PROJECT ON -*CLOUDCOMPUTING*

J-COMPONENT PROJECT FINAL REPORT

REVIEW – 3

ON

COVIDDETECTIONFROMX-RAYIMAGESUSINGAMAZONSAGEMAKER

UNDER THE GUIDANCE OF

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PROGRAMME

M.TECH (Integrated) SOFTWARE ENGINEERING

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SCHOOL OF COMPUTER SCIENCE ENGINEERING AND

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COURSE CODE

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SLOT

B2

ABSTRACT:

The effective management of the globalepidemic now depends critically on the quick andaccurate detection of COVID-19. A widely utilized and reasonably priced diagnostic method for findingCOVID-19is chest X-ray imaging.

Convolutionalneuralnetworks(CNNs),inparticular,areusedintheproposedmethodtoautomatically extract significant features from X-ray pictures and classify them as COVID-19 positive,COVID-19negative,andmaybeotherlung-related disorders.

Toprovideascalableandcloud-basedsolutionforreal-timeinference,themodelwillbedeployedtoAmazon EC2 using Amazon SageMaker.

1. INTRODUCTION:

The COVID-19 epidemic has had a severe impact on the global healthcare system. Rapidand accurate COVID-19 diagnosis is critical for limiting additional virus propagation and deliveringprompt therapyto patients.

Chest X-ray imaging is a commonly available and low-cost diagnostic technique fordetecting COVID-19. The use of artificial intelligence (AI) and machine learning (ML) techniques toanalysesmedicalimagesfordiseaseidentificationand diagnosishasshown considerablepotential.

Amazon Sage Maker, a cloud-based platform for constructing, testing, and deployingmachine learning models, provides an ideal environment for establishing a robust and scalable solutionforCovid-19detection fromX-ray pictures in this Project.

This project intends to exploit the capabilities of deep learning and cloud computing byutilizing Amazon. ThemodelwillbedeployedtoAmazon EC2using Amazon SageMaker.

2. WHYSAGEMAKER?

On the Studio Lab free tier, you get a Tesla T4. On the Google Collab free tier, you get aTeslaP100orTesla K80.Studio offers apersistent environment.

YoucanchoosetorunaCPU-basedenvironmentfor12hoursoraGPU-basedenvironment for 4 hours. This environment will keep running for that long unless you stop it via theconsole.Studio Lab is agood optionfor longerprojects indatascienceor machine learning.

You will be using better hardware and working in a programming environment that youmaycustomize.

3. LITERATURESURVEY:

[1] TITLE:AutomateddetectionofCOVID-19cases usingdeep neuralnetworks withX-ray images
AUTHOR:T. Ozturk etal.***PUBLISHED***
YEAR: 2020,
ELSEVIER***DESCRIPTION:***

The paper presents a new model for automatic COVID-19 detection using raw chest X-rayimages. The proposed model aims to provide accurate diagnostics for binary classification (COVID vs.No-Findings) andmulti-classclassification(COVID vs.No-Findingsvs.Pneumonia). The modelachieveda classificationaccuracy of 98.08%for binary classesand 87.02% for multi-class cases. Itcanbeusedtoassistradiologistsinvalidatingtheirinitialscreeningandcanalsobeemployedviacloudforimmediate patient screening.

PROPOSEDMETHODS:

The authors used the Dark Net model as a classifier for the you only look once (YOLO)real-timeobjectdetectionsystem.Theyimplemented17convolutionallayerswithdifferentfilteringon each layer. The model was trained using the Adam optimizer, cross-entropy loss function, and alearning rate of 3e-3. The training and validation were performed using a 5-fold cross-validationprocedure.

[2] TITLE:CoroDet:AdeeplearningbasedclassificationforCOVID-19detectionusingchestX-rayimages
AUTHOR: Emtiaz Hussain, Mahmudul Hasan, et
al.***PUBLISHEDYEAR:***2021,
ELSEVIER***DESCRIPTION:***

Thepaperdiscussesthedevelopmentofadeeplearning-basedmethodcalledCoroDetforCOVID-19detectionusingchestX-rayimages.Theproposedmethodutilizesa22-layerCNNarchitecture and achieves high accuracy for 2 class, 3 class, and 4 class classification. The paper alsohighlights the construction of a large X-ray image database for COVID-19 classification and presentsexperimentalresults anddiscussions on theperformanceof theproposed method.

PROPOSEDMETHODS:

ThepaperintroducestheCoroDetmethod,whichconsistsofa22-layerCNNmodelforCOVID-19 detection using chest X-ray and CT images. The model is evaluated based on variousperformancemetricssuchasaccuracy,precision,recall,F1score,specificity,sensitivity,andconfusion matrix. The proposed method outperforms existing techniques in terms of accuracy anddemonstratesits effectiveness forCOVID-19 identification.

[3] TITLE:ExploringtheeffectofimageenhancementtechniquesonCOVID-19detectionusingchestX-rayimages

AUTHOR: Tawsifur Rahman, Amith Khandakar, et al.***PUBLISHEDYEAR:***2021, ELSEVIER***DESCRIPTION:***

Thispaperfocusesontheexplorationofdifferentimageenhancementtechniquesforthedetectionof COVID-19usingchestX-rayimages.Ithighlightsthe importance of computer-aideddiagnosis in the fast and reliable detection of COVID-19 to ease the burden on the healthcare system.The paper also introduces a large dataset (COVQU) consisting of 18,479 CXR images with normal,non-COVID,andCOVID-19 cases,and proposesamodifiedU-Netmodel forlung segmentation.

PROPOSEDMETHODS:

The paper utilizes sixdifferent pre-trained Convolutional Neural Networks (CNNs) and ashallow CNN model for classification. It also investigates five different image enhancement techniques,including histogram equalization, contrast limited adaptive histogram equalization, image complement,gamma correction, and balance contrast enhancement technique. A modified version of the U-Net modelis proposedforlung segmentation.

[4] TITLE:Automaticdetectionofcoronavirusdisease(COVID-19)usingX-rayimagesanddeepconvolutionalneural networks

AUTHOR: Ali Narin, Ceren Kaya, Ziynet Pamuk***PUBLISHED YEAR:*** 2021, SPRINGER NATURE.***DESCRIPTION:***

The paper focusesontheautomatic detectionof COVID-19usingX-rayimagesanddeepconvolutional neural networks. It highlights the need for an alternative diagnosis option to prevent thespread of COVID-19 among people due to the limited availability of COVID-19 test kits in hospitals.The study proposes five pre-trained convolutional neural network-based models for the detection ofcoronavirus pneumonia-infected patients using chest X-ray radiographs. The performance results showthat the pre-trained ResNet50 model provides the highest classification accuracy among the four modelsused.

PROPOSEDMETHODS:

The studyproposesthe use of five pre-trainedconvolutionalneuralnetwork-basedmodels,namely ResNet50, ResNet101, ResNet152, InceptionV3, and Inception-ResNetV2, for the detection ofCOVID-19 from chest X-ray images. Three different binary classifications with four classes (COVID-19,normal,viralpneumonia,andbacterialpneumonia)areimplementedusingfive-foldcross-validation.

[5] TITLE:ApplicationofdeeplearningtechniquesfordetectionofCOVID-19casesusingchestX-rayimages: A comprehensive study

AUTHOR:SoumyaRanjanNayak, DeepakRanjanNayak,etal.

PUBLISHEDYEAR: 2021,ELSEVIER.

DESCRIPTION:

The paper discusses the use of deep learning techniques for the detection of COVID-19 casesusing chest X-ray images. It highlights the importance of an automated and early diagnosis system toreduce the diagnosis error and provide fast decisions. The study proposes a DL-assisted automatedmethodusing X-ray images forearly diagnosis ofCOVID-19 infection.

PROPOSEDMETHODS:

The paper evaluates the effectiveness of eight pre-trained Convolutional Neural Network(CNN) models, such as Alex Net, VGG-16, Google Net, MobileNet-V2, etc., for the classification ofCOVID-19 infection cases from normal cases. The ResNet-34 model is found to outperform othernetworkswith an accuracy of 98.33%.

[6] TITLE:AutomaticDetectionofCOVID-19InfectionUsingChestX-RayImagesThroughTransferLearning

AUTHORS:EleneFirmezaOhata,GabrielMaia Bezerra,etal.

PUBLISHEDYEAR:2021,IEEE

DESCRIPTION:

The paper proposes an automatic detection method for COVID-19 infection based on chest X-ray images. The authors construct datasets consisting of X-ray images of patients diagnosed withcoronavirus and healthy patients. They apply transfer learning using different convolutional neuralnetwork (CNN) architectures trained on ImageNet to extract features from the X-ray images. Thesefeaturesarethencombinedwithmachinelearningmethodssuchask-NearestNeighbor,Bayes,Random Forest, multilayer perceptron (MLP), and support vector machine (SVM) for classification.Theresults showhigh accuracyand F1-scores fordetecting COVID-19in X-ray images.

PROPOSEDMETHODS:

Transfer learning with convolutional neural networks (CNNs) trained on ImageNet, combinedwithmachinelearningmethodssuchask-NearestNeighbor,Bayes,RandomForest,multilayerperceptron(MLP), and support vector machine (SVM).

[7] TITLE:ClassificationofCOVID-19fromChestX-rayimagesusingDeepConvolutionalNeuralNetwork
AUTHOR:SohaibAsif,YiWenhui, HouJin,SiJinhai
PUBLISHEDYEAR:2020,IEEE.
DESCRIPTION:

ThepaperfocusesontheautomaticdetectionofCOVID-19pneumoniapatientsusingdigital chest X-ray images. It proposes the use of deep convolutional neural networks (DCNN) foraccurate detection and classification. The study utilizes a dataset consisting of 864 COVID-19, 1345viral pneumonia, and 1341 normal chest X-ray images. The proposed DCNN-based model, InceptionV3with transfer learning,achievesaclassification accuracyof morethan 98%.

PROPOSEDMETHODS:

Thepaperproposestheuseofdeepconvolutionalneuralnetworks(DCNN)fortheclassification of COVID-19 fromchestX-rayimages. Specifically, the Inception V3 modelwithtransfer learning is utilized. Transfer learning allows the model to leverage pre-trained weights andknowledgefromalargedatasetto improveperformanceon asmaller dataset.

[8] TITLE:Covid-19:automaticdetectionfromX-rayimagesutilizingtransferlearningwithconvolutionalneural networks.
AUTHORS:IoannisD. Apostolopoulos,TzaniA.Mpesiana
PUBLISHEDYEAR: 2020,AustralasianCollege ofPhysicalScientistsAndEngineers InMedicine
DESCRIPTIONOF THE PAPER:

ThepaperfocusesontheautomaticdetectionofCovid-19fromX-rayimagesusingtransfer learning with convolutional neural networks. The study aims to evaluate the performance ofstate-of-the-artconvolutionalneuralnetworkarchitecturesformedicalimageclassification.Theresearchers utilized two datasets of X-ray images, one including confirmed Covid-19 cases, commonbacterial pneumonia cases, and normal conditions, and the other including confirmed Covid-19 cases,bacterial and viral pneumonia cases, and normal conditions. The results suggest that deep learning withX-rayimagingcanextractsignificantbiomarkersrelatedtoCovid-19,achievinghighaccuracy,sensitivity,and specificity.

PROPOSEDMETHODS:

The paper utilizes transfer learning with convolutional neural networks for the automaticdetectionofCovid-19fromX-rayimages.Transferlearningallowsthedetectionofvariousabnormalities in small medical image datasets, yielding remarkable results. The researchers adoptedstate-of-the-art pre-trained convolutional neural networks and fine-tuned them using the available X-rayimages.Theperformanceofdifferent CNNarchitectures,such asMobileNetv2, wasevaluated.

[9] TITLE:ProblemsofDeployingCNNTransfer LearningtoDetectCOVID-19fromChestX-rays

AUTHOR:TabanMajeed,RasberRashid,DashtiAli,andArasAsaad

PUBLISHEDYEAR: 2020,MEDRXIV.

DESCRIPTION:

The paper aims to investigate the applicability of convolutional neural networks (CNNs) forCOVID-19 detection in chest X-ray images. It analyses the performance of 12 off-the-shelf CNNarchitecturesandproposesasimpleCNNarchitecturethatoutperformsotherarchitectureswhentrained on a small dataset. The paper also highlights the challenges of using CNNs directly on chest X-rayimages without pre-processing steps.

PROPOSEDMETHODS:

The paper uses transfer learning with 12 CNN architectures and a shallow CNN architecturetrained from scratch. It also employs class activation maps (CAM) to visualize the regions on X-rayimagesused by CNNs for their predictions.

[10] TITLE:Anewapproachforcomputer-aideddetectionofcoronavirus(COVID-19)fromCTandX-rayimages using machine learning methods

AUTHOR:AhmetSaygılı

PUBLISHEDYEAR: 2021,ELSEVIER.

DESCRIPTION:

The paper discusses a new approach for the computer-aided detection of COVID-19 from CTand X-ray images using machine learning methods. The study aims to support early diagnosis andtreatment of the coronavirus epidemic. The proposed approach involves data set acquisition, pre-processing, feature extraction, dimension reduction, and classification stages. The results show highaccuracylevels in detecting COVID-19 from bothCT and X-ray images.

PROPOSEDMETHODS:

Theproposedapproachincludesdatasetacquisition,pre-processing,featureextraction,dimension reduction, and classification stages. Machine learning and image processing methods areused to enable early diagnosis and treatment of COVID-19. The approach is applied to three differentpublic COVID-19 data sets, achieving high accuracy levels in detecting COVID-19 from CT and X-rayimages.

[11] TITLE:COVID-19detectionusingdeeplearningmodelstoexploitSocialMimicOptimizationandstructuredchestX-ray imagesusing fuzzycolor andstacking approaches.

AUTHOR:MesutToğaçar,BurhanErgen,ZaferCömert.

PUBLISHEDYEAR: 2020,ELSEVIER

DESCRIPTION:

The paper focuses on the detection of COVID-19 using deep learning models and structuredchest X-ray images. The authors propose a method that combines the Fuzzy Color technique for pre-processingthedataandthestackingtechniqueforimagestructuring.ThedeeplearningmodelsMobileNetV2 and Squeeze Net are used to train the stacked dataset, and the feature sets obtained areprocessed using the Social Mimic optimization method. The proposed approach achieves an overallclassificationrateof 99.27%andshows potential for efficientCOVID-19 detection.

PROPOSEDMETHODS:

The paper proposes the use of deep learning models (MobileNetV2 and Squeeze Net) to train astacked dataset of chest X-ray images. The dataset is pre-processed using the Fuzzy Color techniqueand the images are structured using the stacking technique. The feature sets obtained from the modelsare then processed using the Social Mimic optimization method. The combined features are classifiedusingSupport Vector Machines (SVM)to detect COVID-19.

[12] TITLE:COVID-19ScreeningonChestX-rayImagesUsingDeepLearningbasedAnomalyDetection

AUTHOR:JianpengZhang, YutongXie, YiLi, ChunhuaShen, andYongXia

PUBLISHEDYEAR: 2020,ARXIV

DESCRIPTION:

The paper focuses on developing a deep learning-based model for the screening of COVID-19using chest X-rayimages. The authors highlight the importance of chest X-rayimaging due toitswider availability and faster imaging time compared to CT scans. They propose a new deep anomalydetection model that can assist radiologists in analyzing chest X-ray images for efficient and reliableCOVID-19screening.

PROPOSEDMETHODS:

The proposed model consists of three components: a backbone network, a classification head,and an anomaly detection head. The backbonenetwork extracts high-level features from the inputchestX-rayimage.Theclassificationheadgeneratesaclassificationscore,whiletheanomalydetection head generates an anomaly score. The model is trained using stochastic gradient descent(SGD)algorithm with data augmentation strategies.

[13] TITLE: COVID-CXNet: Detecting COVID-19 in frontal chest X-ray images using deep learning***AUTHORS:***ArmanHaghanifar,MahdiyarMolahasaniMajdabadi,YounheeChoi,etal.***PUBLISHEDYEAR:***2022, SPRINGER

DESCRIPTION:

ThepaperfocusesondetectingCOVID-19infrontalchestX-rayimagesusingdeeplearning. Theauthorsconductedresearchonefficientlydetectingimagingfeaturesof COVID-19viral pneumonia using deep convolutional neural networks. They collected numerous chest X-ray imagesfrom various sources and prepared one of the largest publicly accessible datasets. The proposed model,COVID-CXNet, is based on the well-known CheX Net model and is capable of detecting COVID-19pneumoniabased on relevant and meaningful features withpreciselocalization.

PROPOSEDMETHODS:

The authors utilized deep convolutional neural networks, specifically the CheXNet model, fordetecting COVID-19 in frontal chest X-ray images. They collected a large dataset of chest X-rayimages from multiple sources and prepared it for training the model. The CheX Net model was fine-tuned on this dataset using the transfer learning paradigm to develop COVID-CXNet, which is capableofdetecting COVID-19pneumoniabasedon relevant and meaningful features.

[14] PAPER:Diagnosisanddetectionofinfectedtissueof COVID-19patientsbasedonlungx-rayimageusing convolutional neural network approaches.

AUTHOR:ShayanHassantabar,MohsenAhmadi,AbbasSharifi.

PUBLISHEDYEAR:2020,ELSEVIER

DESCRIPTION:

The paper presents deep learning-based methods for the diagnosis and detection of COVID-19in patients using lung x-ray images. Two algorithms, deep neural network (DNN) and convolutionalneuralnetwork(CNN),areproposedfortheclassificationanddiagnosisofpatients.TheCNNarchitecture is also used for the segmentation of infected tissue in lung images. The results show highaccuracyand sensitivity in detecting COVID-19 cases.

PROPOSEDMETHODS:

The paper proposes two deep learning-based methods, DNN and CNN, for the diagnosis anddetection of COVID-19 in patients using lung x-ray images. The DNN method utilizes fractal featuresof the images, while the CNN method directly uses the lung images. The CNN architecture is also usedforthe segmentation ofinfected tissuein lung images.

[15] TITLE:DeepLearning-BasedCOVID-19DetectionUsingCTandX-RayImages:CurrentAnalyticsand Comparisons

AUTHOR:AmjadRehman,TanzilaSaba,UsmanTariq,NoorAyesha

PUBLISHEDYEAR:2021,IEEE.

DESCRIPTION:

The paper focuses on deep learning-based COVID-19 detection using CT and X-ray images. Itprovides an overview of the COVID-19 data and discusses the current resources and methodologiesused in combating the pandemic. The paper aims to systematize the available data and help researchersandpractitioners in building solutions forCOVID-19.

PROPOSEDMETHODS:

Thepaperdiscussesvariousdeeplearningmodelsandtechniquesusedfor COVID-19detection, such as iCOVIDX-Net, CNN, fusion models, SqueezeNet, Q-deformed entropy algorithm,and GANdeeptransferlearning. These methods utilize CT scansandX-ray images to accuratelydetectCOVID-19 infections.

[16] TITLE:COVID-Net:atailoreddeepconvolutionalneuralnetworkdesignfordetectionofCOVID-19cases from chest X-ray images

AUTHOR: Linda Wang, Zhong Qiu Lin, Alexander Wong***PUBLISHED YEAR:*** 2020, SCIENTIFIC REPORTS.***DESCRIPTION:***

The paper introduces COVID-Net, a deep convolutional neural network design specificallytailored for the detection of COVID-19 cases from chest X-ray (CXR) images. It emphasizes theimportanceofeffectivescreeningofinfectedpatientsusingradiologyexaminationandpresentsCOVID-Netasanopen-sourcenetworkdesignavailabletothegeneralpublic.Thepaperalsointroduces COVIDx, an open access benchmark dataset comprising a large number of CXR imagesfromCOVID-19 positivecases.

PROPOSEDMETHODS:

The paper describes the use of a human-machine collaborative design strategy to createCOVID-Net,combininghuman-drivennetworkdesignprototypingwithmachine-drivendesignexploration. It introduces a novel deep neural network architecture that incorporates a lightweightprojection-expansion-projection-extension (PEPX) design, enhancing representational capacity whilereducing computational complexity. The paper also discusses the creation of the COVIDx dataset,which combines and modifies publicly available data repositories to provide a large dataset for trainingandevaluating COVID-Net.

[17] TITLE: COVID-19 Detection from Chest X-ray Images Using Feature Fusion and Deep Learning***AUTHOR:*** Nur-A-Alam, Mominul Ahsan, Md. Abdul Based, Julfikar Haider, Marcin Kowalski***PUBLISHEDYEAR:***2021, SENSORS

DESCRIPTION:

The paper focuses on the detection of COVID-19 from chest X-ray images using featurefusion and deep learning techniques. It highlights the importance of early detection for reducing thedeathrateandpresentsacomprehensivestudyontheclassificationofchestX-rayimages.Theproposed method involves the fusion of features extracted by histogram-oriented gradient (HOG) andconvolutional neural network (CNN), along with the application of modified anisotropic diffusionfilteringand watershed segmentation technique for accuratediagnosis.

PROPOSEDMETHODS:

The paper proposes a novel fusion of features extracted by histogram-oriented gradient(HOG) and convolutional neural network (CNN) for COVID-19 detection from chest X-ray images. Italso applies a modified anisotropic diffusion filtering (MADF) technique to eliminate multiplicativespeckle noise and uses the watershed segmentation technique to identify fractured lung regions asevidenceof COVID-19 attacked lungs.

[18] TITLE:DesignofAccurateClassificationofCOVID-19DiseaseinX-RayImagesUsingDeepLearningApproach

AUTHOR:JoyIong-ZongChen

PUBLISHEDYEAR:2021,JOURNALOFISMAC

DESCRIPTION:

The paper focuses onthe accurate classification of COVID-19 diseasein X-ray imagesusing a deep learning approach. It highlights the devastating influence of COVID-19 on global healthand the need for timely and accurate monitoring and classification of healthy and infected individuals.The paper proposes a classification model based on deep learning and histogram-oriented gradients(HOG) feature extraction methodology. It aims to detect COVID-19 viral patterns in thoracic X-raysandprovide reliable results forthe classification ofthe disease.

PROPOSEDMETHODS:

The paper proposes the use of deep learning algorithms, specifically convolutional neuralnetworks (CNN), for the accurate classification of COVID-19 disease in X-ray images. The proposedmodelleveragesaccurateclassificationbasedonmedicalimagesandutilizesedge-basedneuralnetworks for performance evaluation. The research work also includes the analysis of 10-fold cross-validationwithconfusionmetricstodetectvariouslunginfectionscausedbydiseasessuchasPneumoniacorona virus-positiveor negative.

[19] TITLE:ImprovingtheperformanceofCNNtopredictthelikelihoodofCOVID-19usingchestX-rayimages with pre-processing algorithms

AUTHORS:MortezaHeidari,SeyedehnafisehMirniaharikandehei,etal.

PUBLISHEDYEAR: 2020,ELSEVIER

DESCRIPTIONOFTHE PAPER:

The paper presents a computer-aided diagnosis (CAD) scheme for detecting COVID-19infected pneumonia using chest X-ray images. The authors propose a preprocessing algorithm thatremoves diaphragm regions, normalizes image contrast, and reduces image noise. They use a transferlearning-based convolutional neural network (CNN) model to classify the images into three classes:COVID-19 infected pneumonia, other community-acquired non-COVID-19 infected pneumonia, andnormal(non-pneumonia)cases.

Thestudydemonstratesthattheproposedapproachimprovestheperformanceandrobustnessofthe CNNmodel in detecting COVID-19 cases.

PROPOSEDMETHODS:

Thepaperproposesapre-processingalgorithmthatinvolvestwosteps:removingdiaphragm regions and applying histogram equalization and a bilateral low-pass filter to the originalimage. The processed image, along with two filtered images, is used to create a pseudo color image.Thispseudo color image is then fedinto atransfer learning-based CNNmodelforclassification.

[20] TITLE:SAM:Self-augmentationmechanismforCOVID-19detectionusingchest X-rayimages
AUTHOR: Usman Muhammad, Md. Ziaul Hoque, et al.***PUBLISHEDYEAR:***2022, ELSEVIER***DESCRIPTION:***

The paper focuses on the detection of COVID-19 using chest X-ray images. It addressesthelimitationsofthecurrentmethodsbyproposingaself-augmentationmechanism(SAM)thatgeneratesaugmentedfeaturesinthefeaturespace.Theproposedapproachcombinesadeepconvolutional neural network (CNN), feature augmentation mechanism, and a bidirectional LSTM(BiLSTM)foraccurate diagnosis of COVID-19.

PROPOSEDMETHODS:

The proposed method consists of three components: extraction of deep features, anaugmentation-basedlearningmodule,andaBiLSTMbasedclassification.Thedeepfeaturesareextractedusinga CNN,andthe augmentationmechanismgenerateslow-dimensionalaugmentedfeatures.TheBiLSTM isthen used toclassify the processed sequentialinformation.

4. SUMMARYONLITERATURE SURVEY:

REF.NO	PROPOSED METHODS	PARAMETERS	CHALLENGES
[1]	The authors used the DarkNetmodelasaclassifierf orthe you only look once(YOLO) real-time objectdetection system. Theyimplemented 17convolutional layers withdifferent filtering on eachlayer. The model wastrained using the Adamoptimizer, cross-entropylossfunction,andalea rning rate of 3e-3. Thetrainingandvalidationw ereperformed using a 5-foldcross-validationprocedure.	The deep learning model used inthe study consists of 1,164,434parameters.	One of the challenges faced in thestudy was the significant difference inthe number of data samples in theCOVID-19 class compared to the othertwo classes (Pneumonia and No-Findings). This led to a sharp increaseand decrease in loss values during thetraining process. However, thesefluctuations were gradually reduced asthe model examined all X-ray imagesrepeatedly during each epoch oftraining.
[2]	The paper introduces theCoroDet method, whichconsists of a 22-layer CNNmodel for COVID-19detection using chest X-rayand CT images. The modelis evaluated based onvarious performancemetrics such as accuracy,precision, recall, F1 score,specificity, sensitivity, andconfusion matrix. Theproposed methodoutperforms existingtechniques in terms ofaccuracy and demonstratesitseffectivenes sfor COVID-19identification.	The proposed CoroDet methodutilizes a 22-layer CNNarchitecture with convolutional,max pooling, dense, and flattenlayers. It also incorporates threeactivation functions, namelySigmoid,ReLU,andLeakyR eLU. The model is trained usinglabeled data and pre-trained on theImageNet dataset. The learningrate is set to 0.001, the batch sizeis10,andthe numberof epochsis 50. The performance of the modelis evaluated using a 5-fold cross-validationapproach.	Thepaperacknowledges thechallenges faced in COVID-19detection, including the shortage oftesting kits and the need for earlydetection to prevent viral spreading.The authors also highlight thelimitations of their study, such ashardware limitations and the potentialfor further improvement by usinglargerimagesetsinthetrainingstag e.
[3]	The paper utilizes sixdifferent pre-trainedConvolutional NeuralNetworks (CNNs) and ashallow CNN model forclassification. It alsoinvestigates five differentimage enhancementtechniques, includinghistogram equalization,contrast limited adaptivehistogram equalization,image complement, gammacorrection, and balancecontrast enhancementtechnique. A modifiedversion of the U-Net modelisproposed forlung	The paper evaluates theperformance of the proposedmethods based on accuracy,precision, recall, F1-score, andspecificity. It also usesvisualization techniques, such asScore-CAM, to confirm thefindingsofthedeepnetworks.	One of the challenges addressed in thepaper is the limited number of COVID-19 CXR images available for trainingand testing the CNN models. Anotherchallenge is the investigation of theeffect of image enhancementtechniques on COVID-19 detection,which was not extensively studied inprevious

	segmentation.		

[4]	The study proposes the use offive pre-trained convolutionalneural network-based models,namely ResNet50, ResNet101,ResNet152, InceptionV3, andInception-ResNetV2, for thedetection of COVID-19 fromchest X-ray images. Threedifferent binary classificationswith four classes (COVID-19,normal, viral pneumonia, andbacterial pneumonia) areimplemented using five-foldcross-validation.	The performance of theproposed models is evaluatedbased on accuracy. TheResNet50 model achieves thehighest classificationperformance with 96.1%accuracy for Dataset-1, 99.5%accuracy for Dataset-2, and99.7%accuracyforDataset-3.	The main challenge in the study isthelimitedavailabilityof COVID-19 test kits in hospitals,which necessitates thedevelopment of an automaticdetection system using X-rayimages. Another challenge is thelimited amount of data onCOVID-19, which affects thetrainingprocess.However,the study overcomes this challenge byincreasing the number of data andutilizingdeeptransferlearning
[5]	The paper evaluates theeffectiveness of eight pre-trainedConvolutional Neural Network(CNN)models,suchasAlexNet, VGG-16, GoogleNet,MobileNet-V2, etc., for theclassification of COVID-19infection cases from normalcases. The ResNet-34 model isfound to outperform othernetworks with an accuracy of98.33%.	Thestudy uses chestX-rayimages collected from twodifferent sources, including thecovid-chestxray-dataset and theChestX-ray8dataset.Thedataset consists of 203 COVID-19 frontal-view chest X-rayimages and an equal number ofnormal chest X-ray images. Thetraining set contains 286 images,while the test set contains 120images.	The paper mentions the limitedand imbalanced nature of thepublicly available datasets, whichrequired multi-operation dataaugmentation and samplebalancing techniques. Themisclassification between normaland COVID-19 infection cases isalso highlighted as a challengeduetosimilarimagingfeatures.
[6]	Transfer learning withconvolutional neural networks(CNNs) trained on ImageNet,combined with machine learningmethods such as k-NearestNeighbour, Bayes, RandomForest, multilayer perceptron(MLP), and support vectormachine(SVM).	The paper uses two datasets,each consisting of 194 X-rayimages of patients diagnosedwith COVID-19 and 194 X-rayimagesof healthypatients. Different CNN architectures(MobileNet,DenseNet201)areused as feature extractors, andvarious machine learningmethods (k-Nearest Neighbour,Bayes, Random Forest, MLP,SVM) are used forclassification.	One of the challenges mentionedin the paper is the limitedavailability of X-ray images ofpatients with COVID-19. Toovercome this, the authors applytransfer learning to leverage theknowledge acquired by CNNstrained on ImageNet. Anotherchallenge is the accurateclassification of X-ray images asCOVID-19 positive or negative,which is addressed by combiningCNN features with differentmachine learning methods toachieve high accuracy and F1-scores.

[7]	The paper proposes the use of deepconvolutional neural networks(DCNN) for the classification ofCOVID-19fromchestX-rayimages.Specifically, the Inception V3 modelwithtransferlearning isutilized. Transferlearningallowsthemodeltoleverage pre-trained weights andknowledge from a large dataset toimprove performance on a smallerdataset.	The paper does not explicitlymention the specificparameters used in theproposed model. However, itstates that the DCNN-basedmodel, Inception V3 withtransfer learning, achieves aclassificationaccuracyofmorethan 98%. The trainingaccuracy is reported as 97%,and the validation accuracy isreported as93%.	The paper does not explicitlymention the challenges facedin the classification ofCOVID-19fromchest X-ray images. However, it highlightsthe importance of automatedanalysis systems to savevaluable time for medicalprofessionals. The paper alsoreferences other studies thathave utilized deep learningtechniques for COVID-19pneumonia detection,indicating the ongoingresearch and challenges in thisfield.
[8]	The paper utilizes transfer learningwith convolutional neural networksfor the automatic detection of Covid-19 from X-ray images. Transferlearning allows the detection ofvariousabnormalities insmallmedical image datasets, yieldingremarkable results. The researchersadopted state-of-the-art pre-trainedconvolutional neural networks andfine-tuned them using the availableX-ray images. The performance ofdifferent CNN architectures, such asMobileNetv2, was evaluated.	Parameters of the Paper: Thepaper evaluates theperformance of differentconvolutional neural networkarchitectures, includingMobileNet v2, for theautomatic detection of Covid-19 from X-ray images. Theresearchers fine-tuned the pre-trained CNNs using transferlearning and adjustedparameters such as the numberof trainable layers and theclassifier placed at the top ofthe CNN. The metrics used toevaluate the performanceinclude accuracy, sensitivity,andspecificity.	Problem Faced in the Paper:One of the main challengesfacedinthepaperisthe limited availability of Covid-19 cases in the dataset. Due tothe small size of the Covid-19samples, transfer learning waspreferred to train the deepconvolutional neural networks.The researchers had toovercome the limitations of thedata availability and utilizetransfer learning to achieveaccurate feature extraction andclassification for the automaticdetection of Covid-19 from X-rayimages.
[9]	Thepaperusestransferlearningwith12 CNN architectures and a shallowCNN architecture trained fromscratch. Italso employs classactivation maps (CAM) to visualizethe regions on X-ray images used byCNNsfortheirpredictions.	The paper does not mentionspecific parameters used in theCNN architectures or thedatasetsize.	The paper identifies severalchallenges in deploying CNNtransfer learning for COVID-19 detection from chest X-rays. These challenges includethe reliance on artifacts in theimages, the use ofregions/features outside theregion of interest, and the needfor cautious interpretation ofCNN predictions withoutqualitative inspection byradiologists. The paper alsohighlights the importance oflung segmentation and theincorporation of clinical andcardiac features in futureresearch.

[10]	The proposed approachincludes data set acquisition,pre-processing, featureextraction, dimensionreduction, and classificationstages.Machine learningandimage processing methodsare used to enable earlydiagnosisandtreatmentofCOVID-19. The approach isapplied to three differentpublic COVID-19 data sets,achieving high accuracylevels in detecting COVID-19 from CT and X-rayimages.	Theproposedmodelachievesan accuracy of 89.41% fordataset-1 (CT), 99.02% fordataset-2(X-ray),and98.11% for dataset-3 (CT). Inthe X-ray data set, anaccuracy of 85.96% isobtained for COVID-19 (+),COVID-19(-),andthosewith Pneumonia but notCOVID-19classes.Thestudy shows that COVID-19can be detected with a highsuccess rate in less than oneminute using imageprocessingandclassical learningmethods.	One of the challenges in detectingCOVID-19 from CT and X-rayimages is the similarity of diseasefindings to other lung infections,making it difficult for medicalprofessionals to distinguishCOVID-19. The study addressesthis challenge by developingcomputer-aided diagnosticsolutions using machine learningmethods. Another challenge is thehigh false-negative rate and delaysin test results of the ReverseTranscription Polymerase ChainReaction (RT-PCR) test, which iscurrentlyusedasagoldstandardin detectingthevirus.
[11]	Thepaperproposestheuseofdeep learning models(MobileNetV2 and SqueezeNet) to train a stacked datasetof chest X-ray images. Thedataset is pre-processed usingthe Fuzzy Color techniqueand the images are structuredusing the stacking technique.Thefeature setsobtainedfrom the models are thenprocessed using the SocialMimicoptimizationmethod.	The overall classification rateachieved with the proposedapproach is 99.27%. TheSqueezeNetmodelachievesaclassification rate of 97.81%for normal and pneumoniaimages, while theMobileNetV2modelachieves a classification rateof 98.54%. When the featuresets obtained from bothmodels are combined, theoverall classification rateincreasesto 99.27%.	Oneofthechallengesmentionedinthe paper is the limited availabilityof COVID-19 images for trainingand testing. Another challenge isdealingwithlow-resolutionimages, as the proposed approachmay not achieve complete successin such cases. The resolutiondimensions of the original andstructured images must also be thesame for the stacking technique towork effectively. Despite thesechallenges, the proposed approachachievesahigh classification accuracyof99.27%.

[12]	The proposed model consistsofthreecomponents: abackbone network, aclassification head, and ananomaly detection head. Thebackbone network extractshigh-level features from theinput chest X-ray image. Theclassification head generatesa classification score. Themodel is trained usingstochastic gradient descent(SGD) algorithm with dataaugmentationstrategies.	Parameters: The model'sperformance is evaluatedusing100chestX-rayimagesof COVID-19 patients and1431 chest X-ray images ofnon-COVID-19 pneumoniacases. The model achieved asensitivity of 96.00% andspecificity of 70.65% whenevaluated onadataset of1531X-ray images.	The model's performance isevaluated using 100 chest X-rayimages of COVID-19 patients and1431 chest X-ray images of non-COVID-19 pneumonia cases. Themodel achieved a sensitivity of96.00% and specificity of 70.65%when evaluated on a dataset of1531X-ray images.

[13]	The authors utilized deepconvolutional neuralnetworks, specifically theCheXNetmodel,fordetecting COVID-19 infrontal chest X-ray images.They collected a large datasetof chest X-ray images frommultiple sources and preparedit for training the model. TheCheXNetmodel wasfine-tuned on this dataset using thetransfer learning paradigm todevelop COVID-CXNet,which is capable of detectingCOVID-19 pneumonia basedonrelevant andmeaningful features.	The COVID-CXNet modelhas 431 layers andapproximately 7 millionparameters. It is based onthe DenseNet-121architecture, which hasshown better capabilitiesfor this task compared toother architectures used intheliterature.	Oneofthechallengesmentionedinthe paper is the lack of robustness inexisting models, mainly due to theinsufficient number of imagesavailablefortraining.Theauthors alsohighlight the challenges associatedwith using CT scans for COVID-19diagnosis, such as the non-portabilityof CT scanners, higher radiation dosecompared to X-rays, and the need forsanitizing equipment and imagingrooms between patients. Theyemphasize the advantages of usingportable X-ray units, which are widelyavailableandcanbeeasilyaccessedinmostprimary hospitals.
[14]	The paper proposes two deeplearning-basedmethods,DNN and CNN, for thediagnosis and detection ofCOVID-19 in patients usinglung x-ray images. The DNNmethod utilizes fractalfeatures of the images, whiletheCNNmethoddirectly uses the lung images. TheCNNarchitectureisalsousedfor the segmentation ofinfectedtissuein lung images.	The parameters used in theCNN architecture include11 layers with threeconvolutional layers. Theinput images are 256x256grayscale CT scan imagesof COVID-19 patients'lungs, and the output layerincludes the ground truth ofthe input images. Theinfected tissue is labeled by255, while other points areshownwithzeronumbers.	The paper highlights the challenges indetecting the infected region of lungimages using a brain-computerinterface. It also mentions the need fordeep learning methods to handlesegmentation of regions with differentcolors. The lack of availability of largedatasets and the complex nature of thetesting mechanism for COVID-19diagnosis are also mentioned aschallengesaddressed inthepaper.
[15]	The paper discusses variousdeep learning models andtechniques used for COVID-19 detection, such asiCOVIDX-Net, CNN, fusionmodels, SqueezeNet, Q-deformed entropy algorithm,and GAN deep transferlearning. These methodsutilize CT scans and X-rayimages to accurately detectCOVID-19infections.	Parameters: The papermentions the use of AUC(Area Under Curve) as acommon benchmarkingdataset for evaluating theperformanceofCOVID-19detection models. It alsodiscusses F1-scores as ameasure of accuracy forspecificmodels.	Challenges: The paper highlights thechallenges faced in the growth ofCOVID-19 and the need for datascientists to predict possible issues. Itemphasizes the lack of COVID-19datasets, especially in X-ray chestimages, and the need for more data toimprove the precision of virusidentification.Additionally,thepapermentions the challenges of managinghealthcare resources, remote patienttreatment,well-informedpolicies,handling uncertainty, and conductingacceptableclinicaltrialsin

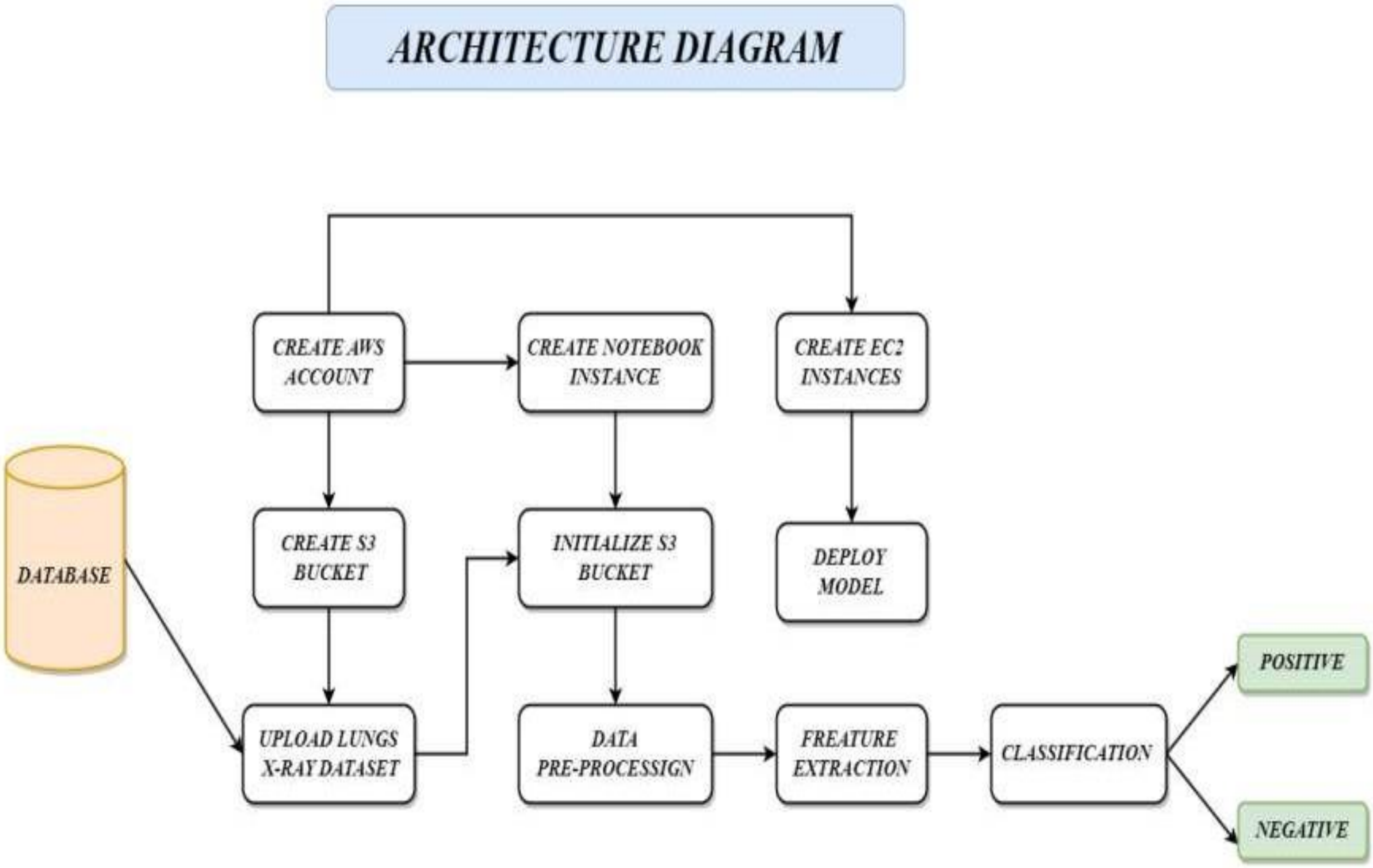
			thefight againstCOVID-19.

[16]	The paper describes the use of ahuman-machine collaborative designstrategy to create COVID-Net,combininghuman-drivennetworkdesign prototyping with machine-driven designexploration.Itintroducesa noveldeepneuralnetwork architecture that incorporatesa lightweight projection-expansion-projection-extension (PEPX) design,enhancing representational capacitywhile reducing computationalcomplexity. The paper also discussesthe creation of the COVIDx dataset,which combines and modifies publiclyavailable data repositories to provide alargedataset fortraining and evaluatingCOVID-Net.	Parameters: Thepaper does notexplicitly mentionspecificparametersusedin COVID Net orthe COVIDxdataset. However,it highlights theuse of deepconvolutionalneural networksand thearchitecturedesignmethodologybehind COVIDNet.	Challenges: The paper acknowledgesthat COVID Net and the COVIDxdataset are continuously evolving asnew patient cases are added. Itemphasizes the need for transparencyand explainability in the decision-making process of COVID Net, aimingto provide clinicians with deeperinsights into critical factors associatedwith COVID cases. The paper alsomentions the importance of improvingsensitivityandpositivepredictivevalue(PPV) to COVID-19 infections andsuggests future directions for riskstratification and individualized careplanning.
[17]	The paper proposes a novel fusion offeatures extracted by histogram-orientedgradient (HOG)andconvolutional neural network (CNN)forCOVID-19detectionfromchestX-ray images. It also applies a modifiedanisotropic diffusion filtering (MADF)technique to eliminate multiplicativespeckle noise and uses the watershedsegmentation technique to identifyfracturedlungregionsasevidenceof COVID-19attackedlungs.	Thepaperdoesnot explicitly mention thespecificparameters usedintheproposedmethods.	The paper highlights the challenges of dataimbalanceandthelackofnecessaryextracted features from chest X-ray images,whichcanaffecttheaccuracyoftheclassification results. The proposed methodaimstoovercomethesechallengesbyincorporatingfeaturefusionanddeeplearningtechniques.

[18]	The paper proposes the use of deeplearningalgorithms,specificallyconvolutionalneuralnetworks(CNN),for the accurate classification ofCOVID-19diseaseinX-rayimages. The proposed model leveragesaccurate classification based onmedical images and utilizes edge-basedneural networksforperformance evaluation. The researchwork also includes the analysis of 10-fold cross-validation with confusionmetrics to detect various lunginfections caused by diseases such asPneumonia corona virus-positive ornegative.	Thepaperdoesnot explicitlymention thespecificparameters usedin the proposedclassificationmodel. However,it mentions theuseofCOVID-19thoracic X-raysand thehistogram-oriented gradients(HOG) featureextraction methodology asinputs for theclassificationmodel.	Thepaperhighlightsthechallengeofdetecting viralpatternsinCOVID-19thoracicX-raysusingexistingdetectionmethods. It emphasizes the importance ofdeveloping accurate classification methodsto address this challenge. Additionally, thepaper mentions that the accuracy of tertiaryclassificationwithCNNmaydecrease whenthereisan increasingnumberofaclassin the trainingnetwork.

[19]	Thepaperproposesapreprocessingalgorithm that involves two steps:removing diaphragm regions andapplying histogram equalizationand a bilateral low-pass filter to theoriginal image. The processedimage, along with two filteredimages, is used to create a pseudocolorimage. Thispseudocolorimage is then fed into a transferlearning-based CNN model forclassification.	The study uses a publiclyavailable dataset of 8474 chestX-ray images, which includes415 COVID-19 infectedpneumonia cases, 5179 othercommunity-acquired non-COVID-19 infected pneumoniacases, and 2880 normal (non-pneumonia) cases. The dataset israndomly divided into training,validation, and testing subsets.The CNN model achieves anoverall accuracy of 94.5% inclassifyingtheimages.	One of the challengesmentioned in the paper is theunbalanced nature of thedataset, with a small numberof COVID-19 infectedpneumonia cases. To addressthis, the authors apply a classweight technique during thetraining process and use atransfer learning approachwith a well-trained VGG16model. Another challenge isthe need for image pre-processing and segmentationalgorithms to removeirrelevant regions andenhancetheperformanceandrobustness of the deeplearning models. The papersuggests that further researchisneededto overcomethese limitations.
[20]	The proposed method consists ofthree components: extraction ofdeepfeatures,an augmentation-based learning module, and aBiLSTM based classification. Thedeep features are extracted using aCNN, and the augmentationmechanism generates low-dimensional augmented features.The BiLSTM is then used toclassifytheprocessedsequential information.	Parameters: The paper does notexplicitly mention the specificparameters used in the proposedmethod.	Challenges: The paperhighlights the challenges oflimited representative X-rayimages available in publicbenchmark datasets, whichlimits the performance ofexisting methods. Theproposed self-augmentationmechanism aims to addressthis challenge by generatingaugmentedfeatures inthe featurespace.

5. ARCHITECTUREDIAGRAM:



6. IMPLEMENTATIONSCREENSHOTS:

7.1. DATASET STORED IN S3

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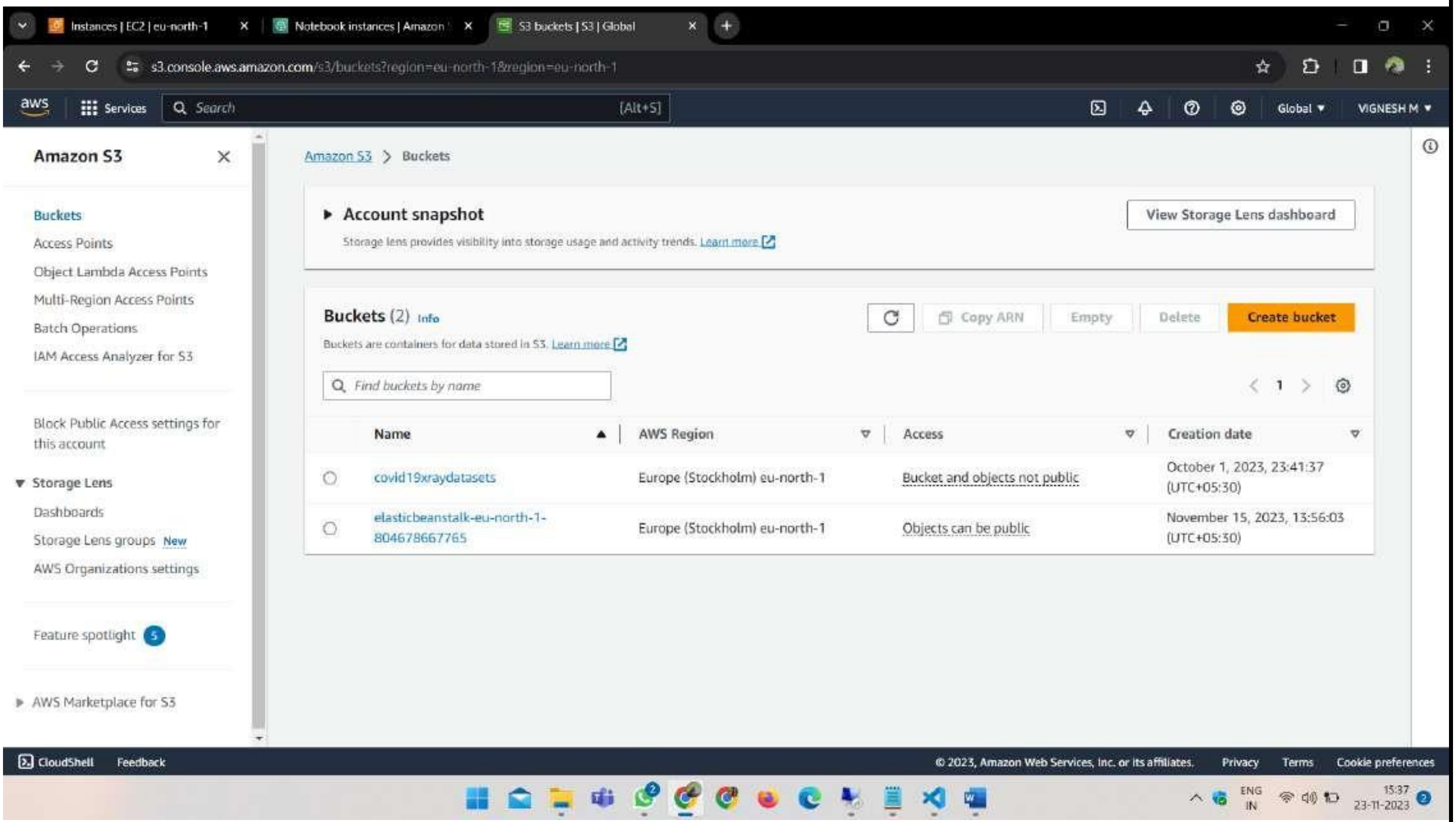

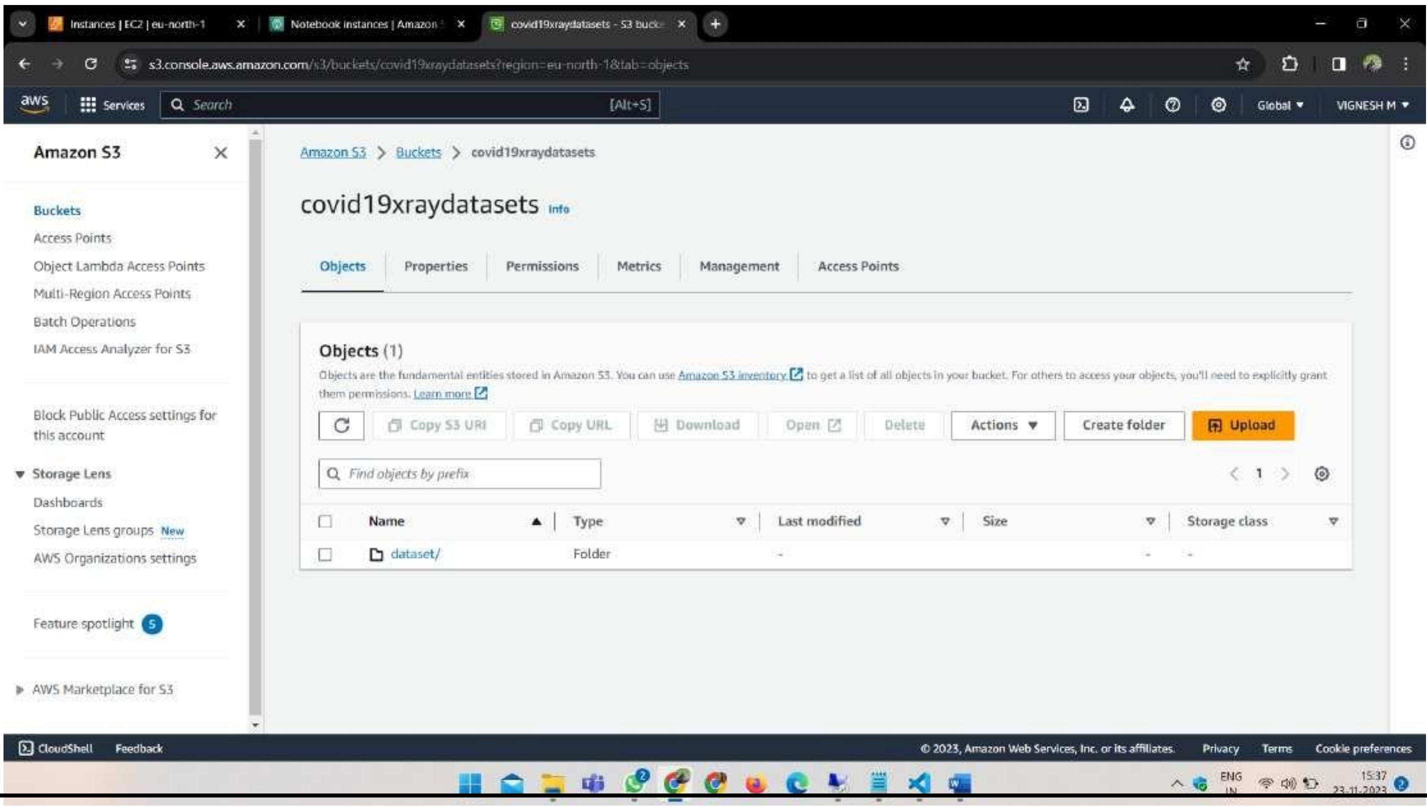

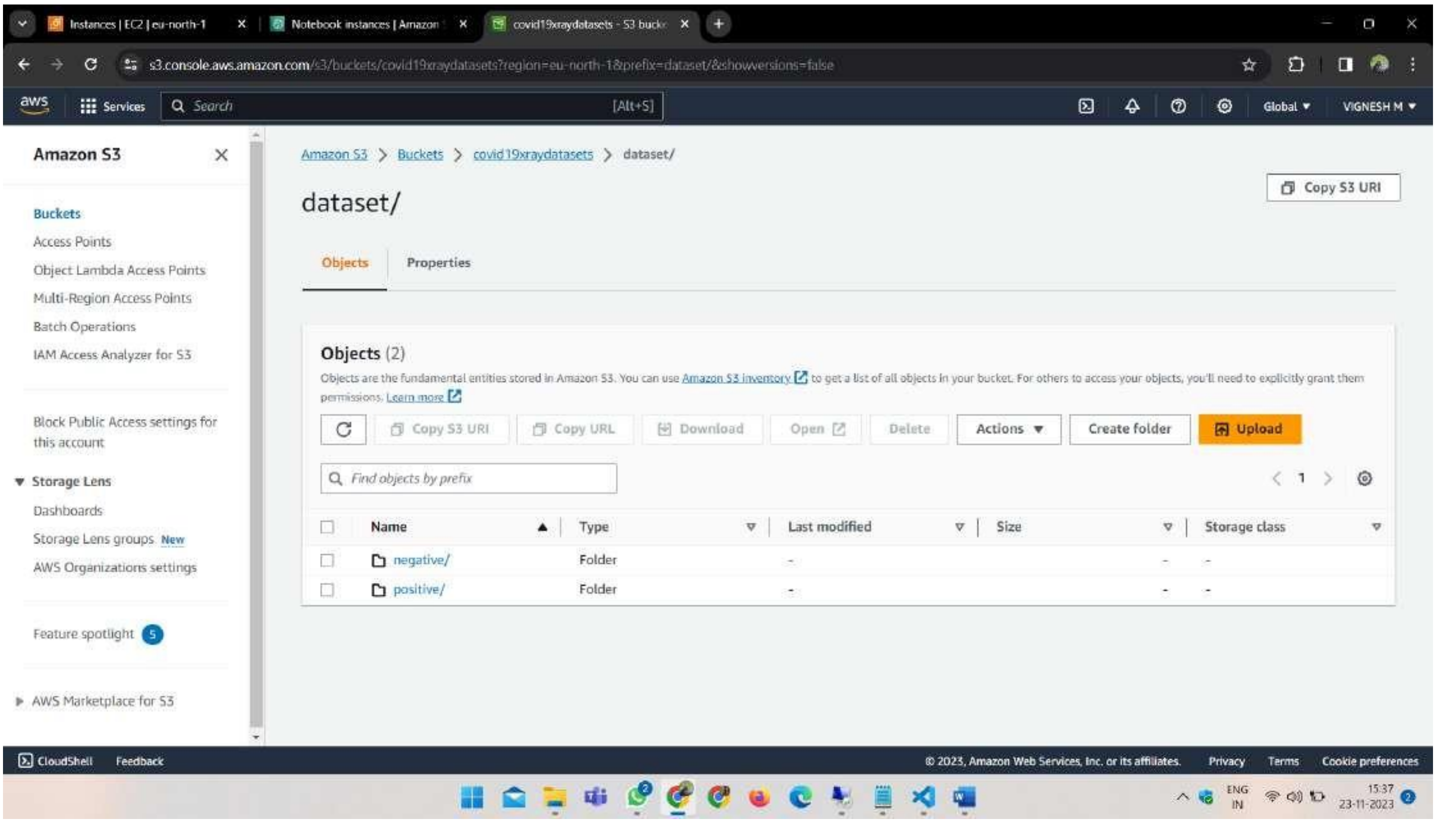

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Notebook instances | Amazon
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Amazon S3
Buckets
Access Points
Object Lambda Access Points
Multi-Region Access Points
Batch Operations
IAM Access Analyzer for S3
Block Public Access settings for this account
Storage Lens
Dashboards
Storage Lens groups New
AWS Organizations settings
Feature spotlight 5
AWS Marketplace for S3
Amazon S3 > Buckets > covid19xraydatasets > dataset/
dataset/
Copy S3 URI
Objects
Properties
Objects (2)
Objects are the fundamental entities stored in Amazon S3. You can use Amazon S3 inventory to get a list of all objects in your bucket. For others to access your objects, you'll need to explicitly grant them permissions. Learn more
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Copy URL
Download
Open
Delete
Actions
Create folder
Upload
Find objects by prefix
Name
Type
Last modified
Size
Storage class
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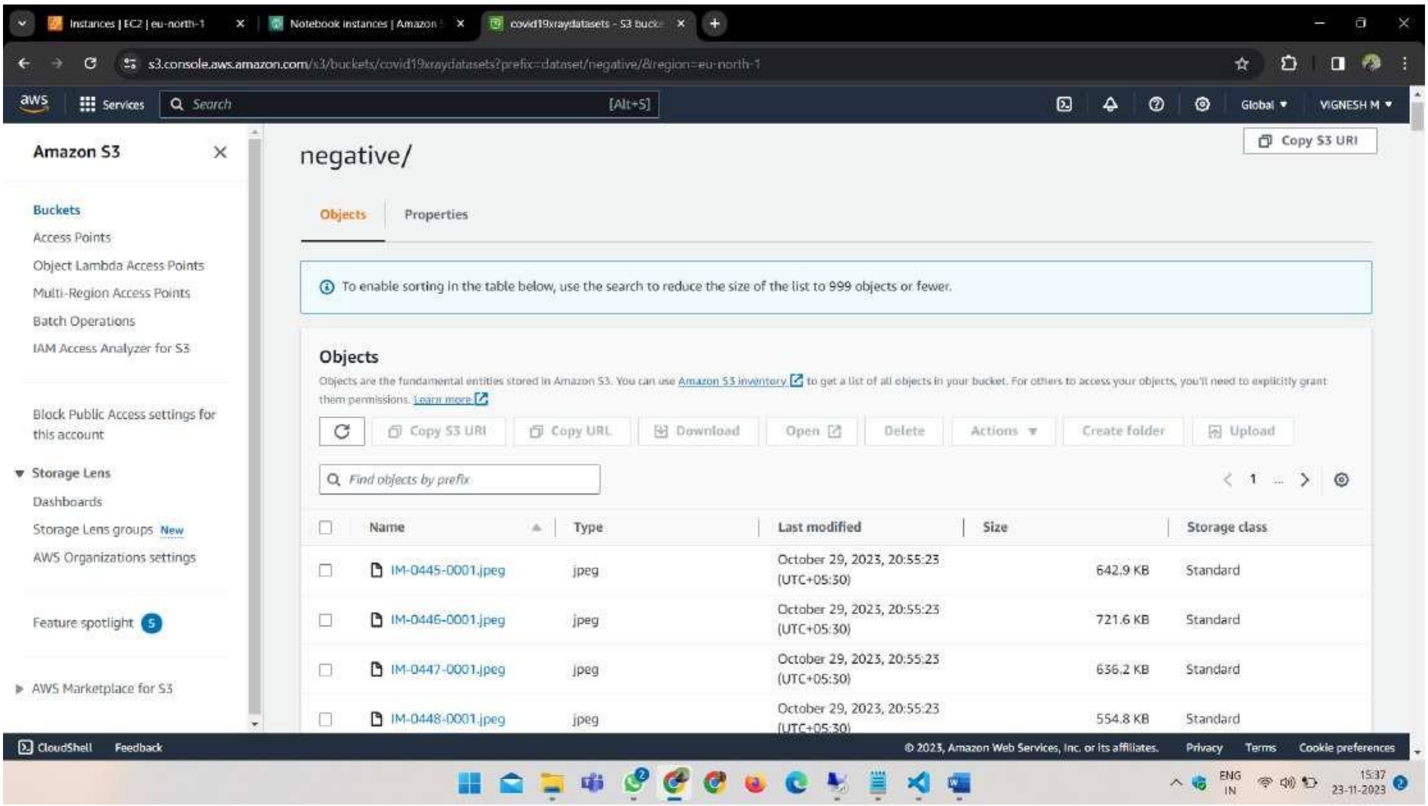

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Notebook instances | Amazon
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Buckets
Access Points
Object Lambda Access Points
Multi-Region Access Points
Batch Operations
IAM Access Analyzer for S3
Block Public Access settings for this account
Storage Lens
Dashboards
Storage Lens groups New
AWS Organizations settings
Feature spotlight 5
AWS Marketplace for S3
negative/
Copy S3 URI
Objects
Properties
To enable sorting in the table below, use the search to reduce the size of the list to 999 objects or fewer.
Objects
Objects are the fundamental entities stored in Amazon S3. You can use Amazon S3 inventory to get a list of all objects in your bucket. For others to access your objects, you'll need to explicitly grant them permissions. Learn more
Copy S3 URI
Copy URL
Download
Open
Delete
Actions
Create folder
Upload
Find objects by prefix
Name
Type
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Size
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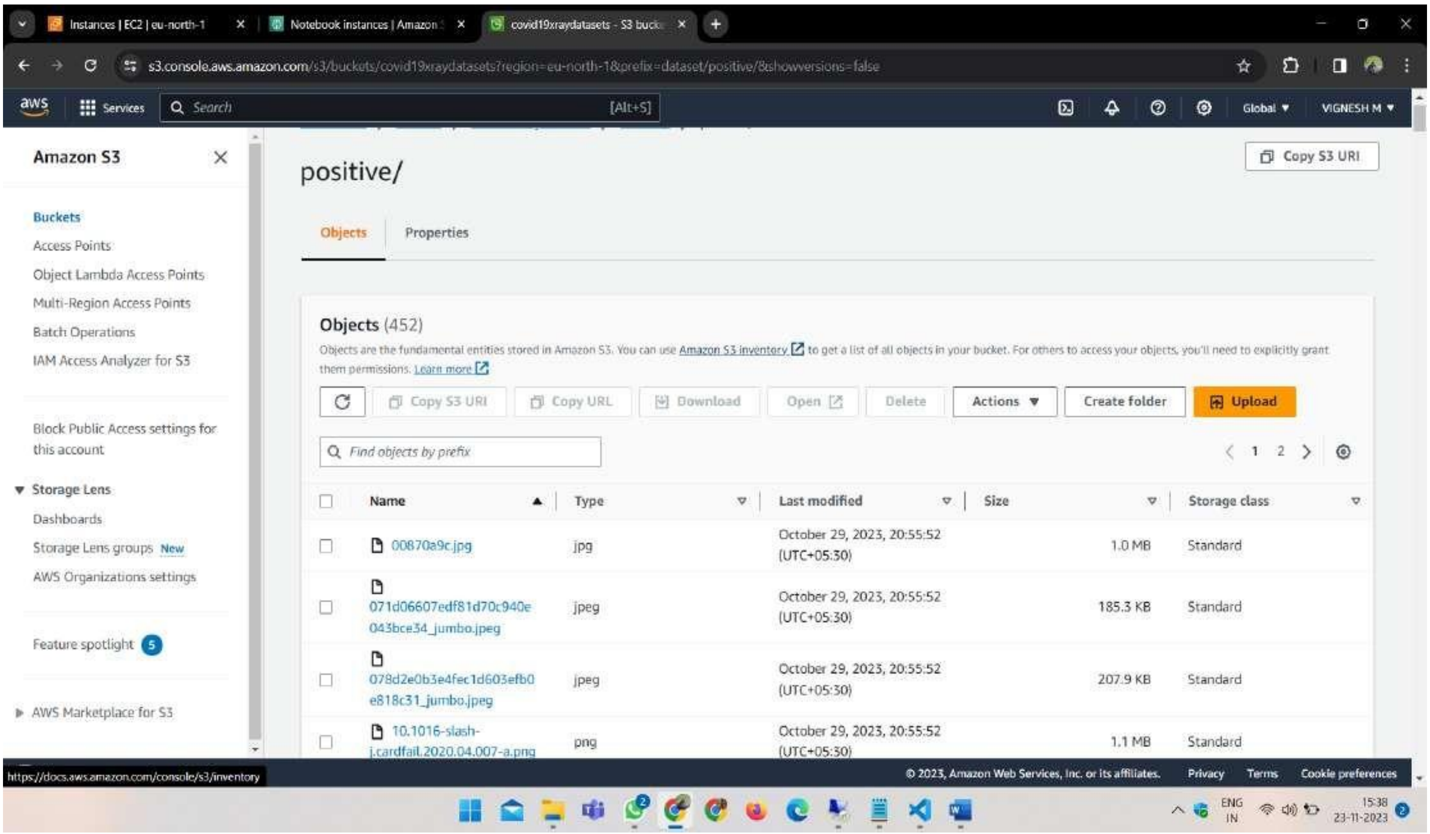
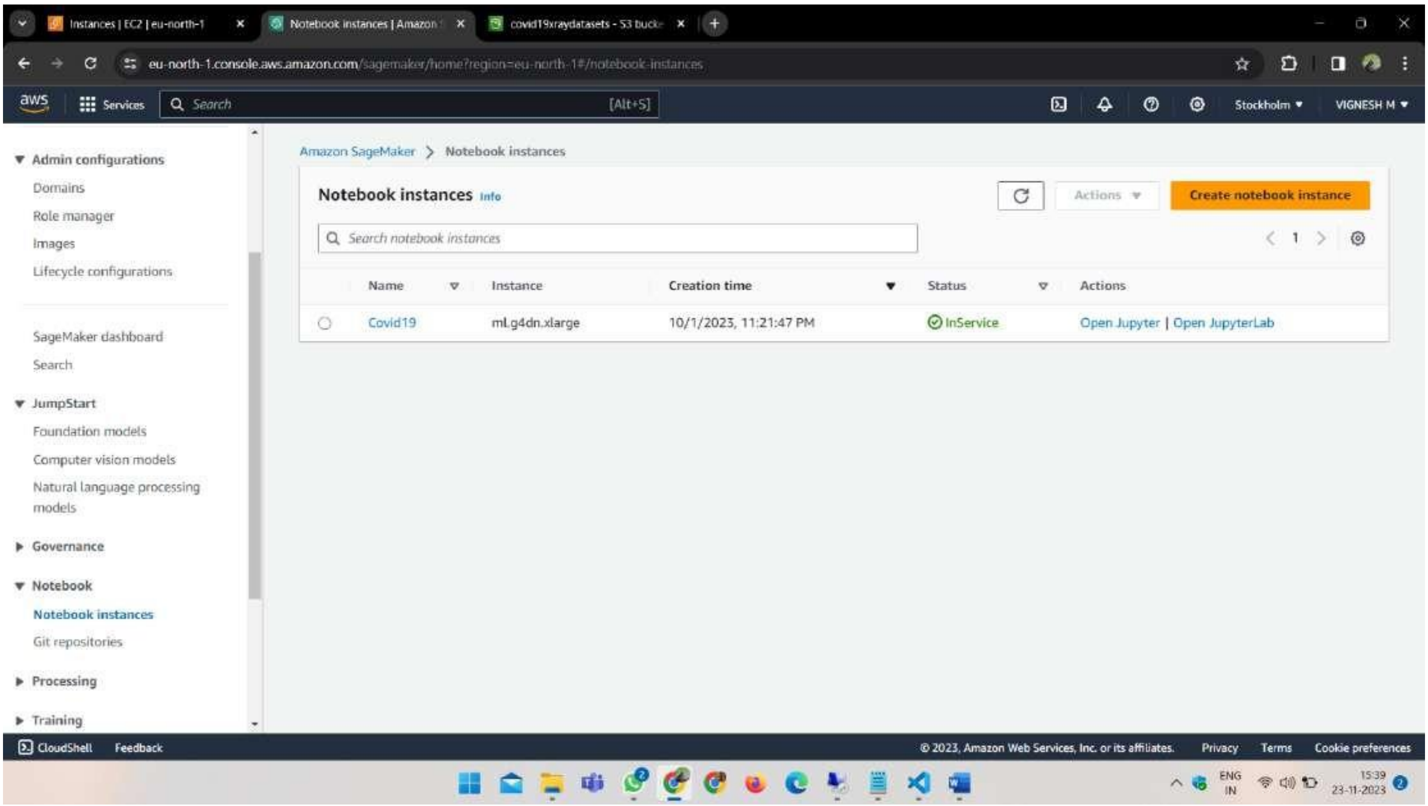
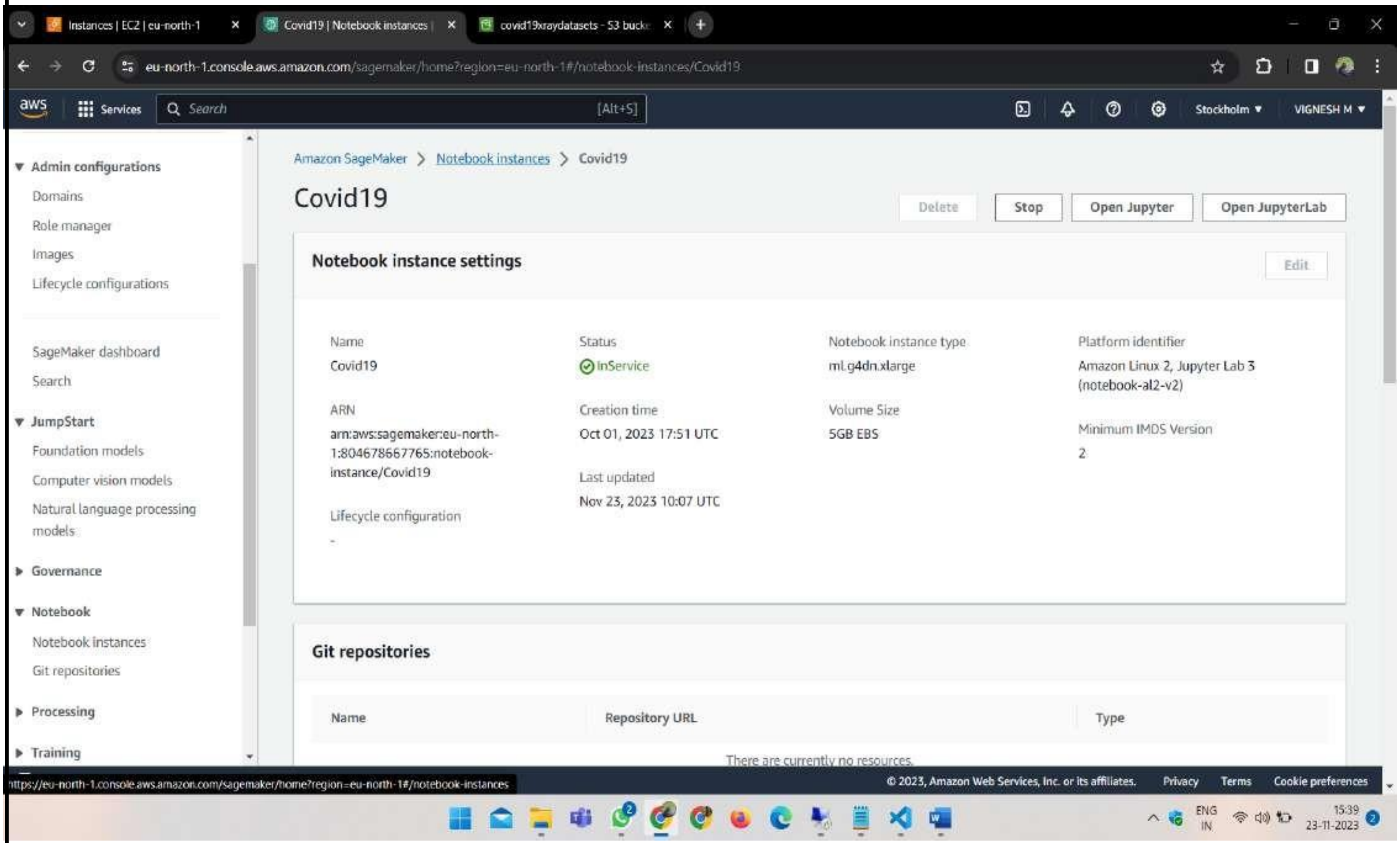


7.2. BUILDMODELINAMAZONSAGEMAKER:

CREATINGJUPYTERNOTEBOOKINSTANCESINSAGEMAKER:

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Role manager
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Lifecycle configurations
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JumpStart
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Computer vision models
Natural language processing models
Governance
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Open JupyterLab
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Edit
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Minimum IMDS Version
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Last updated
Nov 23, 2023 10:07 UTC
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Git repositories
Name
Repository URL
Type
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https://eu-north-1.console.aws.amazon.com/sagemaker/home?region=eu-north-1#/notebook-instances
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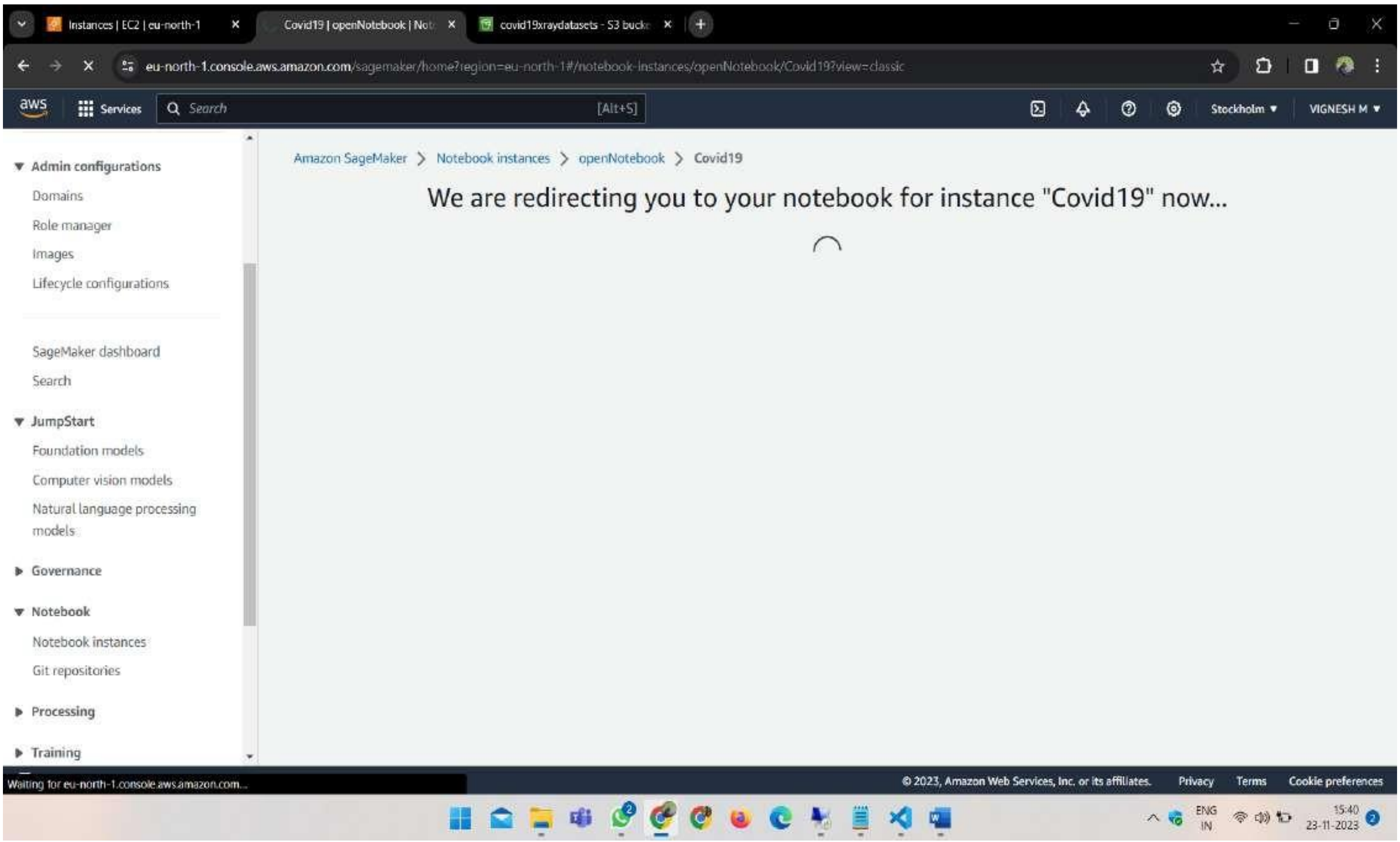
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Images
Lifecycle configurations
SageMaker dashboard
Search
JumpStart
Foundation models
Computer vision models
Natural language processing models
Governance
Notebook
Notebook instances
Git repositories
Processing
Training
Amazon SageMaker > Notebook instances > openNotebook > Covid19
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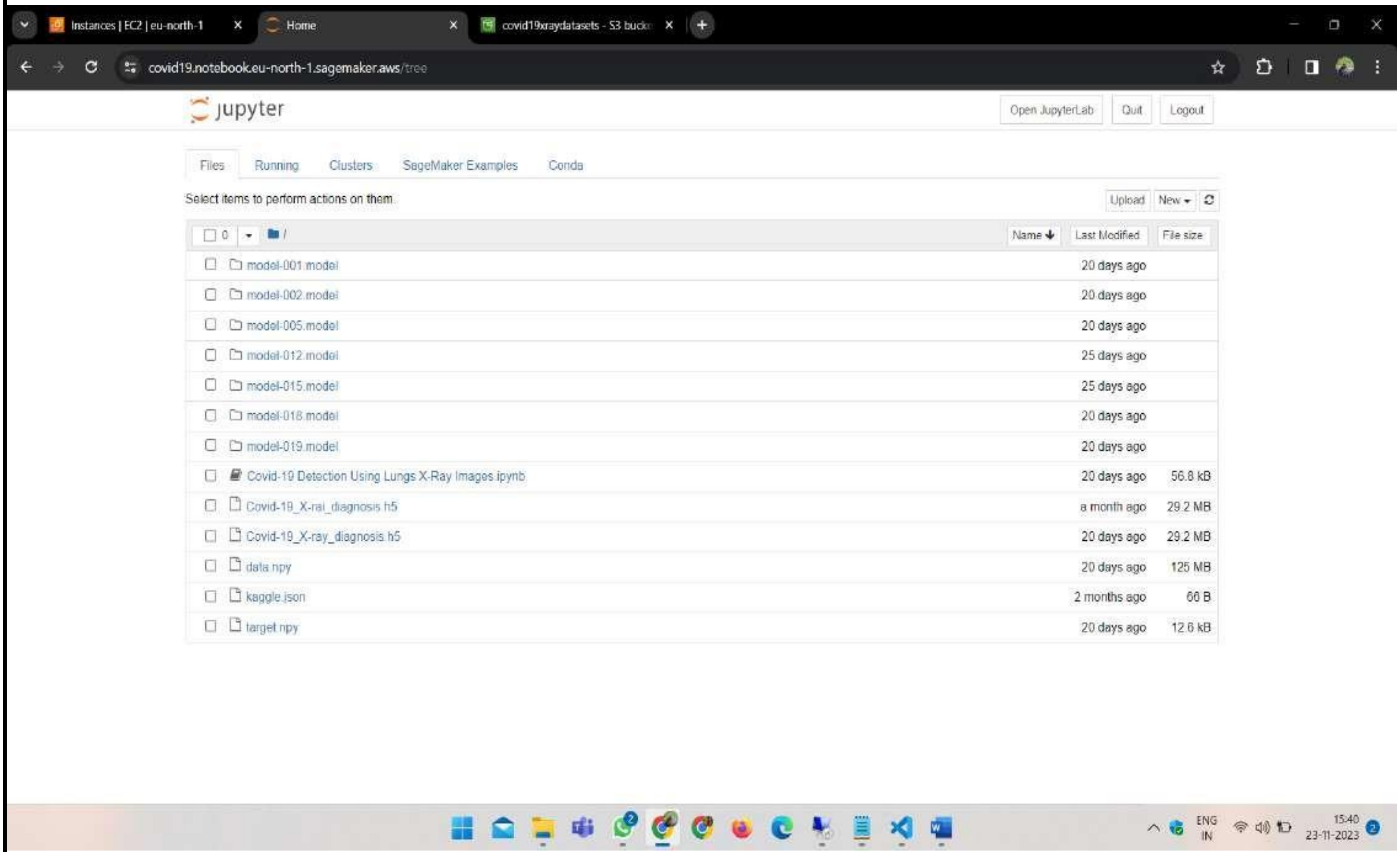
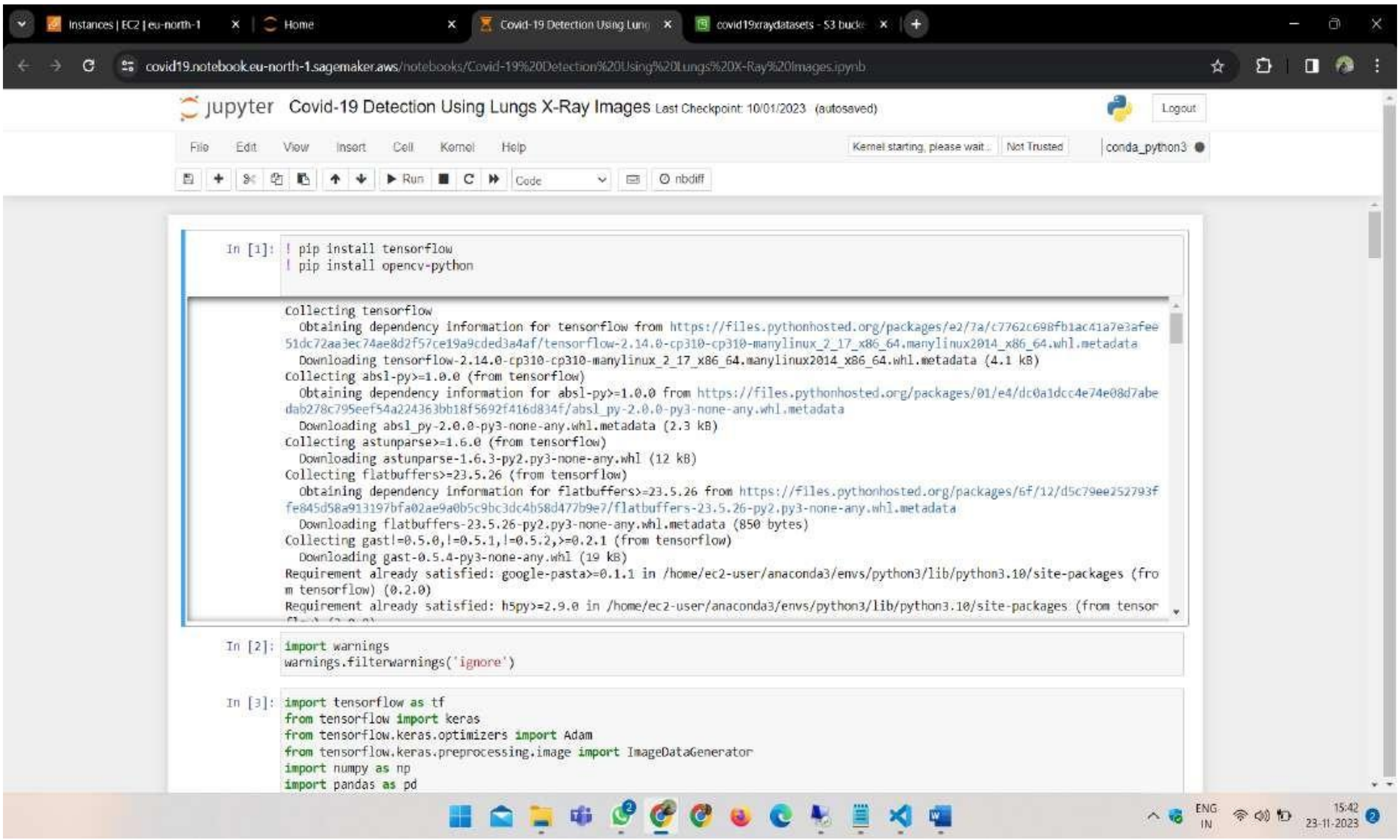
JUPYTER NOTEBOOKIN SAGEMAKER:





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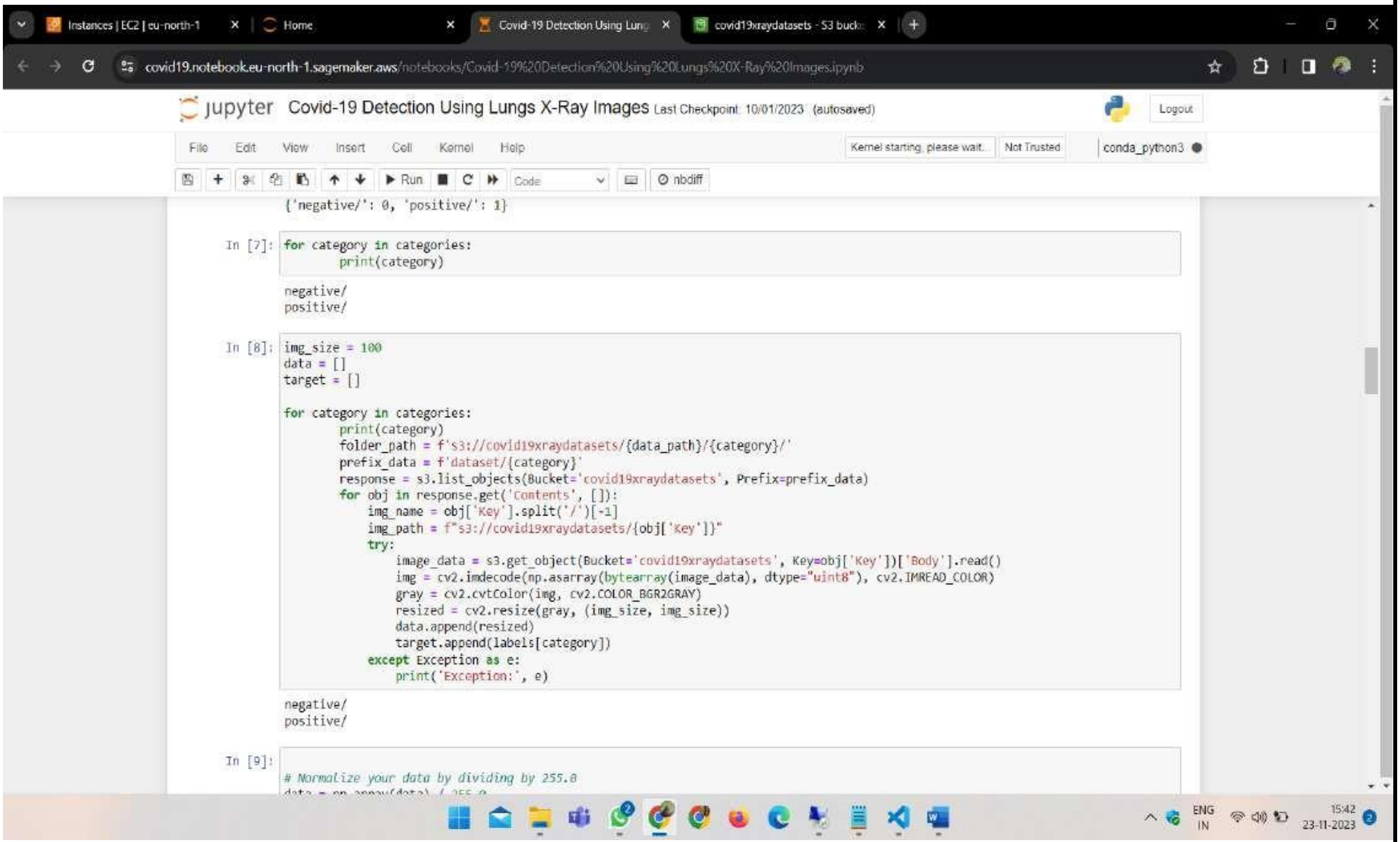
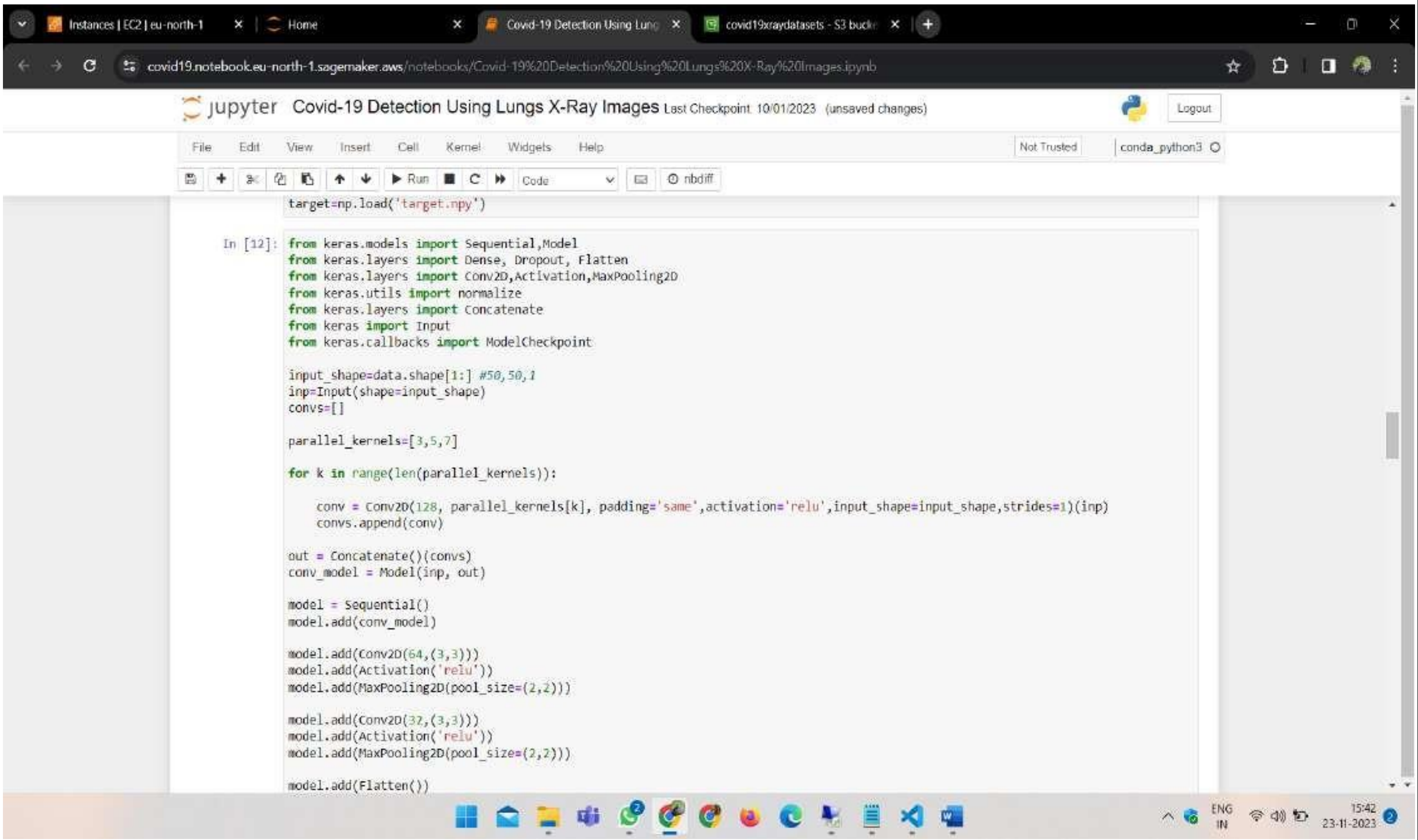
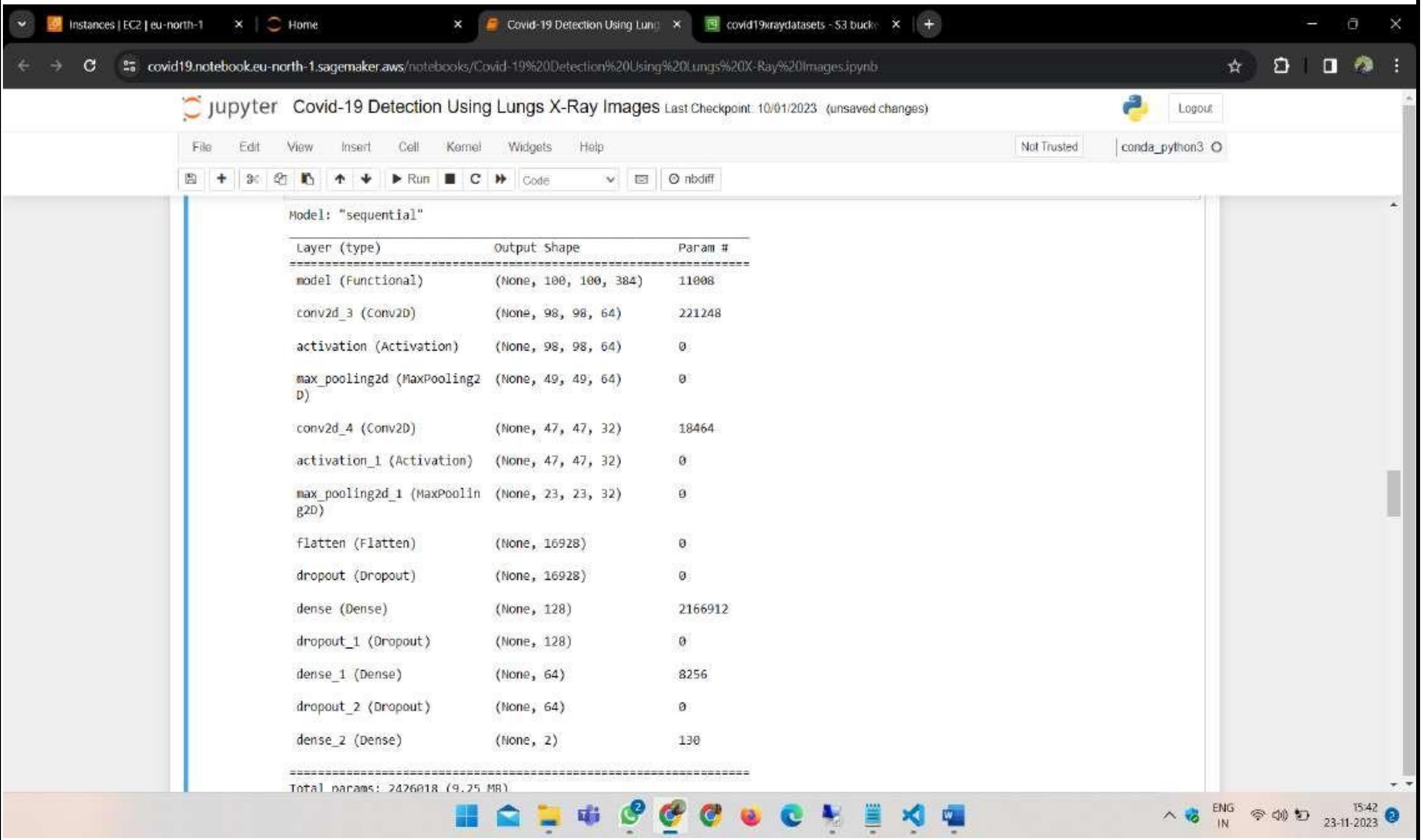


BUILDINGA CNNMODEL:





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 Layer (type)                Output Shape              Param #
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 activation (Activation)     (None, 98, 98, 64)        0

 max_pooling2d (MaxPooling2  (None, 49, 49, 64)        0
 D)

 conv2d_4 (Conv2D)           (None, 47, 47, 32)        18464

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 g2D)

 flatten (Flatten)           (None, 16928)             0

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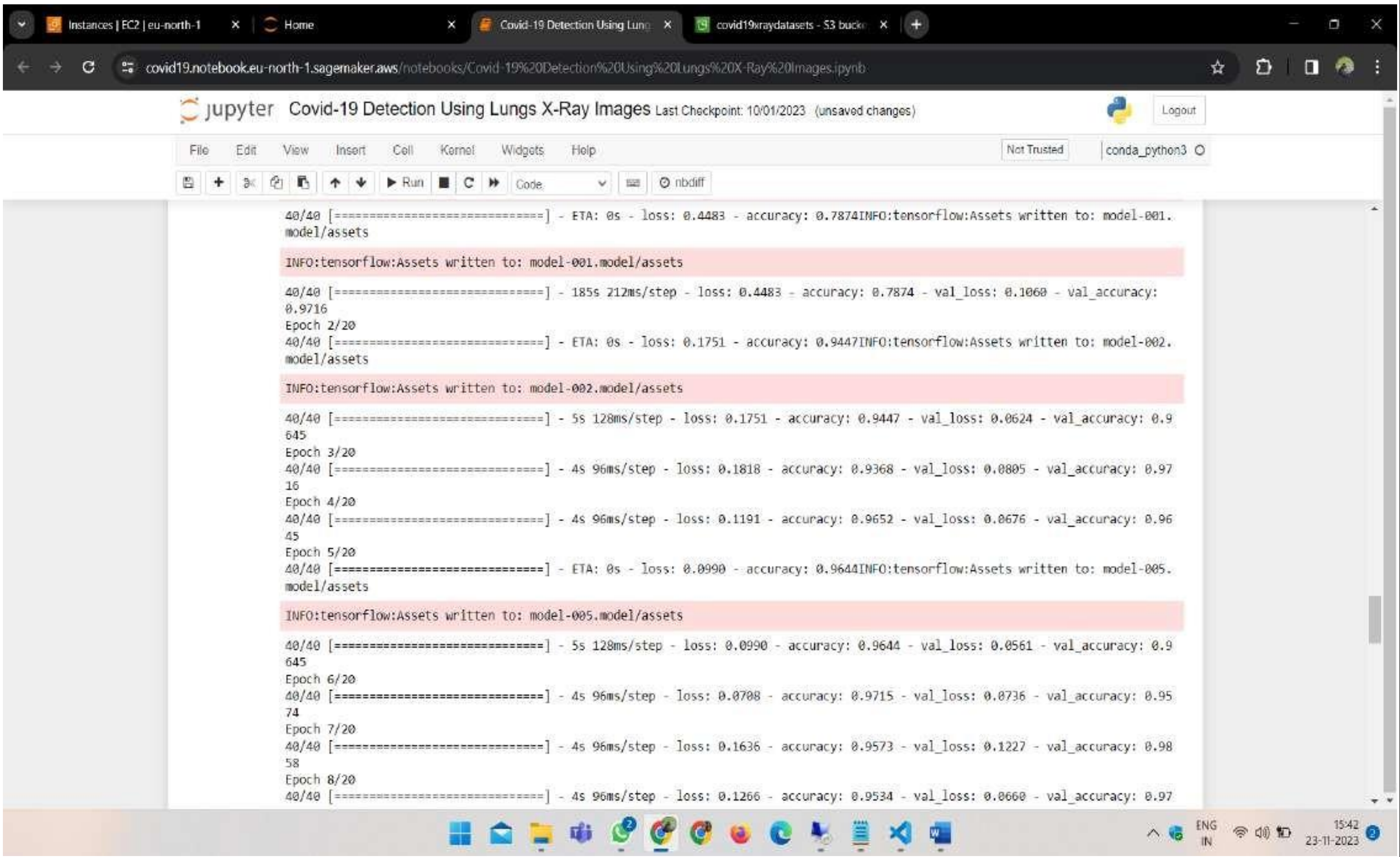

```
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model/assets
INFO:tensorflow:Assets written to: model-001.model/assets
40/40 [==============================] - 185s 212ms/step - loss: 0.4483 - accuracy: 0.7874 - val_loss: 0.1060 - val_accuracy:
0.9716
Epoch 2/20
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40/40 [==============================] - 5s 128ms/step - loss: 0.1751 - accuracy: 0.9447 - val_loss: 0.0624 - val_accuracy: 0.9
645
Epoch 3/20
40/40 [==============================] - 4s 96ms/step - loss: 0.1818 - accuracy: 0.9368 - val_loss: 0.0805 - val_accuracy: 0.97
16
Epoch 4/20
40/40 [==============================] - 4s 96ms/step - loss: 0.1191 - accuracy: 0.9652 - val_loss: 0.0676 - val_accuracy: 0.96
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Epoch 5/20
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INFO:tensorflow:Assets written to: model-005.model/assets
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Epoch 6/20
40/40 [==============================] - 4s 96ms/step - loss: 0.0708 - accuracy: 0.9715 - val_loss: 0.0736 - val_accuracy: 0.95
74
Epoch 7/20
40/40 [==============================] - 4s 96ms/step - loss: 0.1636 - accuracy: 0.9573 - val_loss: 0.1227 - val_accuracy: 0.98
58
Epoch 8/20
40/40 [==============================] - 4s 96ms/step - loss: 0.1266 - accuracy: 0.9534 - val_loss: 0.0660 - val_accuracy: 0.97
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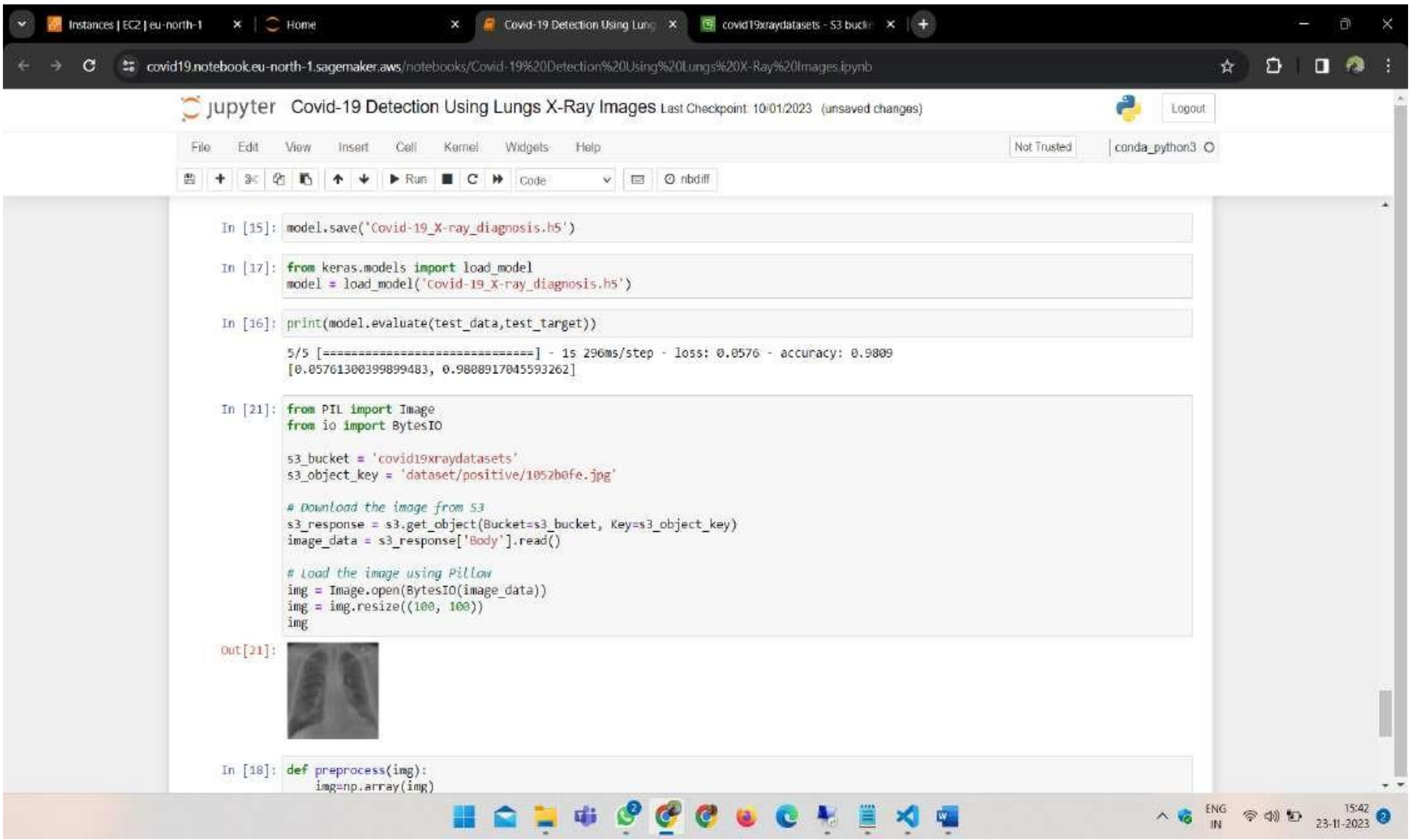
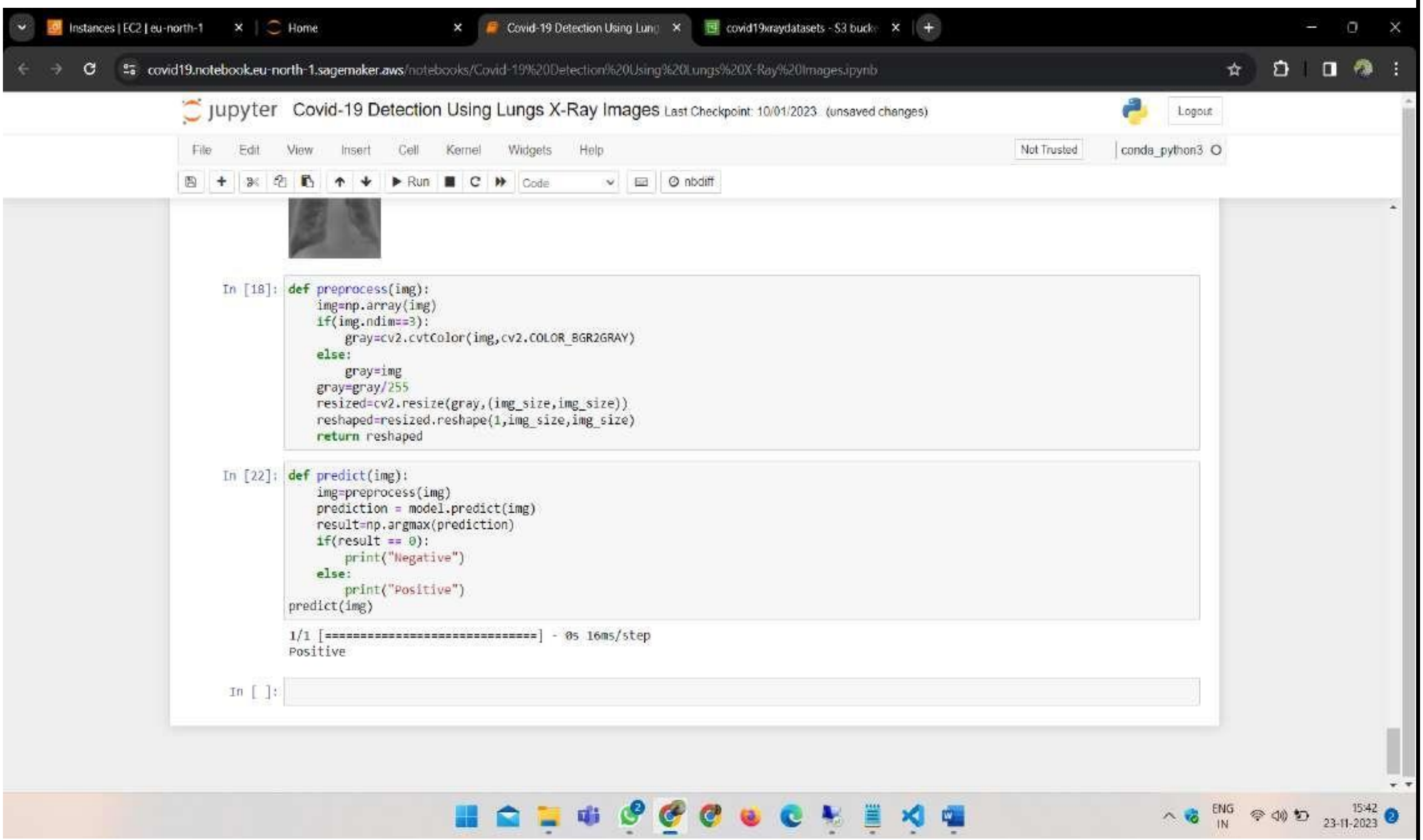
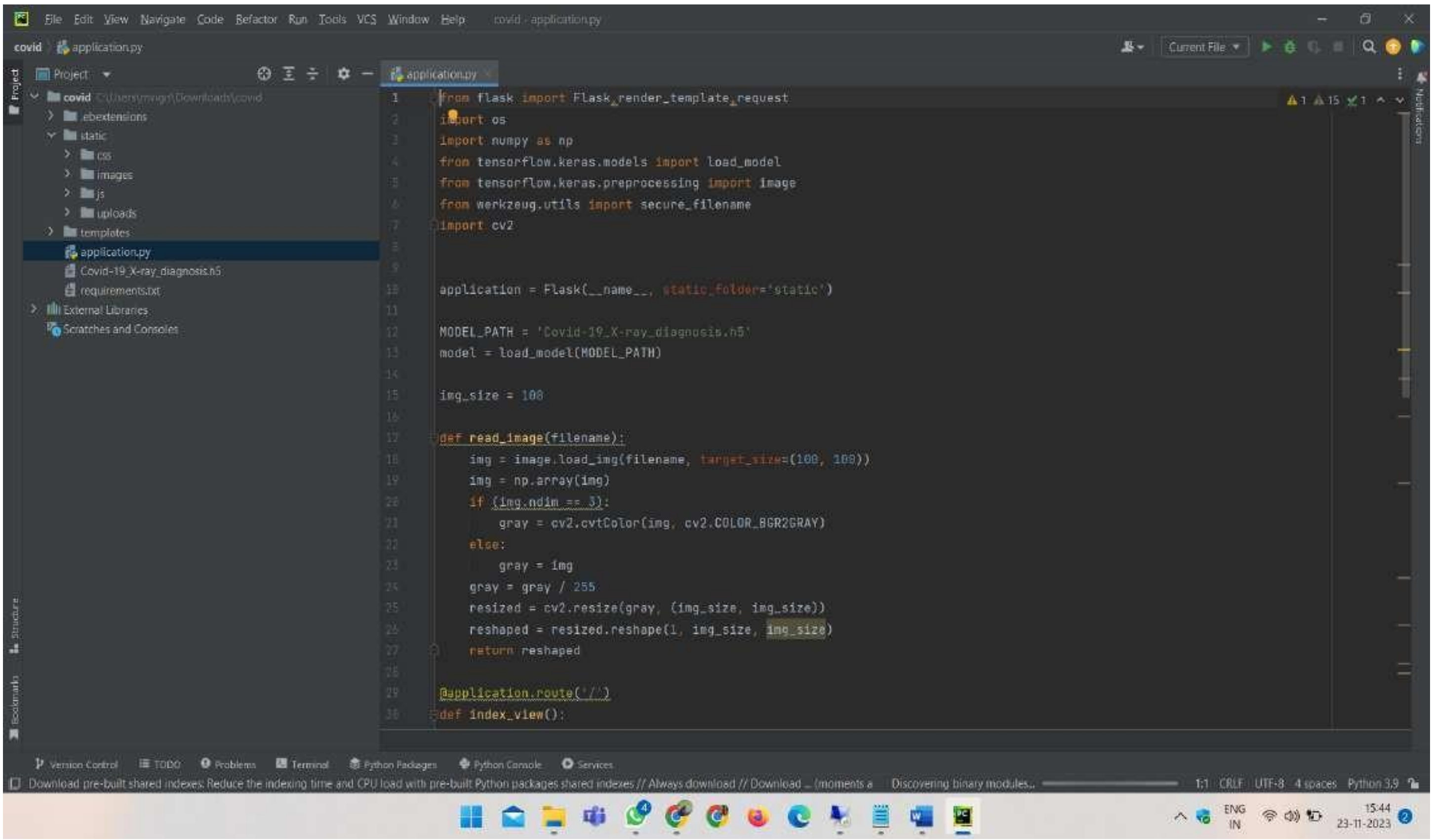


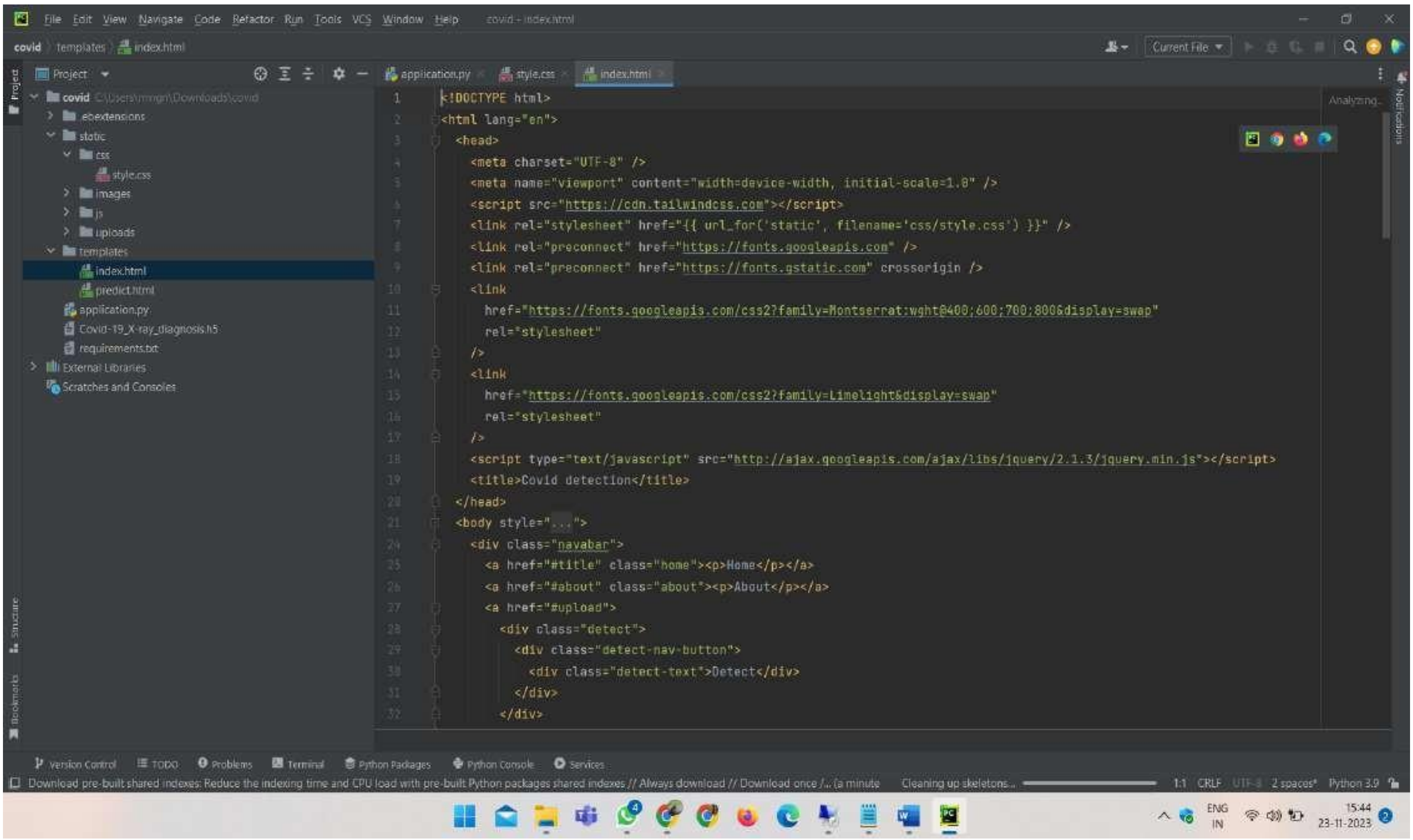
PREDICTINGLUNGSX-RAYIMAGES:

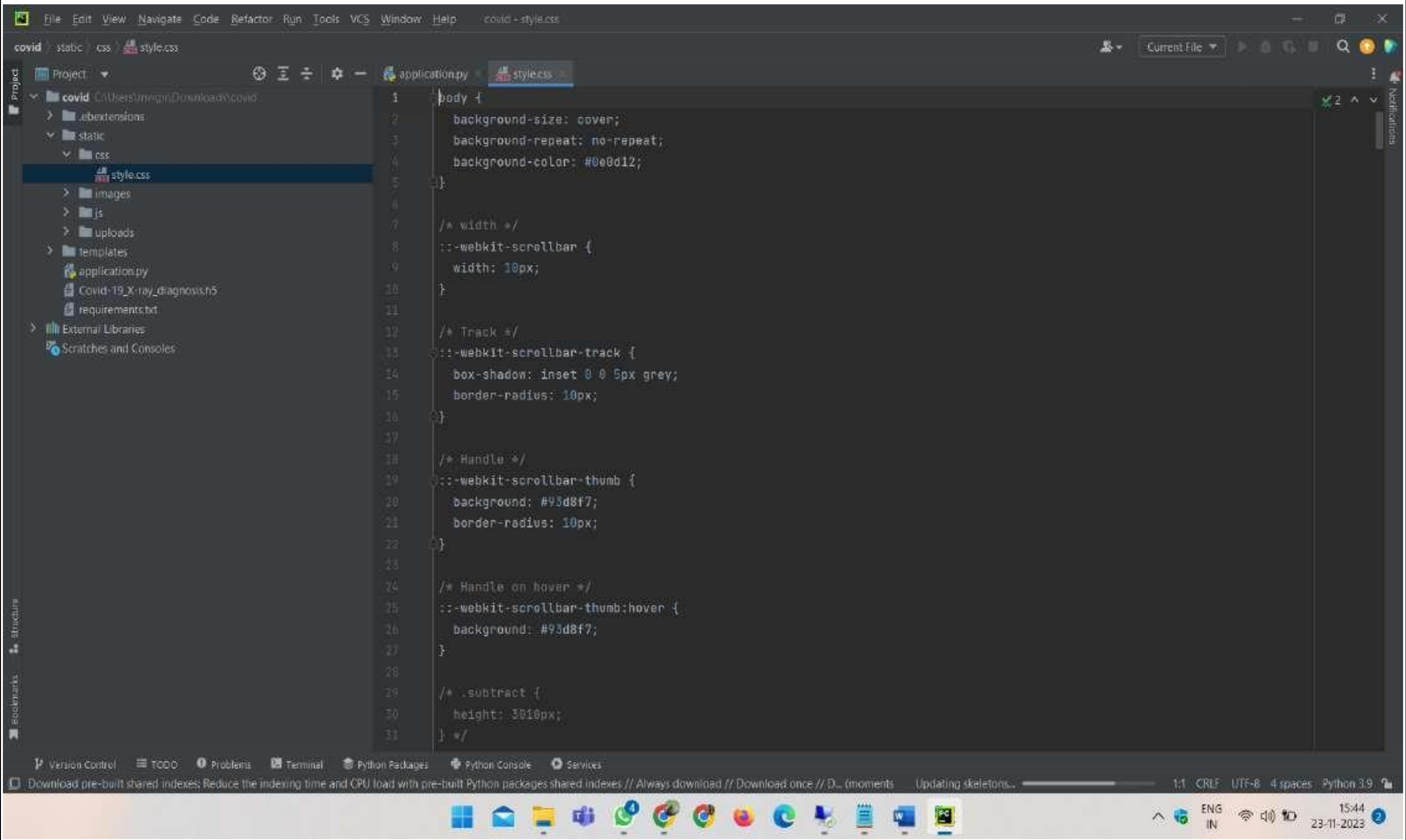


7.3. BUILDA FLASKAPPLICATIONUSING HTML,CSS:

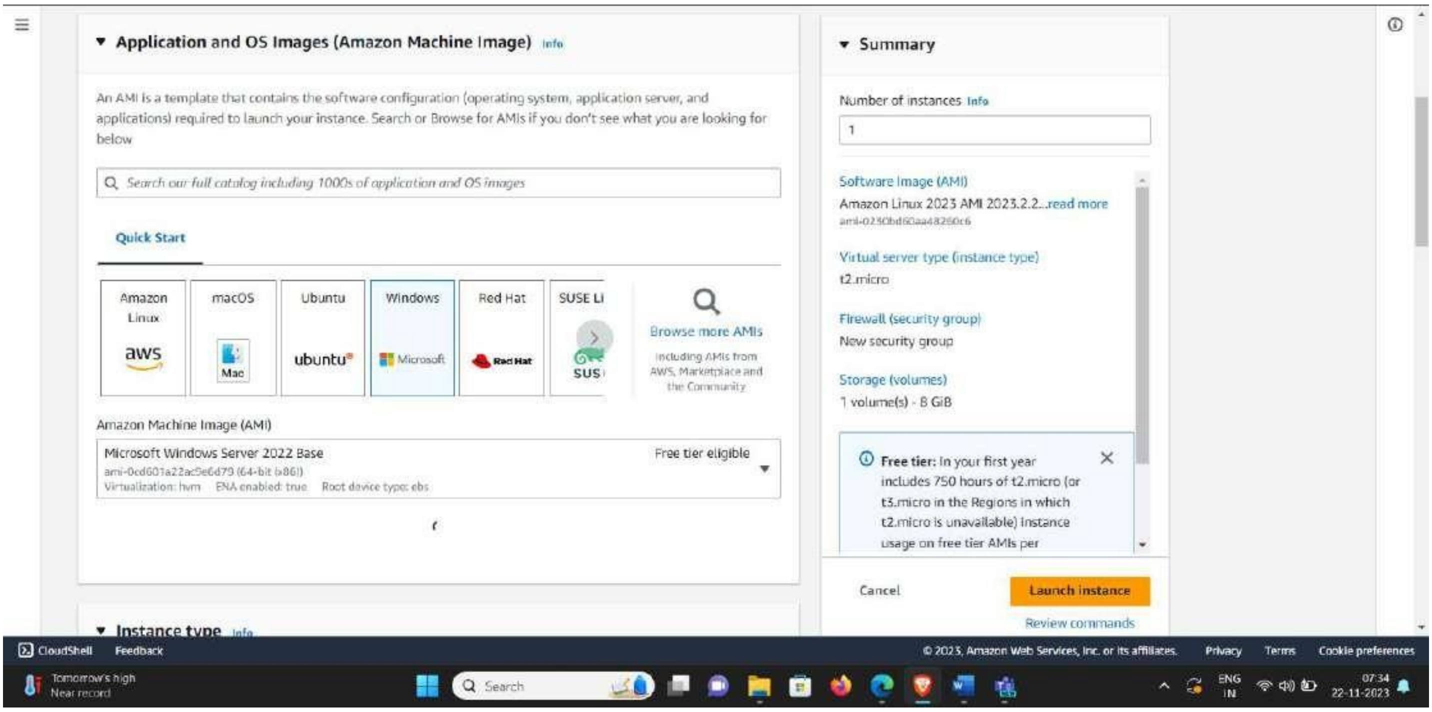
FLASKAPPLICATIONCODE:

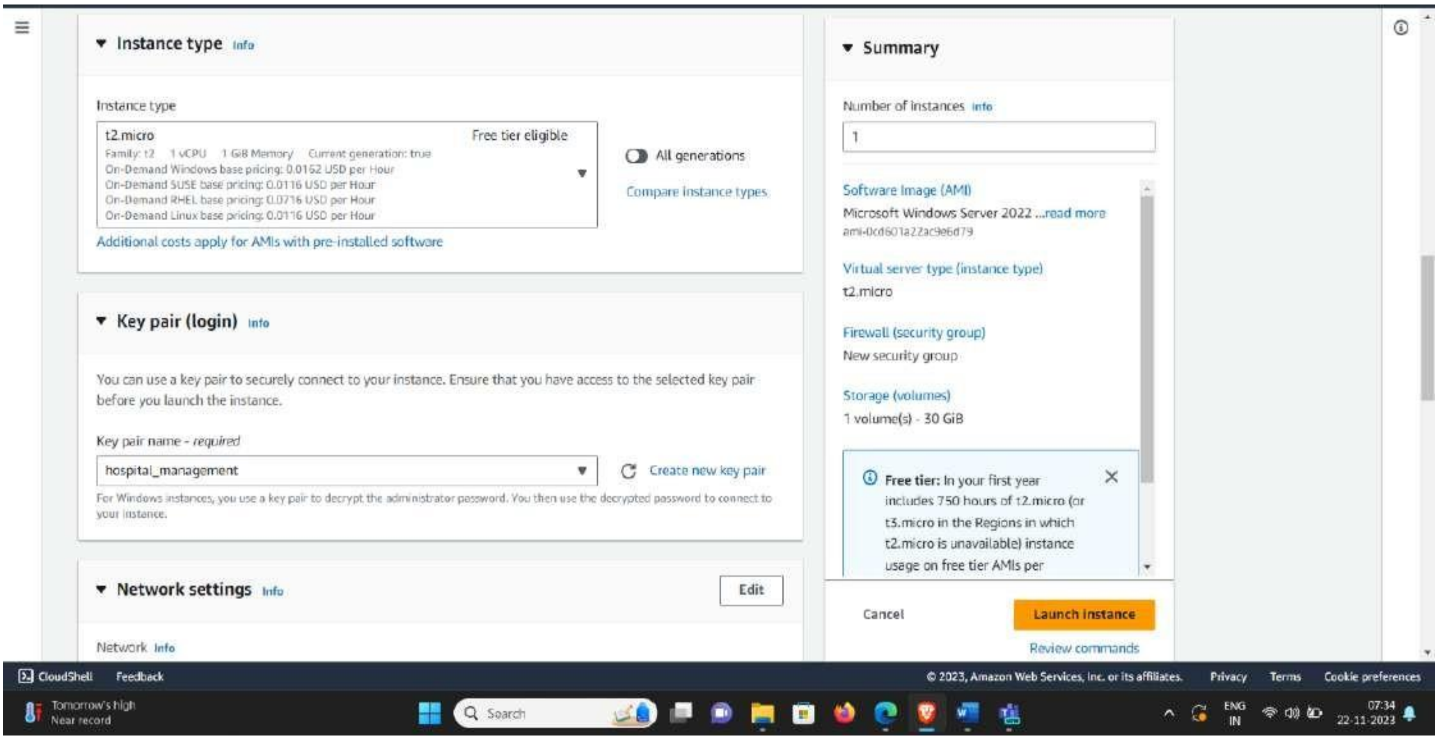


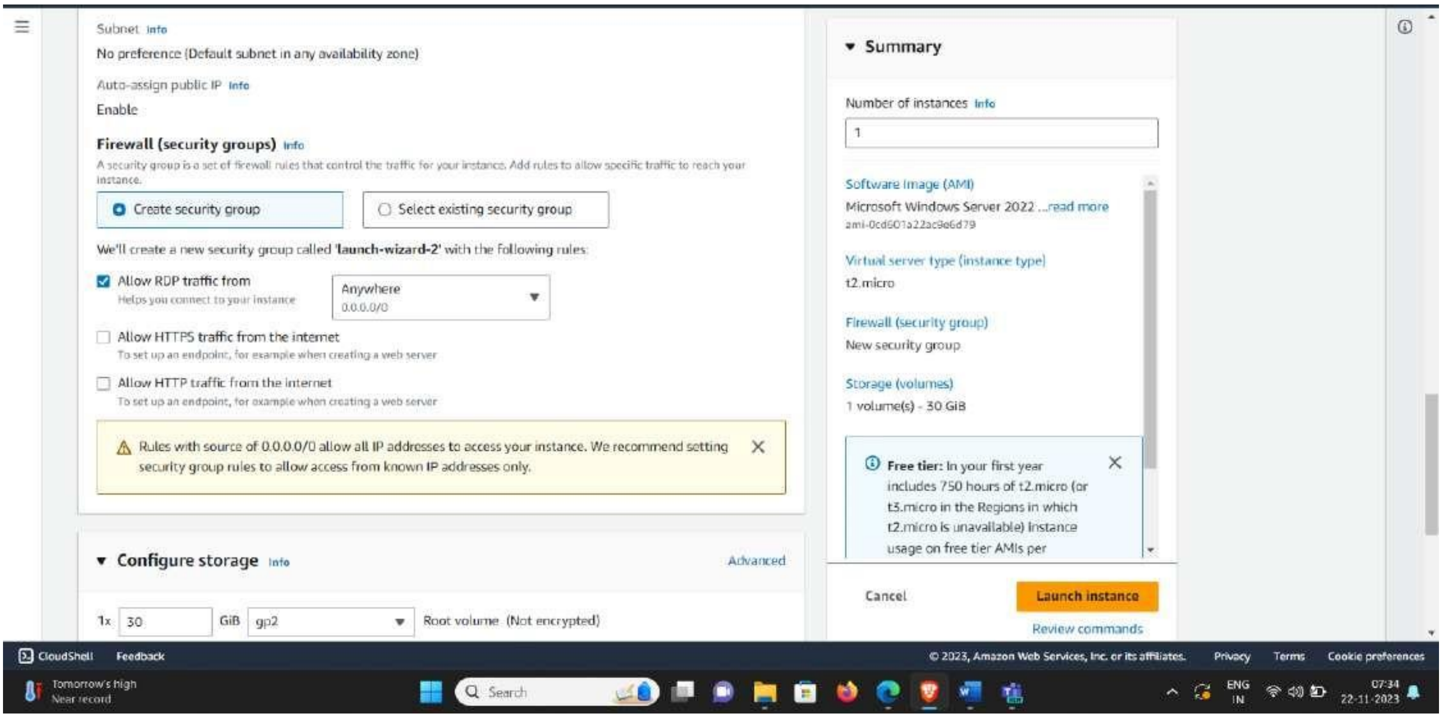


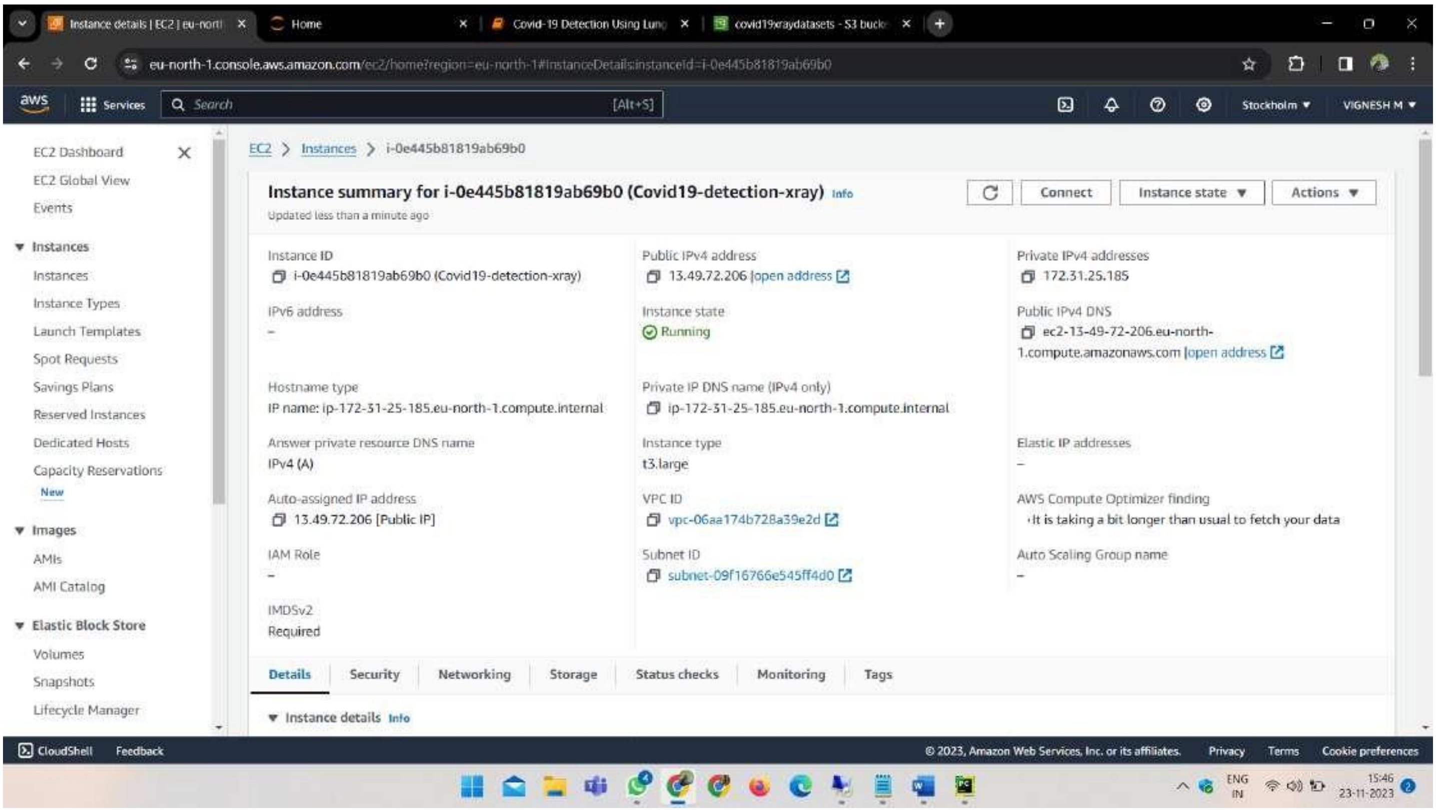


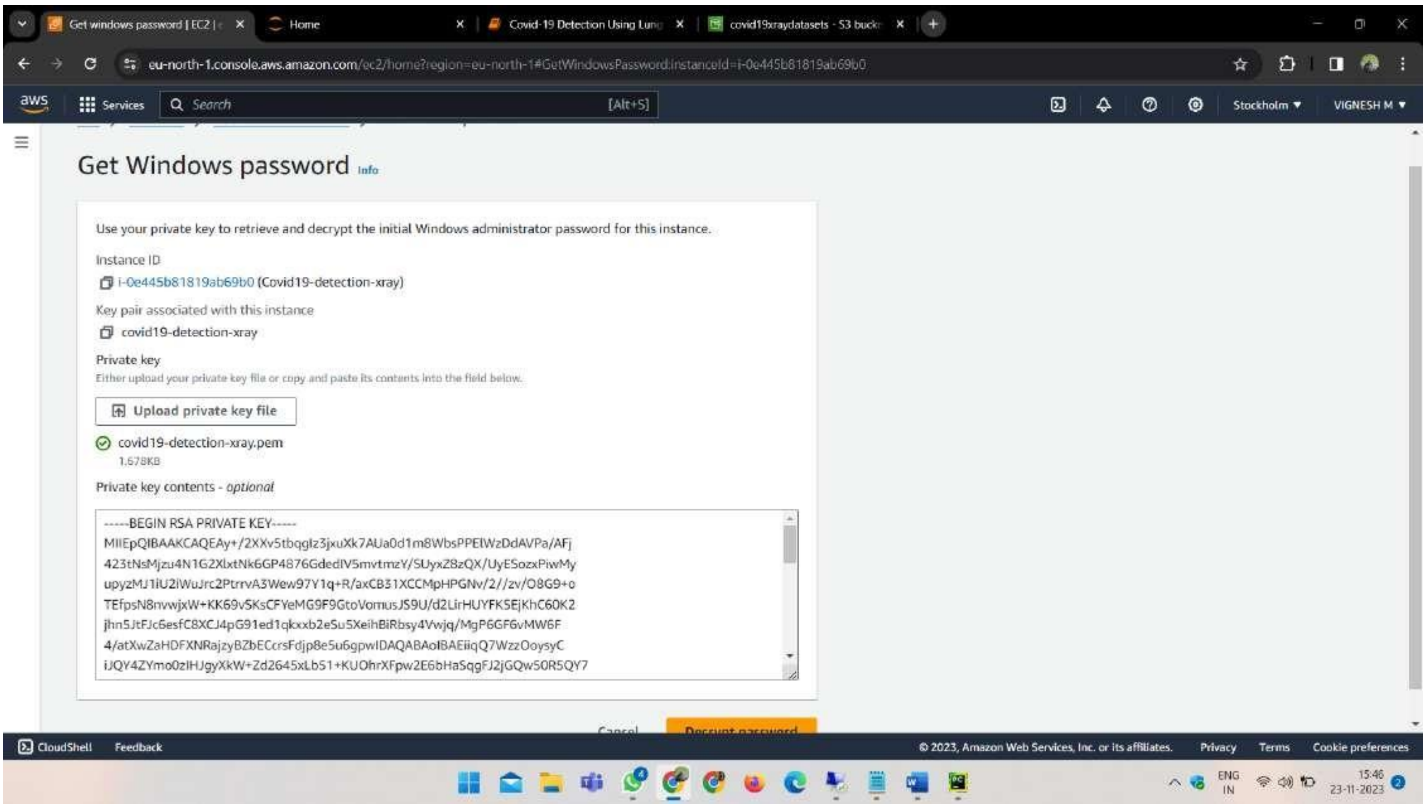
7.4. HOSTINGOURAPPLICATIONUSINGEC2 INAWS:

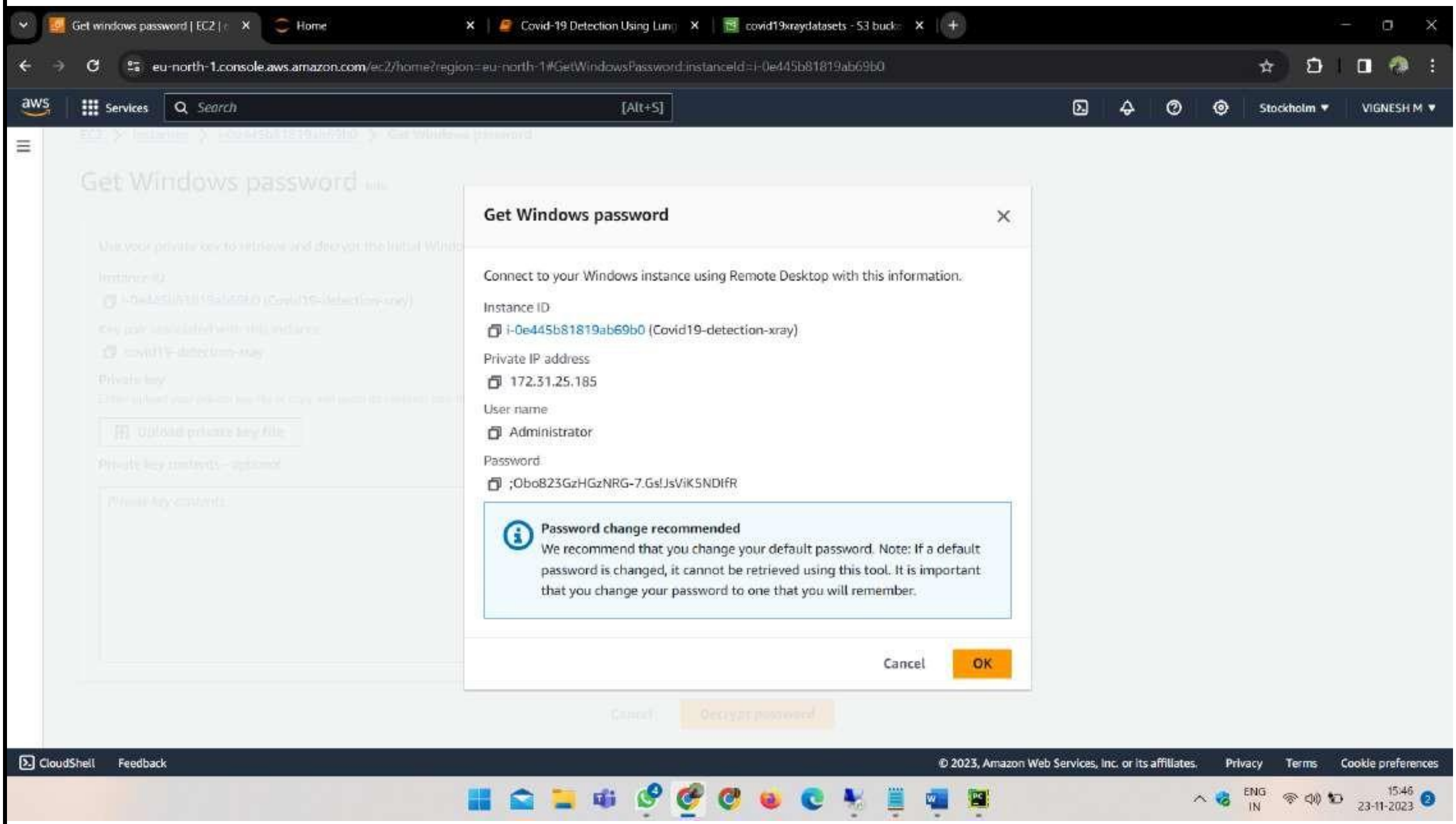



Instance type Info
Instance type
t2.micro
Free tier eligible
Family: t2 1 vCPU 1 GiB Memory Current generation: true
On-Demand Windows base pricing: 0.0162 USD per Hour
On-Demand SUSE base pricing: 0.0116 USD per Hour
On-Demand RHEL base pricing: 0.0716 USD per Hour
On-Demand Linux base pricing: 0.0116 USD per Hour
All generations
Compare instance types
Additional costs apply for AMIs with pre-installed software
Key pair (login) Info
You can use a key pair to securely connect to your instance. Ensure that you have access to the selected key pair before you launch the instance.
Key pair name - required
hospital_management
Create new key pair
For Windows instances, you use a key pair to decrypt the administrator password. You then use the decrypted password to connect to your instance.
Network settings Info
Edit
Network Info
Summary
Number of instances Info
1
Software Image (AMI)
Microsoft Windows Server 2022 ...read more
ami-0cd601a22ac9e6d79
Virtual server type (instance type)
t2.micro
Firewall (security group)
New security group
Storage (volumes)
1 volume(s) - 30 GiB
Free tier: In your first year includes 750 hours of t2.micro (or t3.micro in the Regions in which t2.micro is unavailable) instance usage on free tier AMIs per
Cancel
Launch instance
Review commands
CloudShell
Feedback
© 2023, Amazon Web Services, Inc. or its affiliates.
Privacy
Terms
Cookie preferences
Tomorrow's high
Near record
Search
ENG
IN
07:34
22-11-2023

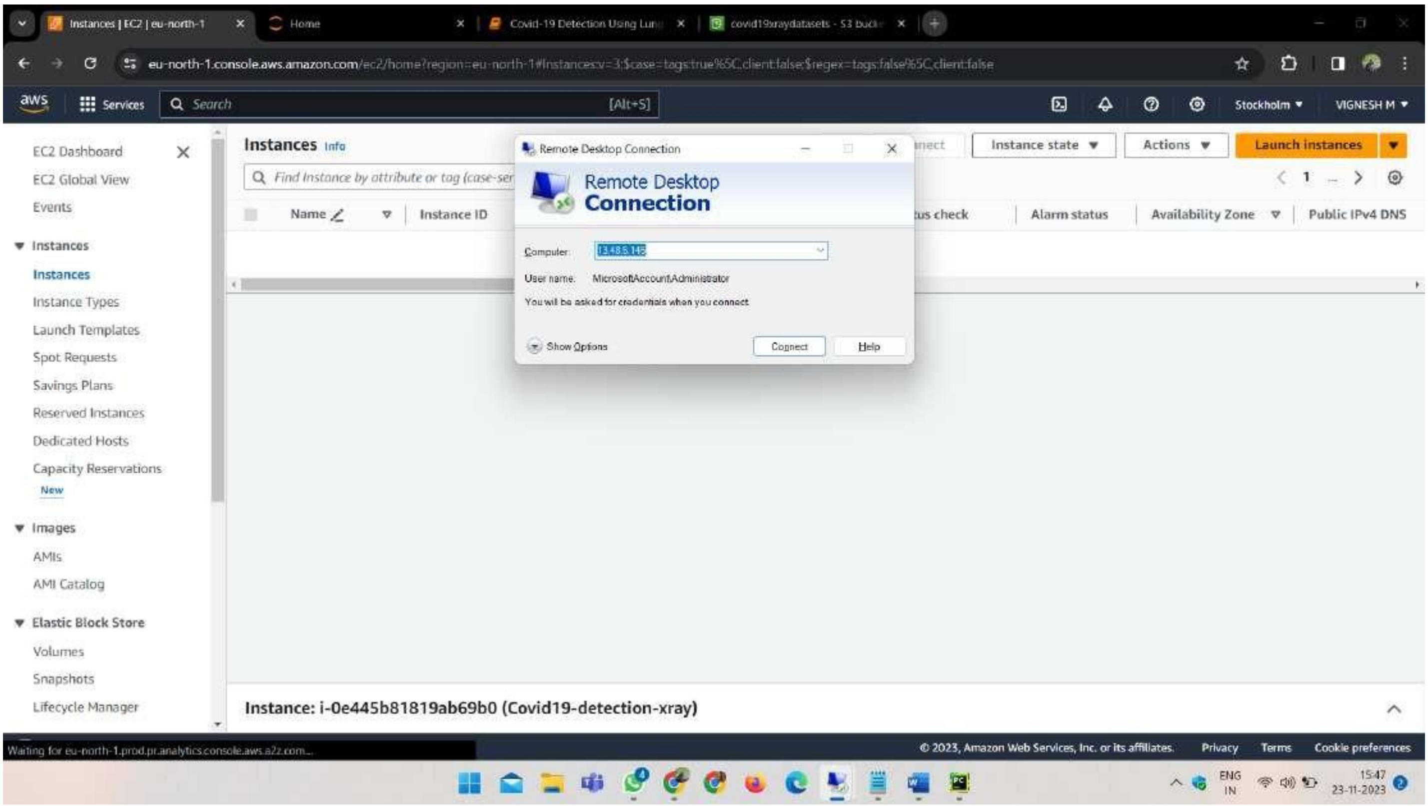

Subnet Info
No preference (Default subnet in any availability zone)
Auto-assign public IP Info
Enable
Firewall (security groups) Info
A security group is a set of firewall rules that control the traffic for your instance. Add rules to allow specific traffic to reach your instance.
Create security group
Select existing security group
We'll create a new security group called 'launch-wizard-2' with the following rules:
Allow RDP traffic from
Helps you connect to your instance
Anywhere
0.0.0.0/0
Allow HTTPS traffic from the internet
To set up an endpoint, for example when creating a web server
Allow HTTP traffic from the internet
To set up an endpoint, for example when creating a web server
Rules with source of 0.0.0.0/0 allow all IP addresses to access your instance. We recommend setting security group rules to allow access from known IP addresses only.
Configure storage Info
Advanced
1x 30 GiB gp2
Root volume (Not encrypted)
Summary
Number of instances Info
1
Software Image (AMI)
Microsoft Windows Server 2022 ...read more
ami-0cd601a22ac9e6d79
Virtual server type (instance type)
t2.micro
Firewall (security group)
New security group
Storage (volumes)
1 volume(s) - 30 GiB
Free tier: In your first year includes 750 hours of t2.micro (or t3.micro in the Regions in which t2.micro is unavailable) instance usage on free tier AMIs per
Cancel
Launch instance
Review commands
CloudShell
Feedback
© 2023, Amazon Web Services, Inc. or its affiliates.
Privacy
Terms
Cookie preferences
Tomorrow's high
Near record
Search
ENG
IN
07:34
22-11-2023

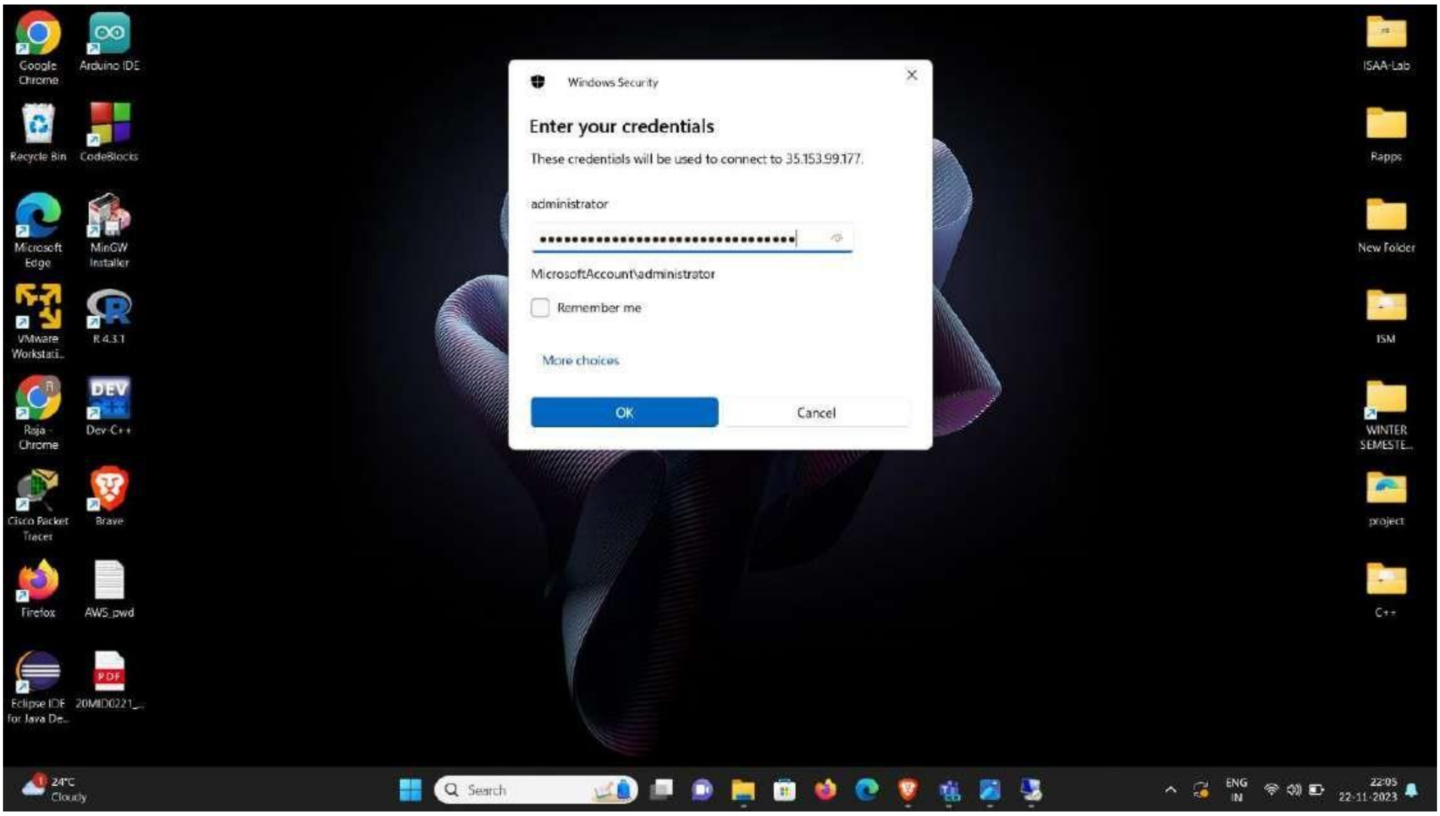

Instance details | EC2 | eu-north
Home
Covid-19 Detection Using Lung
covid19xraydatasets - S3 bucket
eu-north-1.console.aws.amazon.com/ec2/home?region=eu-north-1#InstanceDetails:instanceId=i-0e445b81819ab69b0
Services
Search
[Alt+S]
Stockholm
VIGNESH M
EC2 Dashboard
EC2 Global View
Events
Instances
Instances
Instance Types
Launch Templates
Spot Requests
Savings Plans
Reserved Instances
Dedicated Hosts
Capacity Reservations
New
Images
AMIs
AMI Catalog
Elastic Block Store
Volumes
Snapshots
Lifecycle Manager
EC2 > Instances > i-0e445b81819ab69b0
Instance summary for i-0e445b81819ab69b0 (Covid19-detection-xray) Info
Updated less than a minute ago
Connect
Instance state
Actions
Instance ID
i-0e445b81819ab69b0 (Covid19-detection-xray)
Public IPv4 address
13.49.72.206 | open address
Private IPv4 addresses
172.31.25.185
IPv6 address
–
Instance state
Running
Public IPv4 DNS
ec2-13-49-72-206.eu-north-1.compute.amazonaws.com | open address
Hostname type
IP name: ip-172-31-25-185.eu-north-1.compute.internal
Private IP DNS name (IPv4 only)
ip-172-31-25-185.eu-north-1.compute.internal
Answer private resource DNS name
IPv4 (A)
Instance type
t3.large
Elastic IP addresses
–
Auto-assigned IP address
13.49.72.206 [Public IP]
VPC ID
vpc-06aa174b728a39e2d
AWS Compute Optimizer finding
It is taking a bit longer than usual to fetch your data
IAM Role
–
Subnet ID
subnet-09f16766e545ff4d0
Auto Scaling Group name
–
IMDSv2
Required
Details
Security
Networking
Storage
Status checks
Monitoring
Tags
Instance details Info
CloudShell
Feedback
© 2023, Amazon Web Services, Inc. or its affiliates.
Privacy
Terms
Cookie preferences
ENG IN
15:46
23-11-2023

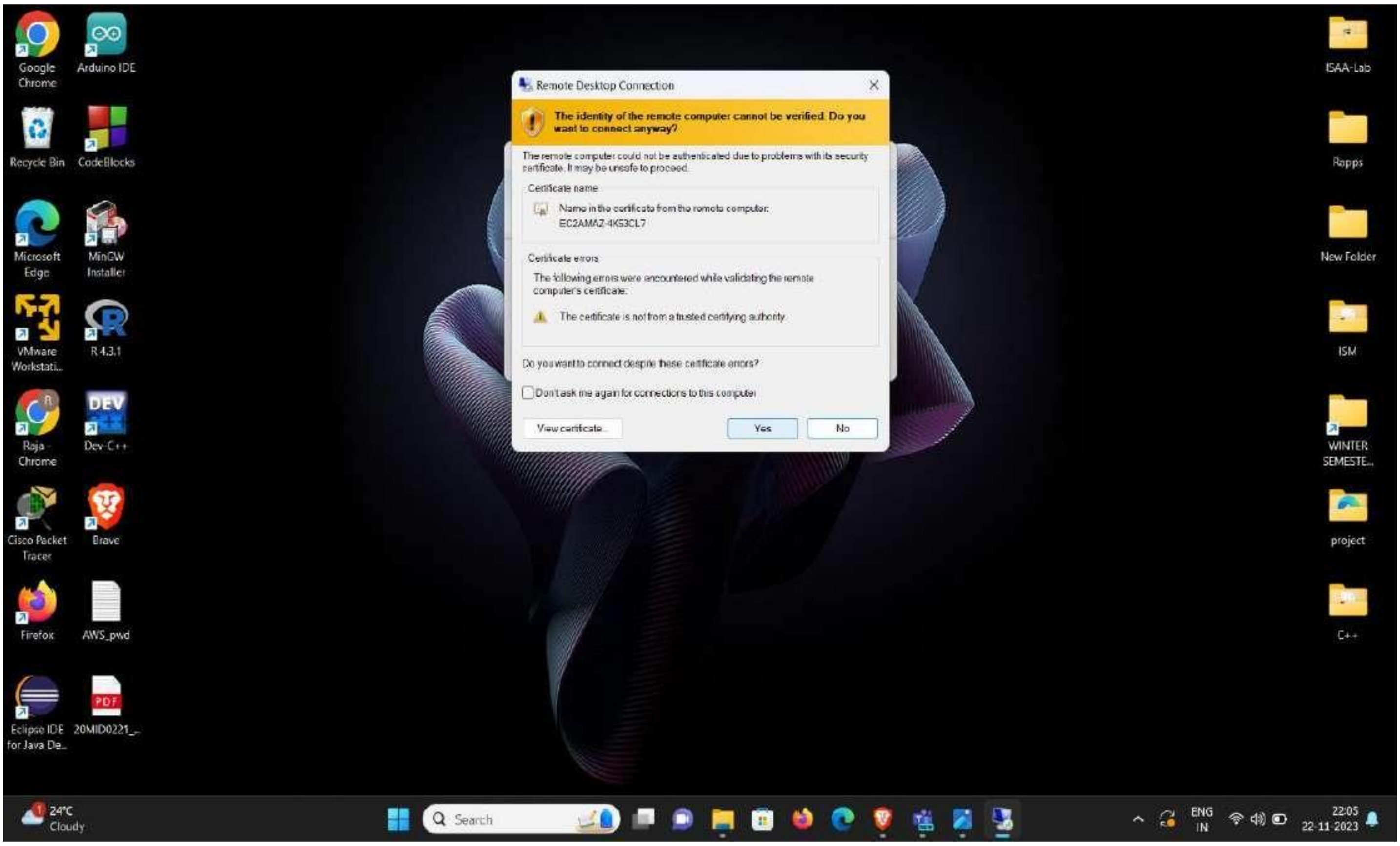

Get windows password | EC2 |
Home
Covid-19 Detection Using Lung
covid19xraydatasets - S3 bucket
eu-north-1.console.aws.amazon.com/ec2/home?region=eu-north-1#GetWindowsPassword:instanceId=i-0e445b81819ab69b0
Services
Search
[Alt+S]
Stockholm
VIGNESH M
Get Windows password Info
Use your private key to retrieve and decrypt the initial Windows administrator password for this instance.
Instance ID
i-0e445b81819ab69b0 (Covid19-detection-xray)
Key pair associated with this instance
covid19-detection-xray
Private key
Either upload your private key file or copy and paste its contents into the field below.
Upload private key file
covid19-detection-xray.pem
1.678KB
Private key contents - optional
-----BEGIN RSA PRIVATE KEY-----
MIIEpQIBAAKCAQEAy+/2XXv5tbqglz3jxuXk7AUa0d1m8WbsPPEIWzDdAVPa/AFj
423tNsMjzu4N1G2XlxtNk6GP4876GdedIV5mvtmzY/SUyxZ8zQX/UyESozxPiwMy
upyzMJ1iU2iWuJrc2PtrrvA3Wew97Y1q+R/axCB31XCCMpHPGNv/2//zv/O8G9+o
TEfpsN8nvwjxW+KK69vSKsCFYeMG9F9GtoVomusJS9U/d2LirHUYFK5EjKhC60K2
jhn5JtFJc6esfC8XCJ4pG91ed1qkxxb2eSu5XeihBiRbsy4Vwjq/MgP6GF6vMW6F
4/atXwZaHDFXNRajzyBZbECcrsFdjp8e5u6gpwIDAQABAoIBAEiiqQ7WzzOoysyC
iJQY4ZYmo0zIHJgyXkW+Zd2645xLb51+KUOhrXFpw2E6bHaSqgFJ2jGQw50R5QY7
Cancel
Decrypt password
CloudShell
Feedback
© 2023, Amazon Web Services, Inc. or its affiliates.
Privacy
Terms
Cookie preferences
ENG IN
15:46
23-11-2023



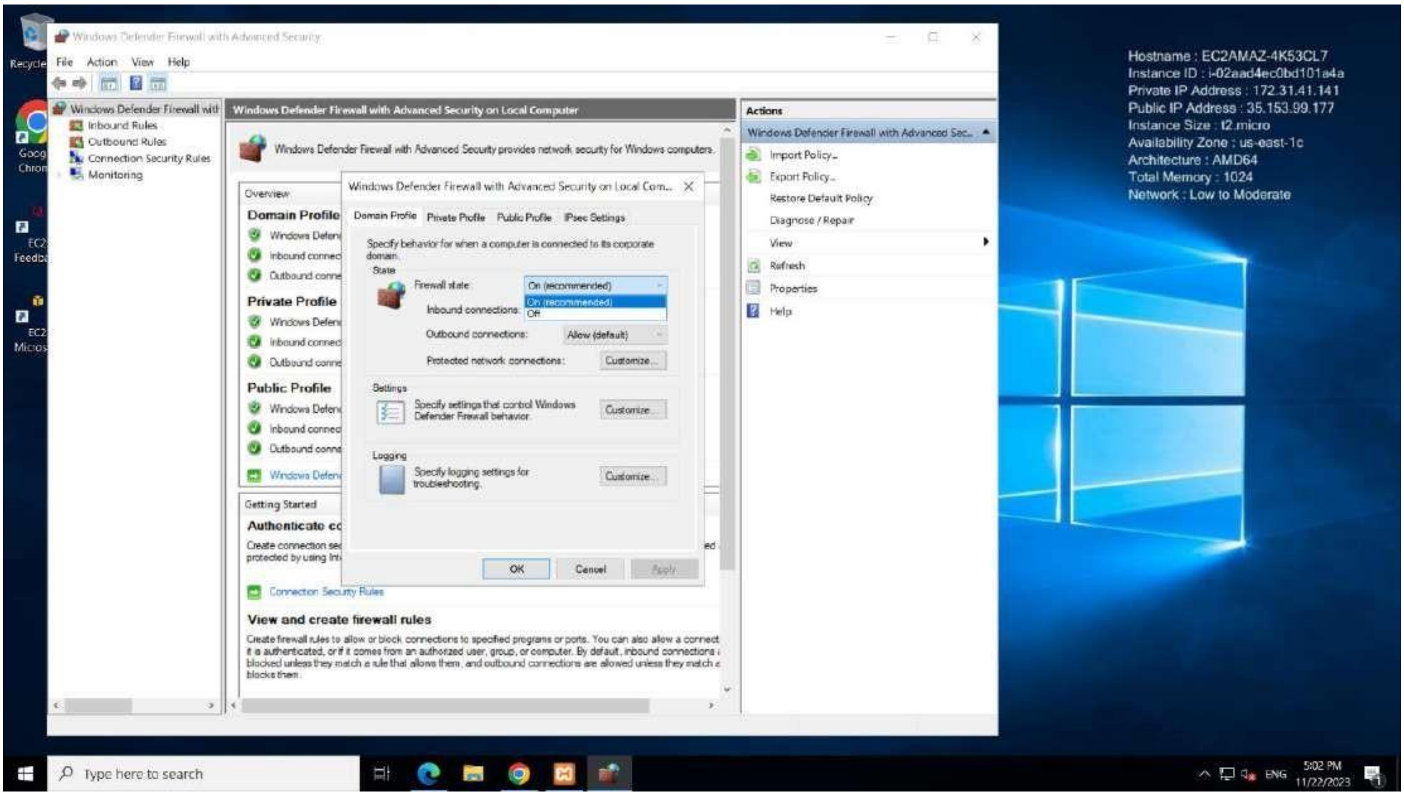
CONNECTINGTOREMOTEDESKTOP:

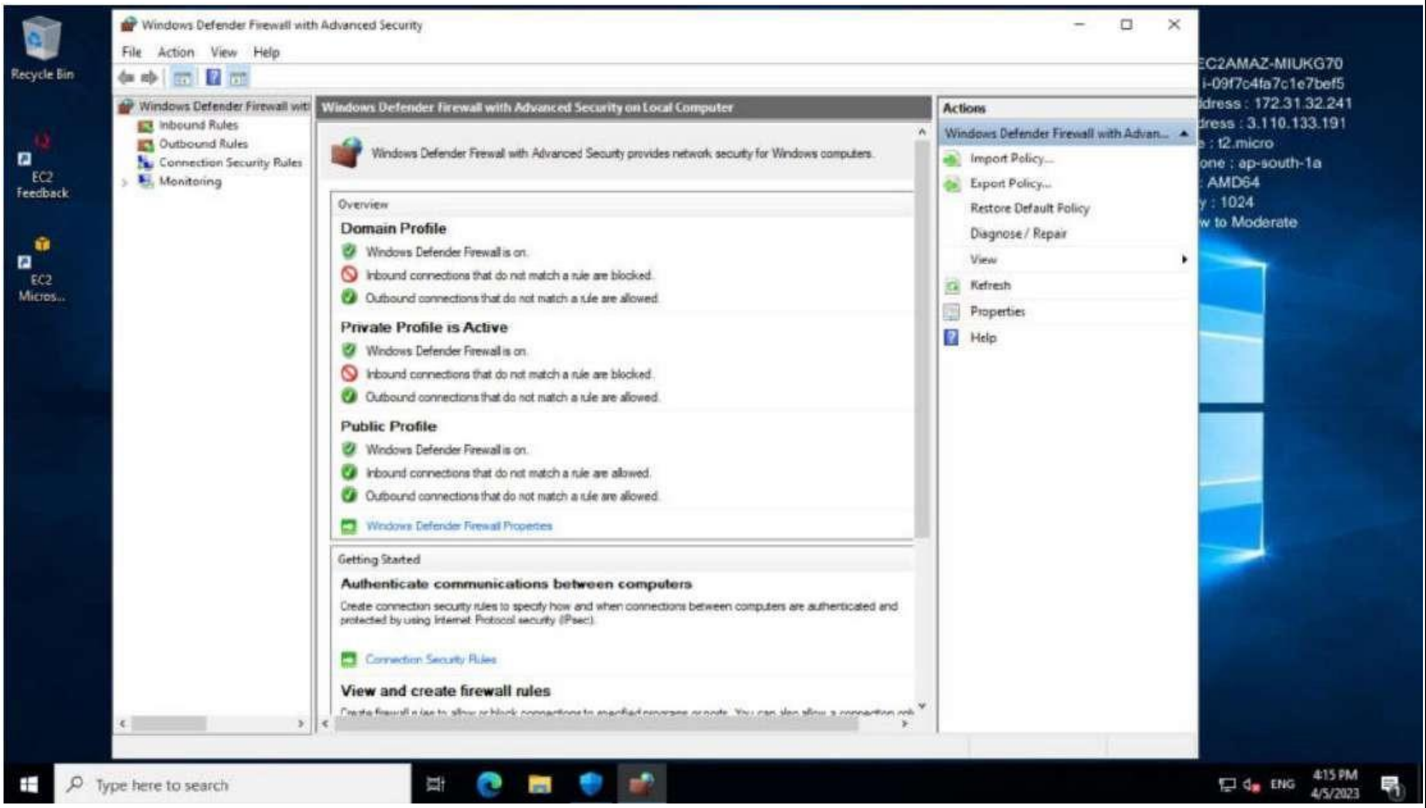



Windows Security
Enter your credentials
These credentials will be used to connect to 35.153.99.177.
administrator
MicrosoftAccount\administrator
Remember me
More choices
OK
Cancel

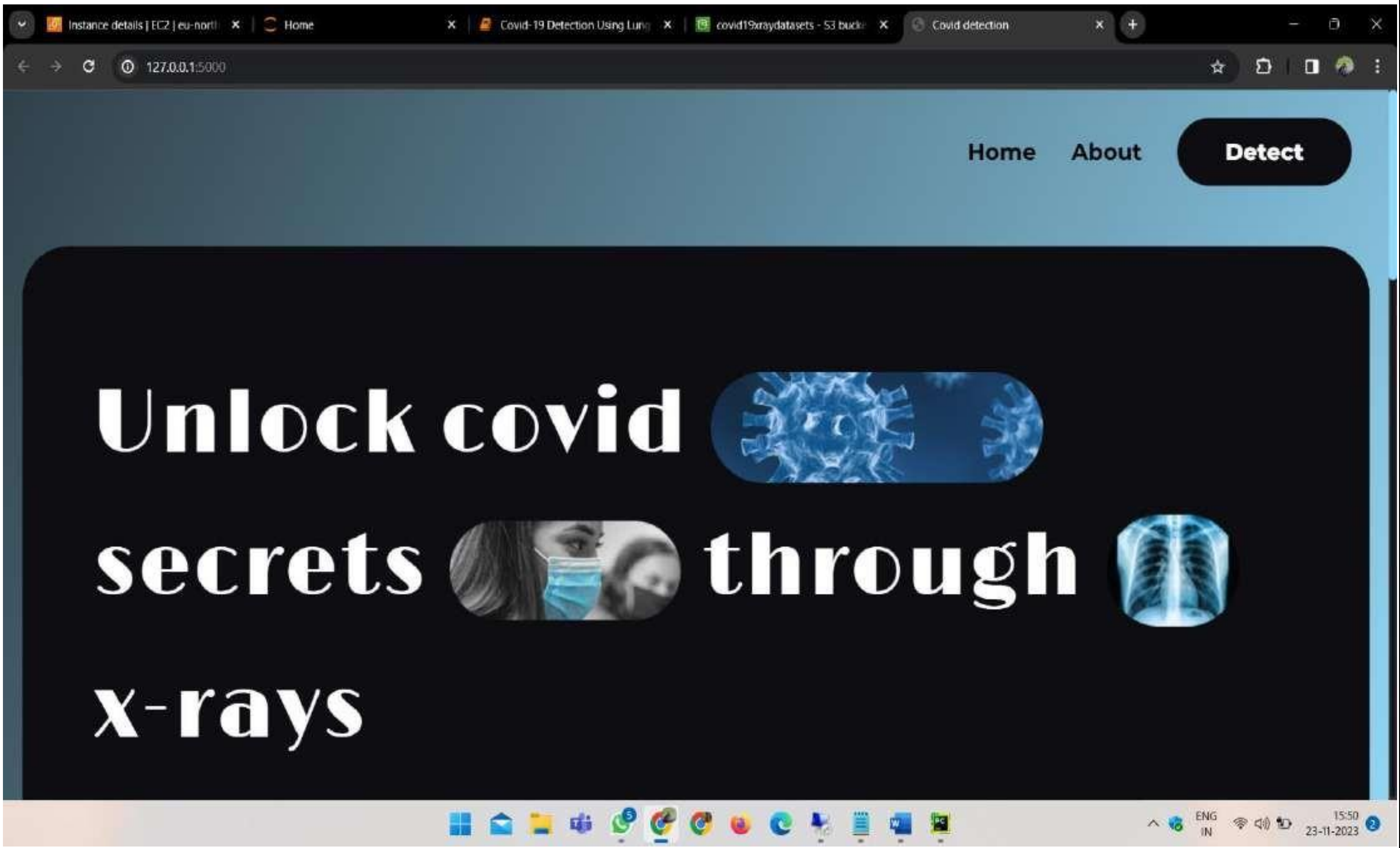

Remote Desktop Connection
The identity of the remote computer cannot be verified. Do you want to connect anyway?
The remote computer could not be authenticated due to problems with its security certificate. It may be unsafe to proceed.
Certificate name
Name in the certificate from the remote computer:
EC2AMAZ-4K53CL7
Certificate errors
The following errors were encountered while validating the remote computer's certificate:
The certificate is not from a trusted certifying authority
Do you want to connect despite these certificate errors?
Don't ask me again for connections to this computer
View certificate...
Yes
No

REMOTEDESKTOPOPENED:

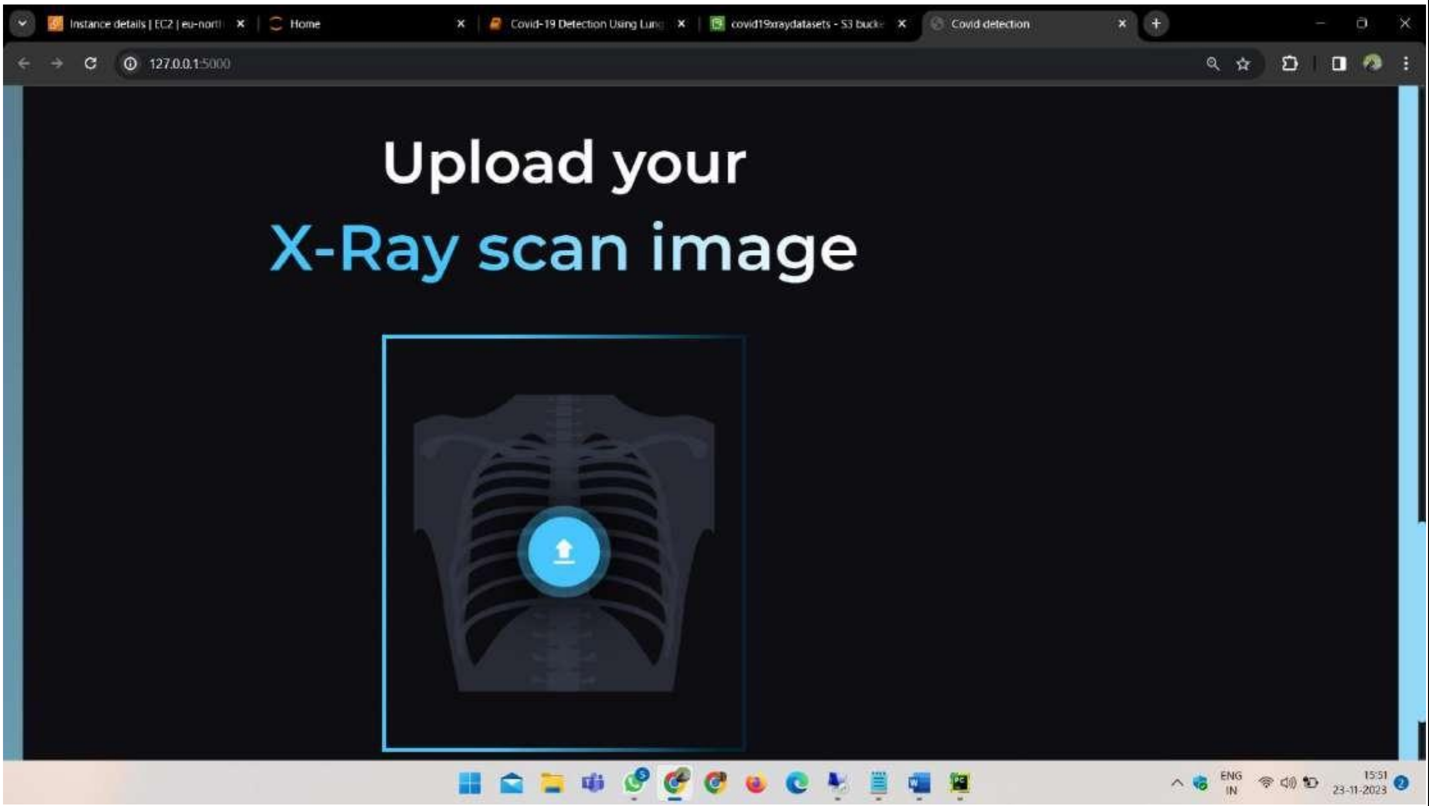




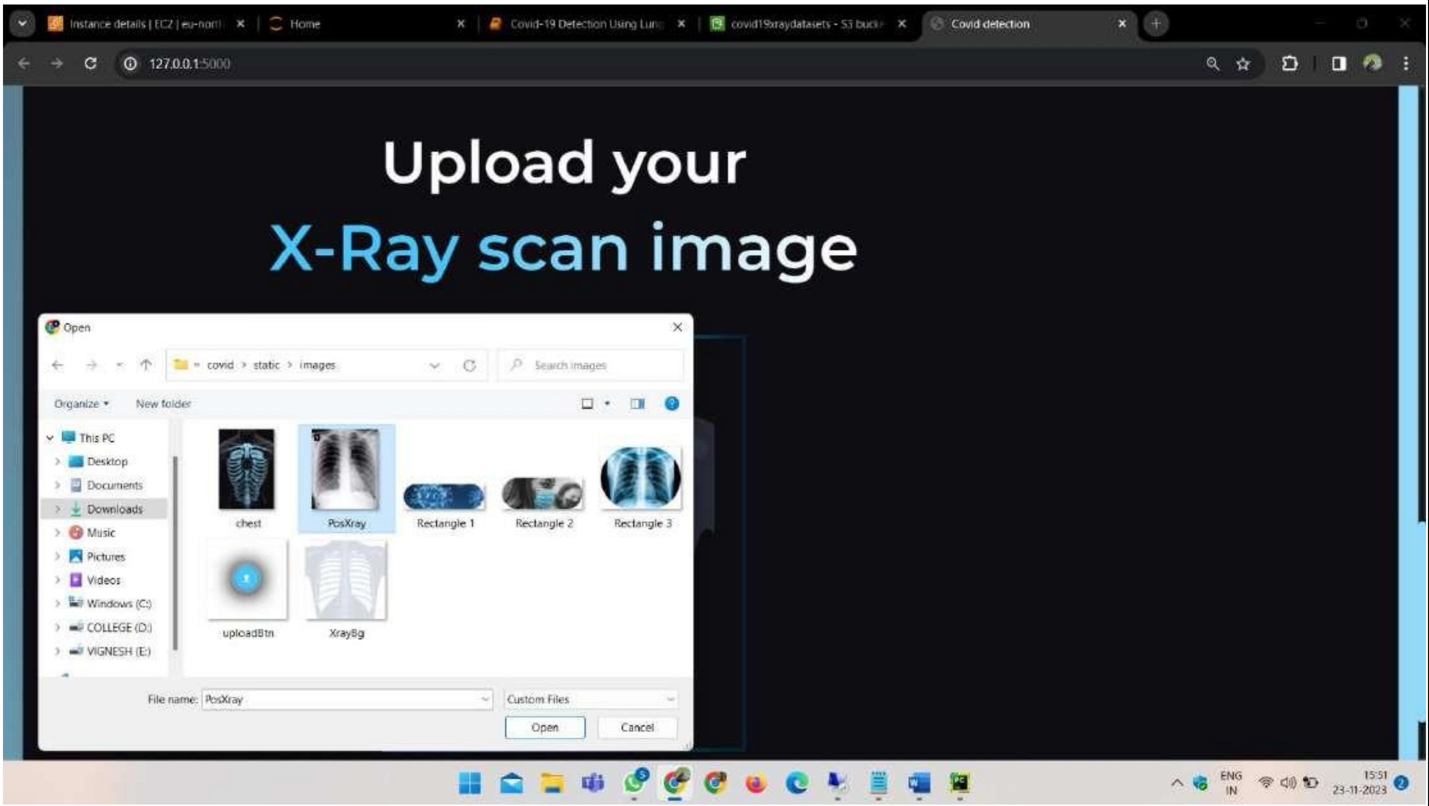
WEBSITEHOSTINGIN AWSSERVER:

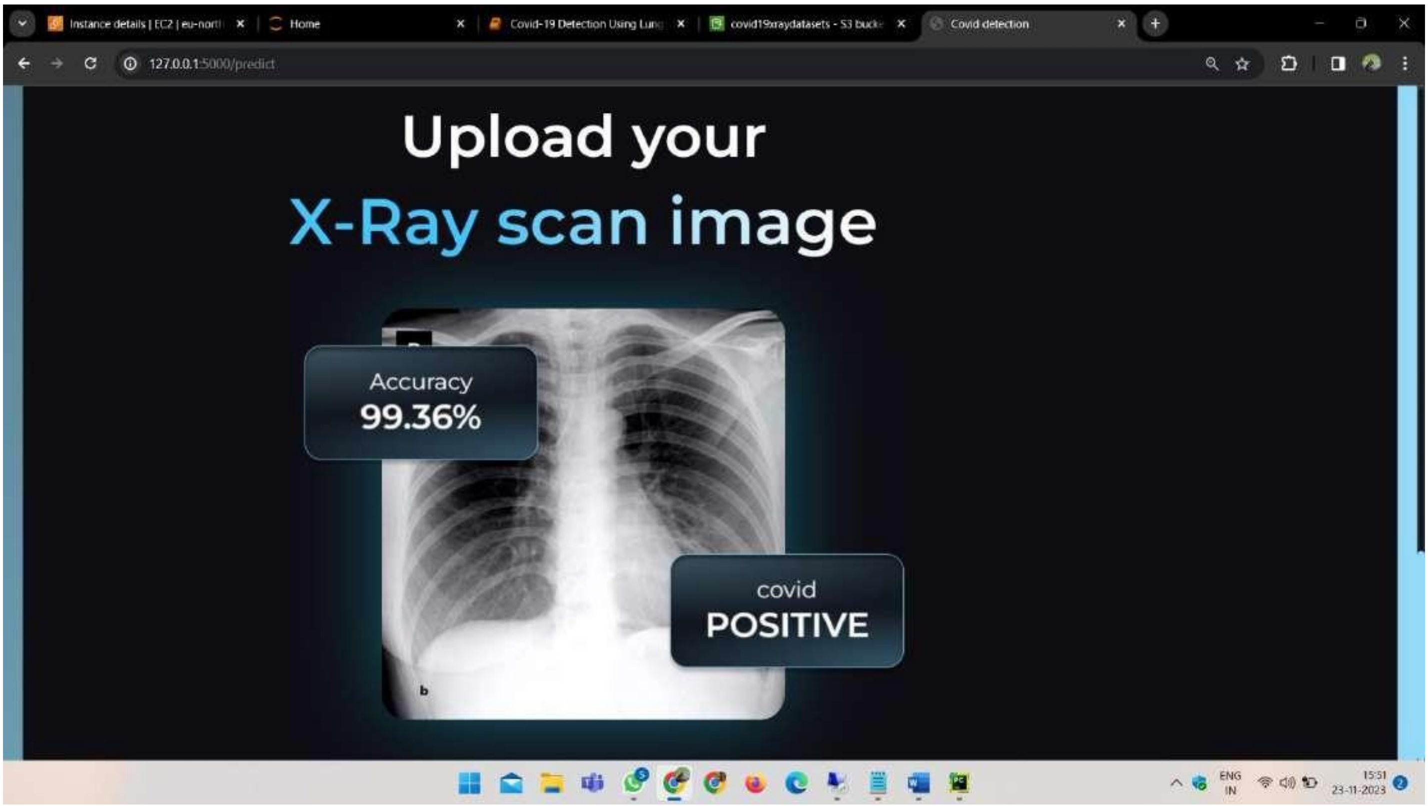


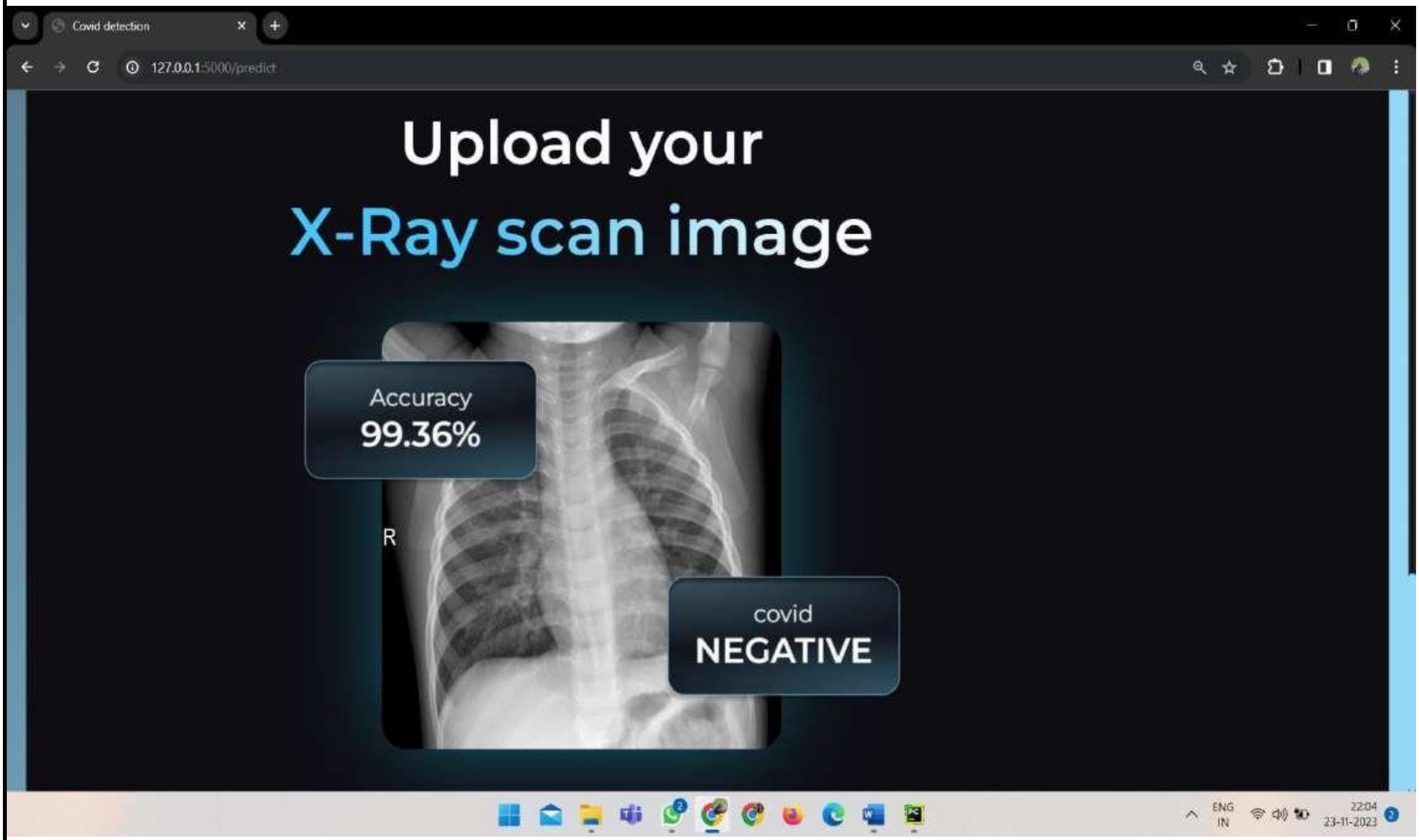

Instance details | EC2 | eu-north
Home
Covid-19 Detection Using Lung
covid19xraydatasets - S3 bucket
Covid detection
127.0.0.1:5000
Detect your condition
Detect →
Diagnose
COVID
By leveraging advanced deep learning algorithms
Detect the covid virus through X-ray images
ENG
IN
15:51
23-11-2023


Instance details | EC2 | eu-north
Home
Covid-19 Detection Using Lung
covid19xraydatasets - S3 bucket
Covid detection
127.0.0.1:5000
Upload your
X-Ray scan image
ENG
IN
15:51
23-11-2023

UPLOADINGLUNGSXRAYIMAGES:







7. *RESULTSANDINFERENCES:*

Results indicate a highly promising outcome, with the COVID-19 detection modelachieving an impressive accuracy of 99.36%. This underscores the effectiveness of utilizing AmazonSage Maker for robust model training, AWS S3 for streamlined dataset storage, and Flask for seamlessmodel deployment. The high accuracy suggests the potential for reliable identification of COVID-19casesfrom X-ray images,showcasing thepracticality of thedeveloped solution.

Inferencesdrawnfromthisprojectincludetheviabilityofcloud-basedservicesformachinelearningapplicationsinhealthcare.Theaccuracyattaineddemonstratesthemodel'sabilitytomakeprecisepredictions,emphasizingitspotentialasavaluabletoolinsupportingmedicalprofessionals. Further validation through rigorous testing on diverse datasets and collaboration withhealthcareexpertswouldstrengthenthemodel'scredibility.Continuousmonitoringandupdatesbasedon evolving medical knowledge and image acquisition technologies are essential to ensure the sustainedeffectivenessof the system.

8. *CONCLUSION:*

In conclusion, our COVID-19 detection project successfully leveraged advancedtechnologies and cloud services. Utilizing Amazon Sage Maker for model training, AWS S3 forefficientdatasetstorage,andFlaskforseamlessmodeldeployment,wehavecreatedarobustsystemfordetecting COVID-19 from X-ray images.

This integration of machine learning, cloud computing, and web developmentshowcases the power of a holistic approach in addressing real-world challenges. As we navigate theongoing pandemic, this project exemplifies the potential for technology to contribute meaningfullytohealthcaresolutions.

9. *FUTUREWORK:*

Future works for this project could involve enhancing the model's performancethrough more diverse datasets and fine-tuning. Exploring transfer learning techniques and stayingupdatedon new X-ray imagingadvancements canfurtherimprove accuracy.

Additionally, integrating real-time data feeds for continuous model training andconsidering multi-modal approaches, such as combining X-ray with other medical imaging data,couldofferamore comprehensive diagnostic solution.

Enhancementstothedeployment,suchasincorporatinguserauthenticationanda user-friendly interface, would contribute to a more accessible and practical tool for healthcareprofessionals.

Ongoingcollaborationwithmedicalexpertsandadherencetoevolvingregulatory standards will be crucial for ensuring the model's clinical relevance and reliability inreal-worldsettings.

10. REFERENCES:

[1] Tulin Ozturk, Muhammed Talo, Eylul Azra Yildirim, Ulas Baran Baloglu, Ozal Yildirim, U.Rajendra Acharya,Automated detection of COVID-19 cases using deep neural networks with X-rayimages,Computersin Biology andMedicine,Volume 121,2020,103792,ISSN 0010-4825.

[2] Emtiaz Hussain, Mahmudul Hasan, Md Anisur Rahman, Ickjai Lee, Tasmi Tamanna, MohammadZavid Parvez,CoroDet: A deep learning based classification for COVID-19 detection using chest X-rayimages,Chaos, Solitons &Fractals,Volume 142,2021,110495,ISSN 0960-0779.

[3] Tawsifur Rahman, Amith Khandakar, Yazan Qiblawey, Anas Tahir, Serkan Kiranyaz, Saad BinAbulKashem, Mohammad Tariqul Islam, Somaya Al Maadeed, Susu M. Zughaier, MuhammadSalman Khan, Muhammad E.H. Chowdhury,Exploring the effect of image enhancement techniqueson COVID-19 detectionusing chestX-ray images,Computers in Biology and Medicine,Volume132,2021,104319,ISSN0010-4825.

[4] Narin, A., Kaya, C. & Pamuk, Z. Automatic detection of coronavirus disease (COVID-19) usingX-rayimages anddeep convolutionalneural networks. PatternAnal Applic 24, 1207–1220(2021).

[5] SoumyaRanjanNayak,DeepakRanjanNayak,UtkarshSinha,VaibhavArora,RamBilasPachori, Application of deep learning techniques for detection of COVID-19 cases using chest X-rayimages:Acomprehensivestudy,BiomedicalSignalProcessingandControl,Volume64,2021,102365,ISSN1746-8094.

[6] E. F. Ohata *et al.*, "Automatic detection of COVID-19 infection using chest X-ray images throughtransfer learning," in *IEEE/CAA Journal of Automatica Sinica*, vol. 8, no. 1, pp. 239-248, January2021,doi: 10.1109/JAS.2020.1003393.

[7] S. Asif, Y. Wenhui, H. Jin and S. Jinhai, "Classification of COVID-19 from Chest X-ray imagesusing Deep Convolutional Neural Network," *2020 IEEE 6th International Conference on ComputerandCommunications(ICCC)*,Chengdu,China,2020,pp.426-433,doi:10.1109/ICCC51575.2020.9344870.

[8] Apostolopoulos, I.D., Mpesiana, T.A. Covid-19: automatic detection from X-ray images utilizingtransferlearning with convolutionalneural networks. Phys EngSci Med 43,635–640 (2020).

[9] Majeed T, Rashid R, Ali D, Asaad A. Problems of Deploying CNN Transfer Learning to DetectCOVID-19from Chest X-rays. medRxiv;2020. DOI: 10.1101/2020.05.12.20098954.

[10] Ahmet Saygılı,A new approach for computer-aided detection of coronavirus (COVID-19) fromCT and X-ray images using machine learning methods,Applied Soft Computing,Volume 105,2021,107323,ISSN1568-4946.

[11] Mesut Toğaçar, Burhan Ergen, Zafer Cömert, COVID-19 detection using deep learning modelsto exploit Social Mimic Optimization and structured chest X-ray images using fuzzy color andstackingapproaches,ComputersinBiologyandMedicine,Volume121,2020,103805,ISSN0010-4825.

[12] Zhang, Jianpeng, et al. "Covid-19 screening on chest x-ray images using deep learning-basedanomalydetection." arXiv preprint arXiv:2003.12338 27.10.48550(2020).

[13] Haghanifar, A., Majdabadi, M.M., Choi, Y. et al. COVID-CXNet: Detecting COVID-19 infrontalchest X-ray imagesusing deep learning. MultimedTools Appl 81,30615–30645 (2022).

[14] Hassantabar, Shayan, Mohsen Ahmadi, and Abbas Sharifi. "Diagnosis and detection of infectedtissueofCOVID-19patientsbasedonlungX-rayimageusingconvolutionalneuralnetworkapproaches." *Chaos, Solitons & Fractals*140 (2020): 110170.

[15] A. Rehman, T. Saba, U. Tariq and N. Ayesha, "Deep Learning-Based COVID-19 DetectionUsing CT and X-Ray Images: Current Analytics and Comparisons," in IT Professional, vol. 23, no. 3,pp.63-68, 1 May-June2021, doi: 10.1109/MITP.2020.3036820.

[16] Wang, L., Lin, Z.Q. & Wong, A. COVID-Net: a tailored deep convolutional neural networkdesignfordetection ofCOVID-19casesfromchest X-rayimages. *SciRep***10**,19549(2020).

[17] Alam, N.-A.-; Ahsan, M.; Based, M.A.; Haider, J.; Kowalski, M. COVID-19 Detection fromChestX-rayImagesUsing FeatureFusionand DeepLearning. Sensors 2021,21, 1480.

[18] Chen,JoyIong-Zong."DesignofaccurateclassificationofCOVID-19diseaseinX-rayimagesusingdeep learningapproach."*Journalof ISMAC*3.02 (2021): 132-148.

[19] Morteza Heidari, Seyedehnafiseh Mirniaharikandehei, Abolfazl Zargari Khuzani, GopichandhDanala, Yuchen Qiu, Bin Zheng,Improving the performance of CNN to predict the likelihood ofCOVID-19 using chest X-ray images with preprocessing algorithms,International Journal of MedicalInformatics,Volume144,2020,104284,ISSN 1386-5056.

[20] Usman Muhammad, Md. Ziaul Hoque, Mourad Oussalah, Anja Keskinarkaus, Tapio Seppänen,PinakiSarder,SAM:Self-augmentationmechanismforCOVID-19detectionusingchestX-rayimages,Knowledge-BasedSystems,Volume241,2022,108207,ISSN 0950-7051.