

[1]Student[1], Assistant Professor[2]

[1]Computer Science,

[1]Velammal Engineering College, Chennai, India

Abstract:

COVID -19 is the disease invoked by a new variety of coronavirus called the severe acute respiratory syndrome coronavirus 2. Recently, COVID-19 has become widespread, causing more than 152 million people in over 216 countries and territories. The research aims to analyze the development of covid disease using Deep learning methods. Computed tomography (CT Scan) and X-ray, on the other hand, reveal specific symptoms associated with this disease. There has been an urgent surge to develop Deep Neural Network (DNN)-based diagnosis solutions mainly based on Convolutional Neural Network (CNN) to identify COVID-19 positive cases. The techniques are compared based on performance measures such as accuracy, sensitivity, specificity. Finally, this review paper will explain the research work of upcoming development in deep learning for COVID-19.

Keywords: COVID-19, Tomography, X-ray computed, Artificial Intelligence, Deep learning. Diagnosis.

I. INTRODUCTION

The coronavirus disease (COVID-19) is defined as a disease or infection evoked by a new breed of coronavirus called the severe acute respiratory syndrome coronavirus 2 (SARS-COV-2, also known as 2019-nCov) has caused a global pandemic. The WHO reported the first COVID-19 cases on 31 December 2019. The Covid disease spread mainly through close contact with infected individuals, although researchers are still investigating potential infection routes. The symptom of COVID -19 infection is fever, dry cough, and breathing difficulty. If we maintain the distance from affected people. The disease can transmit at a distance of 6 feet. The first main reason for a person to get any disease from affected people is from talking or sneezing. Imaging-based medical image systems have been developed in image feature extraction, which includes shape and spatial features. Hence the CNN has hopeful results in feature extraction and learning. In general, doctors can experience fatigue because of long working hours and make the wrong diagnosis. Patients with COVID-19 can present irregularities in their CT or CXR results, and many lung problems are identical to COVID-19. Normally, a CT scan does not indicate a negative COVID-19 case. Traditional ML and DL techniques have been developed by various scholars to assist doctors in making a correct diagnosis. X-ray or CT scan techniques of the chest can classify into two classes: one is infected and another one is normal. A decision is made after several steps, such as the reading of an X-ray image, prepossessing, and extraction of unique features from input images, then features are input for the final prediction decision for ML or DL model. The other purposes of using such techniques are predicting an outbreak separation by analyzing COVID-19 data and predicting red zones and the number of infected cases with AI.

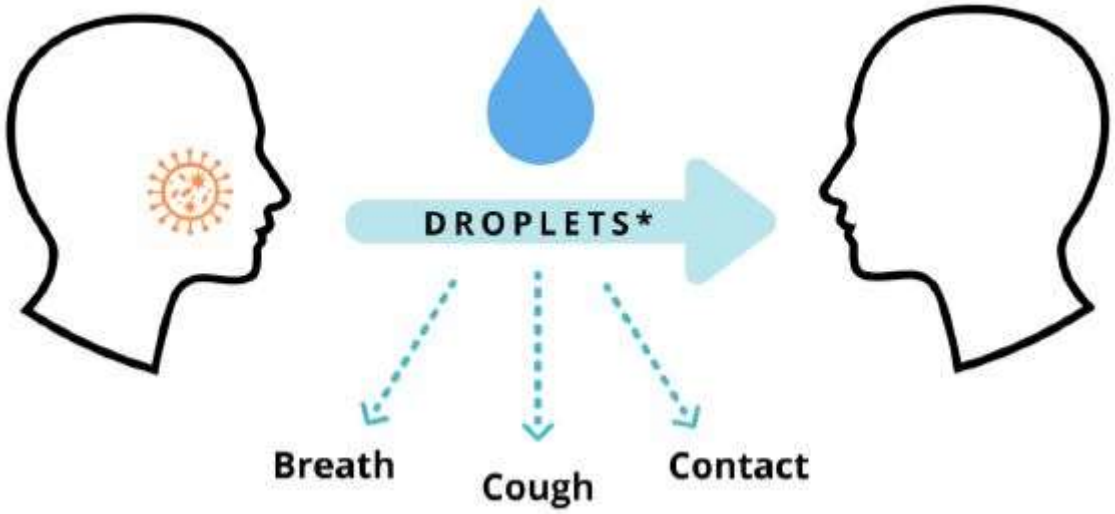

FIGURE 1: COVID-19 Person to person spread

2. Related studies for Covid-19:

A total of 255 papers were retrieved. The studies regarding the analysis of ML and DL techniques for the COVID-19 pandemic were included and it was carried out in April 2021. The three keywords are mainly used in these steps: COVID-19, 'machine learning, and 'deep learning' in different combinations and combined with the 'AND' operator.

In the second step, duplicate papers were omitted. A total of 55 papers were excluded. In the next step, the selected papers were purely based on titles and abstracts, the papers with topics outside the scope of our domain were omitted. More than 100 articles were omitted, and the papers were selected and passed to the next step. In each paper, we skimmed to ensure that its topic is inside the defined scope. As a result, 10 articles were excluded. At last, 90 papers that were similar to ML and DL techniques for COVID-19 prevalent were included.

3. MACHINE LEARNING AND DEEP LEARNING FOR COVID-19:

The widespread infection of the coronavirus, ML, and DL have been used in improving the performance of traditional techniques for COVID-19 detection or prediction.

3.1) MACHINE LEARNING APPROACHES:

ML directs the computers on what to do and trains them to perform actions independently. The analysis method involves the development, fitting of models which allows machines to ‘learn’ by practice and make predictions. ML is used for COVID-19 detection by analyzing the content of the input image of an X-ray or CT scan and extracting unique features from them. The image which we are giving as input will be provided as a normal case or as an infected case.

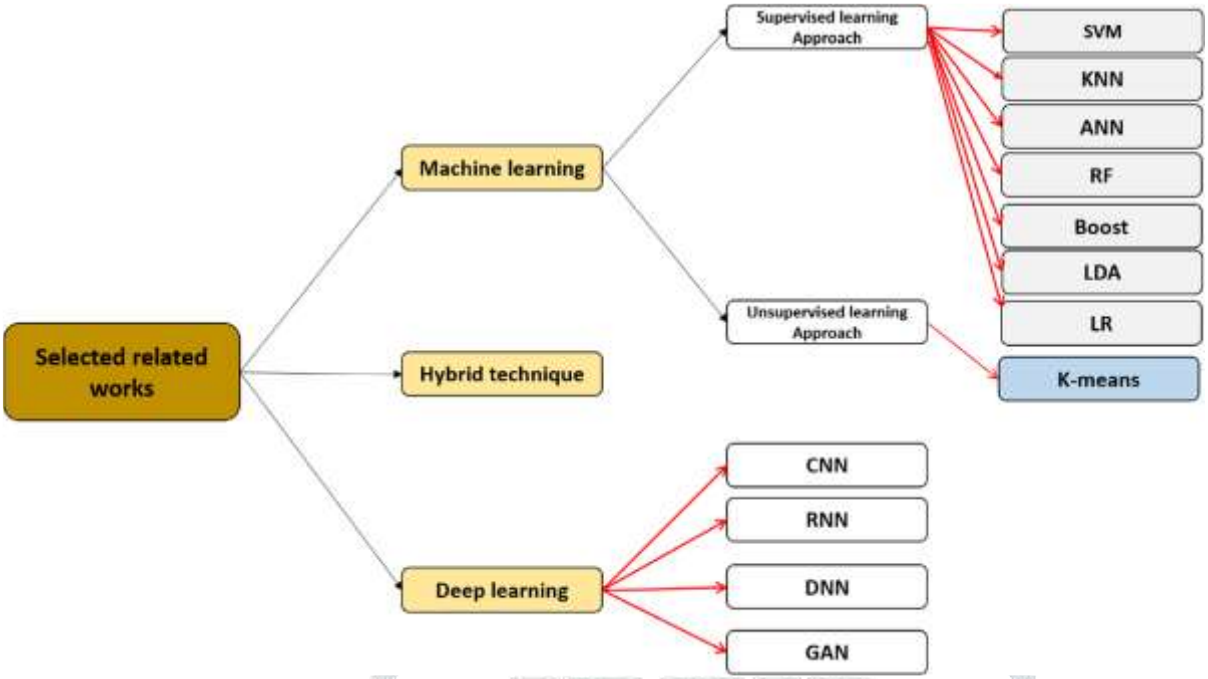

FIGURE 2: Categorizing of related works

3.2. DEEP LEARNING:

The word 'deep learning' is applied with multi-layered AI neural networks (ANN). It has become one of the most effective instruments in the last few decades and is very famous in literature as it manages an immense quantity of data. CNN's are the most common DNNs.

A CNN has many levels, including coevolutionary, nonlinear, pooling, and completely linked levels. The parameters that need to be set are convolutional and completely linked layers.

4. DEEP LEARNING APPROACHES FOR COVID-19:

The DL algorithms are extensively tested to handle COVID-19 disease with different aspects. Rahman et al. (2020) mention that the 5G RAN is integrated with edge computing. The method used for the global DL framework is with three-phase reconciliation for the management of the cloud environment. The proposal of DL model supported experts in the COVID-19 domain to make key decision-making. At first, CT images were sectioned for the reduction of intensity variants. Accordingly, the backgrounds of the CT images were isolated with a histogram thresholding mechanism. Next, each feature was extracted from a CT lung scan with a Q-deformed entropy algorithm combined with a DL mechanism

5. PAST WORK::

Wang et al (2020) have first extracted candidates using a threshold-based strategy. Consequently, randomly two or three regions were selected to form a dataset. By using the developed dataset a pre-trained CNN is fine-tuned. At last, the extracted features from the CNN and extracted to an ensemble of classifiers for the COVID-19 prediction, extend an accuracy of 88%.

Afshar et al (2020) proposed a selection of frameworks which is based on Capsule Networks, which have vivid importance due to the sudden and rapid emergence of COVID-19.

Arias landono et al (2020) proposed a convolutional neural network by using an automatic COVID-19 diagnosis tool by using chest X-Ray images to differentiate between controls, COVID-19 groups. The three preprocessing schemes are carried out to evaluate and compare the developed models.

Hemdan et al(2020) observed that the COVIDX-Net includes seven individual architectures of deep convolutional neural network models. It can be used on smart devices because of its high computational speed in the healthcare sector to assist the exact cost-effectiveness of COVID-19 in X-rays.

Khadidos et al(2020) proposed a hybrid deep learning model which is designed as a synthesis of convolutional neural network (CNN) and it is named as DeepSense method. The classifier is designed to process the classification on learning the multidimensional input data using the export hidden layer. The optimal classification of multidimensional features from CT images by using the DeepSense method algorithm.

Khan et al (2020) proposed a CoroNet, a Deep Convolutional Neural network model which is automatically used to detect COVID-19 infection. The xception architecture is pre-trained on the ImageNet dataset and it is trained by end-to-end on the dataset. By collecting COVID-19 the other chest X-ray images from two different publically are available databases.

Khobahi et al(2020) proposed a semi-supervised learning methodology based on auto Encoders to first extract the infected region's highly tailored deep architecture to extract the relevant feature specific to each class.

Li et al (2020) proposed a deep learning model, which was developed to extract visual features from volumetric chest CT scans for the detection of COVID-19.

Luz et al (2020) proposed efficient convolutional network architecture for detecting any abnormality caused by COVID-19 through chest radiography images.

Ucar et al (2020) observed The SqueezeNet with its light network design. Bayesian optimization is tuned for COVID-19 diagnosis. Fine-tuned hyperparameters have augmented datasets that make the network perform improved existing network designs.

Irfan Uddin et al (2020) proposed deep Convolutional Neural Networks (CNN) models that are implemented to test the technique. The system which guides other people to keep distance from the person informs healthcare professionals to test the person and to put the person in isolation from the general public.

Sekeroglu et al (2020) proposed a deep learning and convolutional neural network which is capable of detecting COVID-19 in three-class, COVID-19/Pneumonia/Normal images, with a macro-averaged. achieved.

Goel et al(2021) proposed an Optimized Convolutional Neural network (OptCoNet) for COVID-19. It is tested and compared with different classification strategies utilizing an openly accessible dataset of COVID-19, normal, and pneumonia images.It can help in the automatic screening of COVID-19 patients.

Shi et al (2020) proposed an infection Size Aware Random Forest method (iSARF) that is with different ranges, followed by random forests in each group for classification. yet. Wang et al. reported a disease screening by using a deep learning method.

Kabid Hassan Shibly (2020) observed a VGG-16 Network-based Faster Regions with Convolutional Neural Networks (Faster R–CNN) framework to observe COVID-19 patients from chest X-Ray images. A deep learning model is to detect COVID-19 cases from Chest X-Ray images.

Minaee et al (2020) proposed learning which is used to guide for four popular convolutional neural networks to identify COVID-19 disease in the chest X-ray images.

6. PERFORMANCE OF COVID-19 SYSTEM:

AUTHOR NAME AND YEAR	ALGORITHM	DATASET	PERFORMANCE
BoXu(2021)	Deep learning, deep convolutional neural network	CTimage(180 cases of viral pneumonia, other 79 cases confirmed nucleic acid)	Accuracy 82.5% Sensitivity 0.75% Specificity 0.86%
Burdik et al(2020)	Machine learning, CNN	U.S Hospitals COVID-19 admission data	Accuracy -76.2% Sensitivity 95% Specificity 76.3%
Natheer Khasawneh(2021)	Deep learning, Transfer Learning	COVID-19 respiratory, chest X-ray image 368 confirmed COVID 10 patients	Accuracy 96.7%
Rachna Jan (2020)	Deep learning, Transfer learning	Total chest X-ray image 6432,Normal-1345,covid -490	Accuracy -95.7% Sensitivity – 90% Specificity-95.80%
Joannis et al(2020)	Transfer learning method	504 image of normal condition,224 images with confirmed Covid-19 disease	Accuracy-96.78% Sensitivity-98.66% Specificity-96.46%
Linda wang(2020)	Deep convolutional neural network	Covid net. Covidx dataset	Accuracy-93.3%
Kabid Hassan Shibly(2020)	Faster Region with Convolutional Neural Networks(Faster R-CNN) framework	1)Custom dataset 5450 chest radiography images across 2500 patient cases. combined and modified Kaggle, two different publicly available datasets: COVID chest X-Ray dataset curated by Dr.Joseph Cohen, a postdoctoral fellow at the University of Montreal and named as COVIDx	Accuracy-97.36% Sensitivity - 97.65% Precision-99.28%
Khadidos(2020)	Hybrid deep learning classifier namely, CNN and RNN	IEEE8023, COVID-CT-Dataset, and COVID-19 Open Research Dataset Challenge	IEEE-96.11 COVID -CT -97.52 CORD-19 -97.59
Tulin et al(2020)	DarkCovidNet	They have used a total of 1125 images to experiment with their developed model	Accuracy 98.08% Sensitivity 85.35% Specificity 92.18%

Li et al(2020)	COVNet	4352 chest CT scans from 3322 patient	Receiver operating characteristic curve of 0.96
Afshar et al(2020)	Convolutional neural networks(CNNs)COVID-CAPS	Wang, A, Wong," COVID-Net: A Tailored Deep Convolutional Neural Network Design for Detection of COVID-19 cases from Chest Radiography Images	Accuracy 95.7% Sensitivity 90% Specificity 95.8%
Yeh et al(2020)	Deep Neural Network (DNN)	Open datset+Clinical Dataset padchest 41,364 RSNA 18,406 Covid-chest xray dataset 167	Sensitivity 96.8%
Wang et al(2020)	Deep model named COVIDNet, accuracy of 92.4%	COVID-Net 16, 756 chest radiography samples with 76 radiography images for the COVID-19 case, 8066 images for the healthy patients, and 5526 patient cases who have non-COVID pneumonia	Accuracy; COVID-Net was able to achieve an accuracy of 92.40% for the classification of COVID19 positive cases. Sensitivity; COVID-Net has achieved decent sensitivity, which is 91.0% for COVID-19 cases. Positive predictive value; The positive predictive value of this approach is 98.9%.
ARIAS-LONDOÑO et al (2020)	Convolutional Neural Network	79,500 X-Ray images HM HOSPITALES COVID-19 DATASET (5,560 RX images) BIMCV COVID19 DATASET (3013 XR images) ACTUALMED SET (ACT) MIMIC-CXR DATABASE CHINA SET - THE SHENZHEN SET	91:5% classification accuracy

		THE MONTGOMERY SET ChestX-ray8 DATASET (CRX8) CheXpert DATASET	
Goel et al(2021)	Optimized Convolutional Neural network (OptCoNet), The GreyWolf Optimizer (GWO) algorithm is used to optimize the hyperparameters for training the CNN layers.	openly accessible dataset	97.78%
Hemdan et al(2020)	COVIDx-Net	50 Chest X-Ray image (25 COVID19 positives, 25 normal).	Accuracy; The highest accuracy obtained among these seven CNN models are 90%. Sensitivity; Moreover, the highest sensitivity obtained among the models is also 100%.
Emrah Irmak et, al(2020)	Two novels, powerful and robust convolutional neural network architecture	1,524 COVID-19, 1,527 pneumonia, and 1524 normal Xray images are collected	98.92% (COVID-19 or not) 98.27% (COVID-19 versus normal versus pneumonia)
Khan et al (2020)	CoroNet, a Deep Convolutional Neural Network model to automatically detect COVID-19 infection from chest X-ray images.	The proposed model is based on Xception architecture pre-trained on ImageNet dataset and trained end-to-end on a dataset prepared by collecting COVID-19 and other chest pneumonia X-ray images from two different publically available databases	The overall accuracy of 89.6% for 4-class cases (COVID vs Pneumonia bacterial vs pneumonia viral vs normal) For 3-class classification (COVID vs Pneumonia vs normal), the proposed model produced a classification accuracy of 95%.

Khobahi et al(2020)	semi-supervised learning methodology based on AutoEncoders to first extract the infected legion highly-tailored deep architecture to extract the relevant features specific to each class	COVID-Net 16, 756 chest radiography samples with 76 radiography images for the COVID-19 case, 8066 images for the healthy patients, and 5526 patient cases who have non-COVID pneumonia	Accuracy 93.5 Precision 93.63 Recall 93.50 F1-Score 93.51
Luz et al(2020)	EfficientNet	13,569 X-ray images	The overall accuracy of 93.9%, COVID-19, the sensitivity of 96.8%, and positive prediction of 100%
Minaee et al (2020)	Transfer learning on a subset of 2,000 radiograms was used to train four popular convolutional neural networks, including ResNet18, ResNet50, SqueezeNet, and DenseNet-121,	5,000 Chest X-rays from the publicly available datasets.	sensitivity rate of 98%, a specificity rate of around 90%
Narin et al(2020)	five pre-trained convolutional neural network-based models (ResNet50, ResNet101, ResNet152, InceptionV3 and Inception-ResNetV2)	fifty COVID-19 patients images are taken from the open-source GitHub repository shared by Dr. Joseph Cohen and another fifty healthy patients images from Kaggle repository of Chest X-Ray Images (Pneumonia)	pre-trained ResNet50 model provides the highest classification performance (96.1% accuracy for Dataset-1, 99.5% accuracy for Dataset2 and 99.7% accuracy for Dataset-3)
Shi et al(2020)	infection Size Aware Random Forest method (iSARF)	1658 patients	sensitivity of 0.907, specificity of 0.833, and accuracy of 0.879

Ucar et al(2020)	deep Bayes-SqueezeNet called COVIDiagnosis-Net	COVIDx dataset The obtained COVIDx dataset [11] consists of a total of 5949 posteroanterior chest radiography images for 2839 patient cases. The dataset includes 1583 normal, 4290 pneumonia and 76 COVID-19 infection cases	98.26
Kabid Hassan Shibly(2020)	VGG-16 (Visual Geometry Group, also called OxfordNet) Network-based Faster Regions with Convolutional Neural Networks (Faster R–CNN) framework	**1**)X-ray images of COVID-19 patients Open source 2)Custom Dataset 5450 chest radiography images across 2500 patient cases.combined and modified Kaggle.	classification accuracy of 97.36%, 97.65% of sensitivity, and a precision of 99.28%

7. CONCLUSION AND FUTURE WORK:

The main purpose of this work is to conclude the previous studies and their applications are useful for COVID-19. It was found CNN based transfer learning was used in most studies. The research used to determine the main characteristics of COVID-19 is still ongoing, It Measures the amount of disagreement between radiologists to develop a benchmark for use in the prediction evaluation of the deep learning models. Semi-supervised algorithms apply a few labeled samples and many unlabeled data as of the training set. The result achieved by GAN is worth further investigation. The evaluation measurements used to diagnose the COVID-19 by using machine learning and deep learning strategies are expressed. Accuracy, sensitivity, and specificity are the most generally used for measurements in previous studies.

8. REFERENCES:

1)Shuai Wang, Bo Kang," A deep learning algorithm using CT images to screen for Corona Virus Disease (COVID-19),"2020.

2) Parnian Afshara, Shahin Heidarian," A Capsule Network-based Framework for Identification of COVID-19 cases from X-ray Images," arXiv:2004.02696v2 2020.

3) ARIAS-LONDONO, LAUREANO MORO-VELÁZQUEZ," Artificial Intelligence Applied to Chest X-Ray Images for the Automatic Detection of COVID-19.A Thoughtful Evaluation Approach", 2020, IEEE Access. 2020; 8: 226811–226827.

4) Tripti Goel & R. Murugan," OptCoNet: an optimized convolutional neural network for an automatic diagnosis of COVID-19."2020, ,Springer, 51(3):1351-1366.

5) El-Din Hemdan, Marwa A. Shouman," A Framework of Deep Learning Classifiers to Diagnose COVID 19 in X-Ray Images,"2020,IEEE Access, 2020 18:21:10 .

6) Emarah Irmak," Implementation of convolutional neural network approach for COVID-19 disease detection,"2020, Applied Intelligence, Springer ,51(14):1-16.

7) Asif Iqbal Khan, Junaid Latief Shah," A deep neural network for detection and diagnosis of COVID-19 from chest x-ray images"2020, IEEE Access,Vol 196 ,105581.

8) Shahin Khobahi, Chirag Agarwal," A Deep Network Architecture for Semi-Supervised Task-Based Identification of COVID-19 from Chest X-ray Images",2020

9) Lin Li, Zeguo Xu, "Using Artificial Intelligence to Detect COVID-19 and Community-acquired Pneumonia Based on Pulmonary CT: Evaluation of the Diagnostic Accuracy,"2020,vol:296(2):E65-E71.

10) Eduardo Luz, Pedro Silva," Towards an Effective and Efficient Deep Learning Model for COVID-19 Patterns Detection in X-ray Images," 2020, Springer.

11) Irfan Uddin, Syed Atif Ali Shah, " A Novel Deep Convolutional Neural Network Model to Monitor People following Guidelines to Avoid COVID-19," 2020,Journal Of Sensor.

12) Boran Sekeroglu and Ilker Ozsahin," Detection of COVID-19 from Chest X-Ray Images Using Convolutional Neural Networks,"2020,vol:25.

13) Pedro R. A. S. Bassi, Romis Attux," A Deep Convolutional Neural Network for COVID-19 Detection Using Chest X-rays,"2021,springer, vol.36

14) A. Wong, M. J. Sha_ee, B. Cheryl, and F. Li, ``FermiNets: Learning generative machines to generate ef_cient neural networks via generative synthesis," 2018.

15) Shahin Khobahi, Chirag Agarwal, Mojtaba Soltanalian "CoroNet: A Deep Network Architecture for Semi-Supervised Task-Based Identification of COVID-19 from Chest X-ray Images

16) Tripti Goel, R. Murugan, "OptCoNet: an optimized convolutional neural network for an automatic diagnosis of COVID-19" 2020.

17) Shervin Minaeea, Rahele Kafieh, " Deep-COVID: Predicting COVID-19 From Chest X-Ray Images Using Deep Transfer Learning" 2020.

18) Ali Narin , Ceren Kaya , Ziynet Pamuk " Automatic Detection of Coronavirus Disease (COVID-19) Using X-ray Images and Deep Convolutional Neural Networks,"2020.

19) Feng Shi, Liming Xia, "Large-Scale Screening of COVID-19 from Community-Acquired Pneumonia using Infection Size-Aware Classification,"2020.

20) Kabid Hassan Shibly, Samrat Kumar Dey," COVID faster R–CNN: A novel framework to Diagnose Novel Coronavirus Disease (COVID-19) in X-Ray images,"2020

21) Ferhat Ucar, Deniz Korkmazb," COVIDiagnosis-Net: Deep Bayes-SqueezeNet based diagnosis of the coronavirus disease 2019 (COVID-19) from X-ray images ." 2020