**Literature review:**

Cengil et al. [1] performed an analysis using Convolutional Neural Networks (CNN) and classification methods on X-Ray images and built a model that had an accuracy of 98.8%, 95.9% and 99.6% on the three different datasets they used for their analysis. The X-Ray images datasets consists of three classes (COVID, normal, pneumonia). Feature extraction methods like-AlexNet, 36 Xception, 37 NASNetLarge, 38 and EfficientNet-B039 methods were used for automated feature extraction which then after was passed to the classification algorithms- Support Vector Machine (SVM), Linear Discriminant Analysis (LDA), k-Nearest Neighbor (KNN), Naïve Bayes (NB) and Decision Tree (DT).

Wang et al. [2] designed a model called as COVID-Net by using deep convolutional neural network (CNN). The COVID-Net model had the best performance of 93.3% among the 3 architecture they used (VGG-19, ResNet-50, and COVID-Net) for building the model. Among all the architecture, VGG-19 obtained the sensitivity of 98% in detecting normal X-Ray images, ResNet-50 with 94% in detecting non-COVID-19 pneumonia and COVID-Net with 91% in detecting COVID-19 pneumonia. Thus, making the COVID-Net to be the best COVID-19 detector using Chest X-Ray images.

Baltazar et al. [3] worked on Chest X-Ray (CXR) images to detect the COVID-19 using transfer learning which is one of the machine learning techniques. They used five well-known architectures for developing the COVID detection system. There were-InceptionV3, Inception-ResNet, Xception, VGG19 and MobileNet. Stochastic Gradient Descent (SGD) was used an optimizer and categorical cross-entropy as a loss function for training and fine-tuning the CNN models. Three different detection ideas were adopted: two-class detection (Normal/Pneumonia), three-class detection (Normal/Non-COVID-19 pneumonia/COVID-19 pneumonia), and four-class detection (Normal/Viral pneumonia/Bacterial pneumonia/COVID-19 pneumonia). Two different strategy was used for different detection scenarios. First, the dataset was divided into training and test data in which 80% was training data and 20% test data. Second strategy divided the data into three parts: training, validation, and test data in which 70% was training data, 20% was validation, and 10% was testing data. model obtained by using InceptionV3 had best sensitivity of 86% and specificity of 99% with high positive predictive value (PPV) value of 91%.

Mahmud et al. [4] proposed a deep convolutional neural network (CNN) based architecture called CovXNet which uses Chest X-Ray (CXR) images of COVID-19 caused pneumonia and other traditional pneumonia (viral/bacterial) since they had significant similarity. Multiple classification algorithms like- XGBoost, Random Forest, Decision Tree, Support Vector Machine (SVM) k-Nearest Neighbor (KNN), GuassianNB, and Logistic regression were adopted to see which algorithms performs best in predicting the COVID-19 pneumonia in which XGBoost and Random Forest seemed to be performing best in detecting every type. Using two extensive experimentation datasets, the model obtained an accuracy of 97.4% for COVID/normal, 96.9% for COVID/Viral pneumonia, 94.7% for COVID/Bacterial pneumonia, and 90.2% for multiclass COVID/normal/Viral/Bacterial pneumonias.

Hanafi et al. [5] developed an AI-driven model having 98% accuracy using deep Convolutional Neural Network (CNN) in combination with Autoencoder (AE) which was named as CAE-COVIDX. Accuracy, precision, recall, loss function, and confusion matrix were used for the model performance evaluation. Two task models were built in which for each task 60% data was used for training, 10% for validation, and 30% for testing. CAE-COVIDX was considered the best performing model after they run the experiment five times on traditional CNN, VGG-16 and CAE-COVIDX to ensure performance stability.

J.L, Gayathri et al. [6] developed a model by integrating Convolutional Neural Network (CNN) with dimensionality reduction method named as Sparse Autoencoder and Feed Forward Neural Network (FFNN) for detecting the COVID-19 using CXR. Chest X-Ray image dataset having 504 COVID-19 and 542 non-COVID-19 images was used to train the model. Multiple pre-trained networks- InceptionResNetV2 having depth 164, ResNet101 with 101, Xception with 72, EfficientnetB0 with 82, and Darknet with depth 53 were used for feature extraction. When sparse autoencoder was not used, the single-CNN model using FFNN performed best on EfficientnetB0 pre-trained network with an accuracy=93.21% and AUC=0.9756 but when sparse autoencoder was implemented to the single-CNN model using FFNN, the model was able to predict the COVID-19 with 95.78% accuracy and had an AUC=0.9821 and was using the combination of Xception and InceptionResNetV2 pre-trained network. An AUC of 1 is considered as perfect classifier and a model with AUC less than or equal to 0.50 is considered worthless. So, the model with AUC=0.9821 is considered good classifier.

Ackall et al. [7] constructed a convolutional neural network (CNN) model that used xRGM-Net CNN to detect COVID-19 using chest X-ray images. An activation mapping technique called Score-CAM was implemented on the X-Ray images that creates a heatmap over an X-ray and helps in indicating which areas are most influential over the diagnosis. The model was built by using 2754 healthy X-Ray images and 439 COVID-19 X-ray images. The CNN model was trained with 90% data and 10% data was used for validation and testing. Three different algorithms were implemented to construct the model (AlexNet, VGG-19, and xRGM-NetV2). The best performing model achieved an accuracy=96.6%, sensitivity=93.6% and specificity=97.1% using xRGM-NetV2.

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