SOFT COMPUTING

J Component -- Project Report

MedicAI

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ABSTRACT

Artificial intelligence is being used in a variety of ways by those trying to address variants and for data management. AI, on the other hand, not only uses historical data, it makes assumptions about the data without applying a defined set of rules. This allows the software to learn and adapt to information patterns in more real time. Numerous sources of medical images (e.g., X-ray, CT, and MRI) make deep learning a great technique to combat the COVID-19 outbreak. Motivated by this fact, a large number of research works have been proposed and developed. Chest CT is an emergency diagnostic tool to identify lung disease. Artificial intelligence (AI) gives a big guidance in rapid analysis of CT scans in order to differentiate variants of COVID-19 findings. Focusing on the recent advances of COVID-19 drug and vaccine development using artificial intelligence and the potential of intelligent training for the discovery of COVID-19 therapeutics.

1. INTRODUCTION

Coronavirus or the Coronavirus infection is a breathing sickness achieved by defilement with the coronavirus of serious acute respiratory disorder, also known by the name SARS-V2. COVID19 directly tainted more than 16.6 crores individuals worldwide causing more than 34.3 lakhs deaths. A significant issue in the determination of COVID19 is the shortcoming and shortage of clinical tests. In such a manner, a few endeavours were dedicated to looking for elective techniques for determining COVID19's occurrence. Computed tomography scans or the CT examinations are seen as promising for the identification of patients with suspected COVID19 infection. CT shows clear radiological discoveries from patients with COVID19, filling in as a more effective and open test strategy. The principal issue with this strategy is that it relies upon the expert to investigate the CT pictures, as the cycle is tedious, tedious, and tiring for the master, because of various pictures to be examined, causing weariness, which can prompt mistakes in finding .

Despite the fact that quick purpose of care COVID19 tests is relied upon to be utilized in clinical settings eventually, for the present, usually, the time taken for COVID19 test outcomes range from 3 hours to 3 days, and most likely not all nations will approach those test units that give results quickly. To manage these issues, CT scans based strategies have been proposed by various works as of late, indicating incredible guarantee for the use of Deep Learning techniques and profound Machine Learning or the ML-primarily based methodologies for powerful popularity of the disease from chest CT photos. Inspired by using the requirement for an extensive assessment of such AI-based diagnosing methodologies, in this work, Deep CNN based strategies are investigated and focused tentatively to get the measure of the handiness of these methodologies in the modern emergency.

Artificial intelligence instruments have created steady and exact outcomes in the applications that utilize either picture-based or different sorts of information. Mpesiana-2 performed one of the principle assessments on COVID19 identification utilizing X-beam pictures along with Apostol Poulos. In their investigation, they considered exchange getting the hang of utilizing pre-prepared networks, for example Xception, and Inception-ResNet-V2, VGG-19, MobileNet V2, Inception which are the frequently used pre-trained models. A few assessment measurements were utilized to assess the outcomes obtained from two distinctive data sets. The last end was made by the creators utilizing the acquired disarray lattices, not the precision results due to the imbalanced information.

Overall, CNNs that endeavour to replicate characteristic pieces of people on PCs require pre-handling of pictures or data prior to dealing with them to the organization. Right when the ConvNet was first grown, regardless, it was portrayed as a neural organization that requires

insignificant pre getting of pictures prior to dealing with them to the organization, and a structure that is good for removing the features from pictures to improve the learning execution of the neural organization.
The ConvNet includes both segment extraction and request stages in a single organization. A customary ConvNet involves three layers: convolution, pooling, and totally related layers or FCs. Feature extraction is acted in the convolutional layer by applying cover, which is the route toward disconnecting pictures into a predefined estimation of segments and using channels to isolate features from the image. By then a feature map, which is the projection of features on the 2D the guide is made by applying an establishment ability to the characteristics obtained by the cloak. The activation limits establish the most capable neurons in a nonlinear way and reduce the computational cost of the neural organization.

The discipline of scientific imaging has seen revolutionary adjustments inside the ongoing past, due to the head ways within the field of DL and Open CV or CV, for a few, contagion, equivalent to Pneumonia, MERS, SARS, ARDS etc. And in these situations of pandemic, it has gotten a good deal extra significant for such Deep Learning primarily based ways to address being applied progressively. Effective utilization of such Deep Learning based methodologies can conceivably be of high utility for people, particularly concerning quick testing and recognition of the illness that is quick diagnosis and predictions for the COVID19.

A couple of incitation limits are available in CNNs and the corrected straight unit ReLU is the most ordinarily used commencement work; it doesn't enact all the neurons at the same time, and along these lines gives a quicker assembly at the point when the loads locate the ideal qualities to deliver the automatic reflex during the preparation. A pooling activity is performed on the delivered highlight guide to diminish the measurements of the pictures.

Finally, the part map is levelled into a vector and sent off the totally related layer. The get together of the neural organization and the gathering of the data plans are acted in the totally related layer and its guidelines rely upon good backpropagation to invigorate the heaps inside this layer. Each readied neural organization gets data for the particular task that is considered. While the fundamental guideline of fake neural networks is to re-enact human conduct and insight, the exchange learning in counterfeit neural networks is utilized to apply the put away information on a specific assignment for another connected assignment. Profound learning for picture acknowledgment applications are fit for learning a great many pictures, and a few tremendous models were prepared with various structures. These pre-prepared models have been freely mutual with the goal that everything scientists can utilize the put away information. The cutting edge pre-prepared openly accessible networks, specifically, VGG-16, Inception-V3, VGG-19, MobileNet-V2, ResNet50, and Densenet121 were considered in the correlation.

The paper aims to bring in methodologies currently implemented in this arena, both with vanilla custom CNN based learning and transfer learning, understand them and try to understand the implementations and bring out the challenges that were faced. Also to explore the data sets which have been used like COVID CT data set with approx. 750 images and data set, also with pneumonia infected or affected patients and non-pneumonia patients as CT scans of COVID-positive patients and non-covid patients is quite similar. And also adding another layer to it by implementing a model which classifies COVID positive patients with Pneumonia positive and COVID positive. This step becomes very essential as there is a high chance that Pneumonia positive patients can be diagnosed as COVID positive as the CT scans of patients affected by these diseases are pretty similar. So we had an extra model which differentiates COVID positive from pneumonia positive as the last step if the patient gets detected as COVID positive.

Also there have been works on pre-processing the scans data or the CT scan images using OpenCV library. Histogram Equalization, Adjusted Log and Rank Equalization is done on the images to get a clear picture about all the abnormalities in the lung CT scan and more accurate results while we were dealing with deep learning models while training.

2. LITERATURE SURVEY

1) Deep Learning Applications on Covid 19

Connor Shorton -2021

As we all know Deep Learning is one of the most used technologies in recent and Past events, in this paper we study the applications of DL which can be used for any analytical research of Covid-19. This paper covers every time used applications like Natural Language Processing, Computer vision, Medical Robotics, Life Sciences and others. The Paper concentrates on the application of DL on the different types of analysis which can be performed using that particular application. In NLP, we can do Public Sentiment analysis, Social Network Analysis, Medical Report analysis etc. Coming to Computer Vision, it can be used for Bronchiectasis, Dyspnoea, Pneumonia, Asthma and others. The next one deals with Life Sciences. "Life Sciences for Dl" scope ranges from improving the COVID-19 diagnostic capabilities of blood testing to ground-breaking applications in protein modelling and drug repurposing. The applications also include Epidemiology. Their survey completely provides a description of how some of these problems can be solved with deep learning.

2) Ai in Tackling Covid-19

Neelima Arora -2020

The new technological developments, in the medical field which is supporting mankind with all help it has. In this paper, a complete survey or an understanding was given on Artificial Intelligence used to take care of Covid-19. Paper does not only focus on the time of effect of covid, but also, pre-covid study and post covid study was done and the related understanding was described. Even the therapeutic drug analysis, early diagnosis, contact tracing, protein structure prediction, development in therapeutic, vaccine effect, was done and described. Also suggest a three way propaganda based on testing, isolation and contact tracing is warranted to combat Covid-19 in its future works.

3) How Ai is being used for Covid 19 vaccine creation and distribution, An Article

Jonathan Gerg - 2021

Artificial intelligence is being used in a variety of ways by those trying to address variants and for data management. AI, on the other hand, not only uses historical data, it makes assumptions about the data without applying a defined set of rules. This allows the software to learn and adapt to information patterns in more real time. The AI utility for vaccine distribution could be applied

in a variety of ways from understanding which populations to target to curve the pandemic sooner, adjusting supply chain and distribution logistics to ensure the most people get vaccinated in the least amount of time, to tracking adverse reactions and side effects. The advantage to using AI in vaccine rollout is that it will set us up for success during round two of vaccine dosing. It will also positively impact future vaccine dissemination by creating a blueprint for the next mass inoculation. Researchers, he said, can leverage data about how COVID-19 has mutated and vaccine effectiveness to continuously refine the vaccine sequence and, in some cases, get ahead of COVID-19 and prepare new vaccines before additional strains fully develop.

4) A retrospective study: Prognostication of patients with COVID-19

Zhicheng Jiao - 2021

Chest x-ray is a relatively accessible, inexpensive, fast imaging modality that might be valuable in the prognostication of patients with COVID-19. They aimed to develop and evaluate an artificial intelligence system using chest x-rays and clinical data to predict disease severity and progression in patients with COVID-19. A retrospective study in multiple hospitals in the University of Pennsylvania Health System in Philadelphia, PA, USA, and Brown University affiliated hospitals in Providence, RI, USA. Patients who presented to a hospital, with a diagnosis of COVID-19 confirmed by RT-PCR and with an available chest x-ray from their initial presentation or admission, were retrospectively identified and randomly divided into training, validation, and test sets. Using the chest x-rays as input to an Efficient Net deep neural network and clinical data, models were trained to predict the binary outcome of disease severity. The models were externally tested on patients and compared with severity scores provided by radiologists.

5) Current limitations to identify COVID-19 using artificial intelligence with chest X-ray imaging

Ruben Arzoca - 2020

The early identification of the disease, as well as the evaluation of its evolution is a primary task for the timely application of medical protocols. The use of medical images of the chest provides valuable information to specialists. Specifically, chest X-ray images have been the focus of many investigations that apply artificial intelligence techniques for the automatic classification of this disease. The results achieved to date on the subject are promising. However, some results of these investigations contain errors that must be corrected to obtain appropriate models for clinical use. This research discusses some of the problems found in the current scientific literature on the application of artificial intelligence techniques in the automatic classification of

COVID-19. It is evident that in most of the reviewed works an incorrect evaluation protocol is applied, which leads to overestimating the results.

6) Artificial intelligence for the detection of COVID-19 pneumonia on chest CT using multinational datasets

Stephanie A. Harmon, Thomas H. Sanford - 2020

Chest CT is an emergency diagnostic tool to identify lung disease. Artificial intelligence (AI) gives a big guidance in rapid analysis of CT scans in order to differentiate variants of COVID-19 findings. This paper have many deep learning algorithms, trained in a diverse multinational cohort of around 1000 patients to localize parietal pleura/lung parenchyma followed by differentiation of COVID-19 pneumonia, can achieve up to 90.8% accuracy, with 84% sensitivity and 93% specificity, as evaluated in an independent test set (not included in training and validation) of 1337 patients. Normal controls included chest CTs from oncology, emergency, and pneumonia-related indications. The false positive rate in 140 patients with laboratory confirmed other (non COVID-19) pneumonias was 10%. AI-based algorithms can readily identify CT scans with COVID-19 associated pneumonia, as well as distinguish non-COVID related pneumonias with high specificity in diverse patient populations.

7) Artificial Intelligence for COVID-19 Drug Discovery and Vaccine Development

Arash Keshavarzi Arshadi - 2020

This paper focuses on the recent advances of COVID-19 drug and vaccine development using artificial intelligence and the potential of intelligent training for the discovery of COVID-19 therapeutics. To facilitate applications of deep learning for SARS-COV-2, this has highlighted multiple molecular targets of COVID-19,inhibition of which may increase patient survival. CoronaDB-AI, a dataset of compounds, peptides, and epitopes discovered either in silico or in vitro that can be potentially used for training models in order to extract COVID-19 treatment. The information and datasets provided in this review can be used to train deep learning-based models and accelerate the discovery of effective viral therapies.

8) Cerebral Micro-Structural Changes in COVID-19 Patients An MRI-based 3-month Follow-up Study

Yiping Lu, Xuanxuan L - 2020

This study aimed to identify the existence of potential brain micro-structural changes related to SARS-CoV-2. In this prospective study, diffusion tensor imaging (DTI) and 3D high-resolution

T1WI sequences were acquired in 60 recovered COVID-19 patients (56.67% male; age: 44.10 § 16.00) and 39 age and sex-matched non-COVID-19 controls (56.41% male; age: 45.88 § 13.90). Registered fractional anisotropy (FA), mean diffusivity (MD), axial diffusivity (AD), and radial diffusivity (RD) were quantified for DTI, and an index score system was introduced. Regional volumes derived from Voxel-based Morphometry (VBM) and DTI metrics were compared using analysis of covariance (ANOVA). Two sample t-test and Spearman correlation were conducted to assess the relationships among imaging indices, index scores and clinical information. In this follow-up stage, neurological symptoms were presented in 55% COVID-19 patients. COVID-19 patients had statistically significantly higher bilateral gray matter volumes (GMV) in olfactory cortices, hippocampi, especially AD in the right CR, EC and SFF, and MD in SFF compared with non-COVID-19 volunteers (corrected p value <0.05). Global GMV, GMVs in left Rolandic operculum, right cingulate, bilateral hippocampi, left Heschl's gyrus, and Global MD of WM were found to correlate with memory loss (p value <0.05). GMVs in the right cingulate gyrus and left hippocampus were related to smell loss (p value <0.05). MD-GM score, global GMV, and GMV in right cingulate gyrus were correlated with LDH level (p value <0.05). Study findings revealed possible disruption to micro-structural and functional brain integrity in the recovery stages of COVID-19, suggesting the long-term consequences of SARS-CoV-2.

9) An in silico deep learning approach to multi-epitope vaccine design: a SARS-CoV-2 case study

ZikunYang, Shahin Nazarian - 2020

Vaccines are urgently needed to avoid the spread of this disease. This paper proposes an in silico deep learning approach for prediction and design of a multi-epitope vaccine (DeepVacPred). By combining the in silico immunoinformatics and deep neural network strategies, the DeepVacPred computational framework directly predicts 26 potential vaccine subunits from the available SARS-CoV-2 spike protein sequence. The further use in silico methods to investigate in the 26 subunit candidates and identify the best 11 of them to construct a multi-epitope vaccine for SARS-CoV-2 virus. The human population coverage, antigenicity, allergenicity, toxicity, physicochemical properties and secondary structure of the designed vaccine are evaluated via state-of-the-art bioinformatic approaches, showing good quality of the designed vaccine. The 3D structure of the designed vaccine is predicted, refined and validated by in silico tools. Finally, optimize and insert the codon sequence into a plasmid to ensure the cloning and expression efficiency. In conclusion, this proposed artificial intelligence (AI) based vaccine discovery framework accelerates the vaccine design process and constructs a 694aa multi-epitope vaccine containing 16 B-cell epitopes, 82 CTL epitopes and 89 HTL epitopes, which is promising to fight the SARS-CoV-2 viral infection and can be further evaluated in clinical studies. Moreover, tracing the RNA mutations of the SARS-CoV-2 and ensuring that the designed vaccine can tackle the recent RNA mutations of the virus.

10) Deep learning assisted COVID-19 detection using full CT-scans

Varan Singh Rohila, Deepak Kumar Sharma - 2021

This work proposes an automated diagnosis of COVID-19 infection from CT scans of the patients using deep learning techniques. The proposed model, ReCOV-101 , uses full chest CT scans to detect varying degrees of COVID-19 infection. To improve the detection accuracy, the CT-scans were preprocessed by employing segmentation and interpolation. The proposed scheme is based on the residual network that takes advantage of skip connection, allowing the model to go deeper. The model was trained on a single enterprise-level GPU. It can easily be provided on a network's edge, reducing communication with the cloud, often required for larger neural networks. This work aims to demonstrate a less hardware-intensive approach for COVID-19 detection with excellent performance that can be combined with medical equipment and help ease the examination procedure. With the proposed model, an accuracy of 94.9% was achieved.

11) Deep learning and medical image processing for coronavirus (COVID-19) pandemic: A survey

Sweta Bhattacharya - 2021

In the field of healthcare, deep learning has been implemented in many applications, e.g., diabetic retinopathy detection, lung nodule classification, fetal localization, and thyroid diagnosis. Numerous sources of medical images (e.g., X-ray, CT, and MRI) make deep learning a great technique to combat the COVID-19 outbreak. Motivated by this fact, a large number of research works have been proposed and developed for the initial months of 2020. This paper, focuses on summarizing the state-of-the-art research works related to deep learning applications for COVID-19 medical image processing. Then, provides an overview of deep learning and its applications to healthcare found in the last decade. Next, three use cases from China, Korea, and Canada are also presented to show deep learning applications for COVID-19 medical image processing.

12) Deep facial Recognition using Tensorflow

C. A. Mattmann and Z. Zhang - 2019

Involves tensorflow framework and ConvNet with the help of ADAM optimizer. FaceNet uses the VGG 16 framework, which is called the Visual Geometry Group. Even though other implementations exist, only 48% of the data could be recognized. But with this implementation,77.99% could be recognized. This work was performed using Maverick2 supercomputer.Mainly this research paper describes on Data gathering,processing and supercomputer access for tuning,training and scalingLibraries used includes tf.random_crop; tf.image.random_flip_left_right; tf.random_brightness.

13) Rotating Your Face Using Multi-task DNN

Yim, Junho & Jung - 2015

Face recognition under viewpoint and illumination is a difficult problem. The listed type of multitask learning includes rotating + illumination and reconstruction. This research has taken the Multi-PIE dataset which has more than 750,000 images .Here, Auxiliary DNN combined with an auxiliary task gives out a series interconnection of main DNN.DNN and auxiliary DNN helps to reconstruct the original input image and thus the identity -preserving; else DNN would deviate even further from original. Warp along the path that deviates from ground truth .Locally connected without weight sharing and Pooling leading to FC in order to preserve id. The Cuda-convnet which acts as the DNN toolboxes to control initial Weight, W decay etc.

14) Classification of Graphomotor Impressions – CNN

H. Bin Nazar - 2017

Graphomotor impressions are complex cognitive, perceptual, motor skills. Applying deep learning methods to recognize these visual structures. Bender Gestalt Test (BGT) is to identify visual*[spatial, constructive] disorders and helps to Evaluate the visual-motor maturity and perceptual distortions. In this research, Transfer learning is implemented using pre-trained CNNs. SVM is used for classification. Linear Discriminant Analysis (LDA) is used for pattern recognition classification which are as Group A: Enclosed shapes, Group B: Shapes formed by solid lines, Group C: Shapes formed by dots or small circles/lines.The model includes CNN and act. Relu with few FCs removed and added the data along with AlexNet, VGG, GoogLeNet, ZFNet, ResNet etc which are for pretrained models – FC.

15) Emotion Recognition from multi-channel EEG C-RNN

X. Li - 2016

This research focuses on developing a Hybrid Deep Learning model,a combination of CNN and RNN together on a DEAP dataset. Multi channel EEG is an electrode capturing brainwave activity which indicates Arousal and Valence that denotes pleasant to unpleasant .Multi channel EEG values have greater importance than the combination of facial expressions and voice based approaches For a Long-term emotion monitoring, CNN should be helped by RNN which involves evolution, transition and long term dependencies of the signals. This Encapsulates the multi-channel neurophy-signals into grid-like frames.. Each frame represents the wavelet spectral energy information of the multi-channel signals within a specific time window. RNN tends to vanish or explode. So add GRU and LSTM .LSTM chain has three gate structures which decides what information from prior step should be forgot and what information in current time step

should be added into the main flow 3D CNN for Diagnosis of Alzheimer via MRI Alzheimer-neurodegenerative disease.structural changes; brain.Irreversible neural damage occurs. So early detection is crucial. Building a 3D VGG (CNN).3D MRI into 2D images.2D Conv Filters.

16) Hospitals Deploy AI Tools to Detect COVID-19 on Chest Scans

MEGAN SCUDELLARI - 2020

Deep learning algorithms can diagnose and monitor coronavirus cases from lung images. Already, these deep learning tools are being used in hospitals. Teams in China and the United States published a series of papers. COVID-19 CT scans - hazy darkened spots in the lung. Those became frequent & spread across both lungs the longer a person was infected. RADLogics, for example, is reporting up to 98 percent accuracy; there is little likelihood these AI tools - primary diagnostic tools.

17) Covid-19 Datasets: A survey and future challenges

Junaid Shuja - 2020

COVID-19 have mild or moderate symptoms like coughing, a fever, and shortness of breath. But some who catch the new coronavirus get severe pneumonia in both lungs. COVID-19 pneumonia is a serious illness that can be deadly. Medical images include Chest CT scans and X-rays essential for automated COVID-19 diagnosis. COVID-19 Textual data-sets are thos Case reports, Social media data and Scholarly articles. The main challenges include Contact-less work-flows and some RT-PCR tests, which are Primary sources of diagnosis that show test results positive but can have a normal chest CT.

3. PROBLEM STATEMENT

“Currently COVID-19 is in the "early stages" of the third wave and we want to play our role as the AI engineers to handle the situation by providing AI based solutions to some of the problems.”

Areas of Prediction

- Scans Classification [CT/MRI]
- Audio Signals Diagnosis [Cough/Resp etc]
- Vaccination Drive Forecast
- COVID Genome Viz [Stress etc]

Above mentioned are important medical diagnoses done before a person gets treated with COVID-19. Each area has its own way of predicting the presence of COVID 19 in humans.

➔ Scans classification include MRI/CT scans of brain and lungs.

➔ Audio signal diagnosis includes audio files of cough and breathing files which are then processed with machine learning techniques for data cleansing. After the cleansing of the data, using the XGBoost model we try to predict if the person is negative or positive with COVID 19.

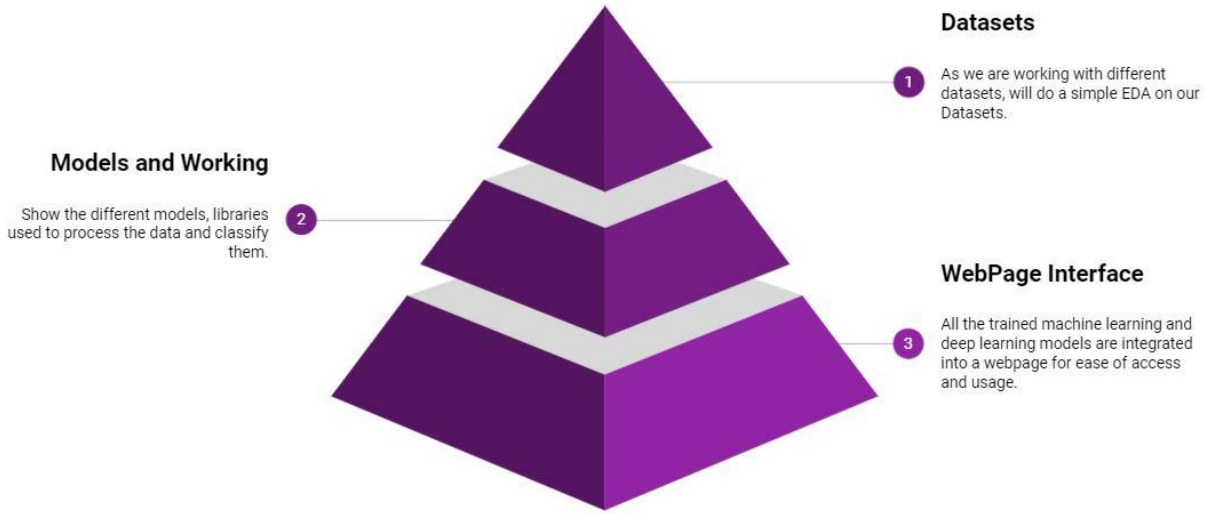
➔ Vaccine forecasts can also help us to understand the changes taking place in virus DNA structure. With the study of virus DNA we can predict if the virus is being more dangerous or becoming immune to the human body.

➔ COVID Genome study helps us to predict the variance of DNA structure of humans and viruses and can predict a variant which can fight against the virus. Therefore COVID Genome visualization gives us the complete picture to study and understand if a vaccine is helping to make the body immune or is helping

viruses to be stronger and also to understand the incubation period of vaccine in a human body.

4. PRACTICAL APPROACH

FLOW we follow now



4.1 DATASETS

Datasets have been procured from different sources:

- CT Scans | MRIs - *Kaggle*
- Cough Datasets - *RPs/GitHub*
- Brain MRIs - *Kaggle*
- Vaccine Datasets - *Kaggle*
- COVID GENOME - *Kaggle*

4.2 MODELS & WORKING

★ Cough/Respiration Audio Signals Diagnosis

STEP-1-: Using the recorded audio files as an input

STEP-2-: With machine learning techniques data cleansing the audio input file

STEP-3-: Using techniques like MFCC, Zero Crossing centroid, features of the data are extracted

STEP-4-: We use XGBoost model we classify the audio signals on positive/negative of COVID-19

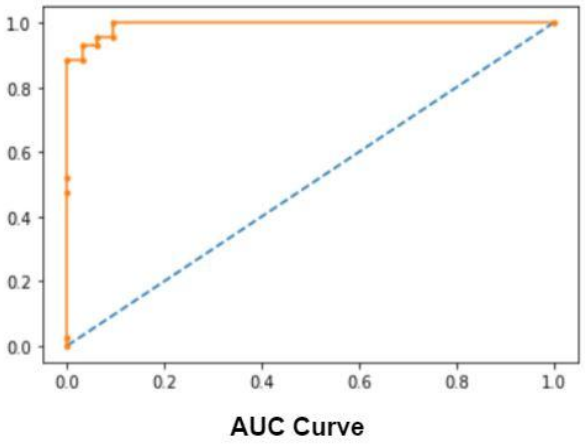
```
Confusion Matrix     : [[30  3]
                        [ 2 41]]

Accuracy             :  0.93421

Recall               :  0.9534

Precision            :  0.9318

F1 Score             :  0.9425
```



★ COVID Lung Scans Classification [CT/MRI]

IMPL 1 - Feature Extraction using EfficientNet-B7(8.4x smaller and 6.1x faster) and classify through LR.

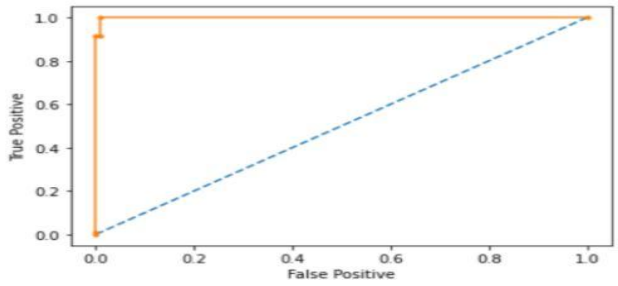
- EfficientNet-B7 pre-trained model for feature extraction with “BCEWithLogitLoss” and “Adam” optimizer.
- Feature Vectors are transformed and can be further used in machine learning classification.
- Logistic Regression for Covid Classification

OUTPUT

```
model = EfficientNet.from_pretrained("efficientnet-b7")
model._fc = nn.Linear(2560, 1)
```

⇩

```
clf = LogisticRegression(max_iter=20000)
clf.fit(X_train, y_train)
```



IMPL-1:

Validation Accuracy: 0.9849

IMPL 2 - KMeans clustering followed by DenseNet121 for classification.

- KMeans to cluster the images have close patterns for Covid and non-Covid separately.
- Before splitting the train and validation sets, we need to make sure that images from the same patients do not appear in both sets to prevent data leakage.

- DenseNet121 pre-trained model with BCE and nAdam optimizer.

OUTPUT

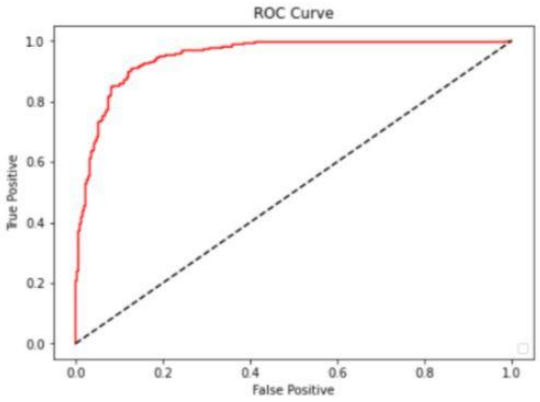
```
kmeans = KMeans(k)
cluster0 = kmeans.fit_predict(X0)
cluster1 = kmeans.fit_predict(X1)
cluster1 += k
cluster = np.concatenate([cluster0, cluster1])
```

⇩

```
    net = tf.keras.applications.DenseNet121(include_top = False,
                                             weights = 'imagenet',
                                             pooling = None)

inp = Input(shape = (IMAGE_SIZE, IMAGE_SIZE, 3))
x = Conv2D(3, (3, 3), padding = 'same')(inp)
x = net(x)
x1 = GlobalAveragePooling2D()(x)
x2 = GlobalMaxPooling2D()(x)
x = Concatenate()([x1, x2])
x = BatchNormalization()(x)
x = Dropout(0.5)(x)
x = Dense(512, activation = 'relu')(x)
x = BatchNormalization()(x)
x = Dropout(0.5)(x)
out = Dense(1, activation = 'sigmoid')(x)

model = Model(inputs = inp, outputs = out)
```



IMPL-2:

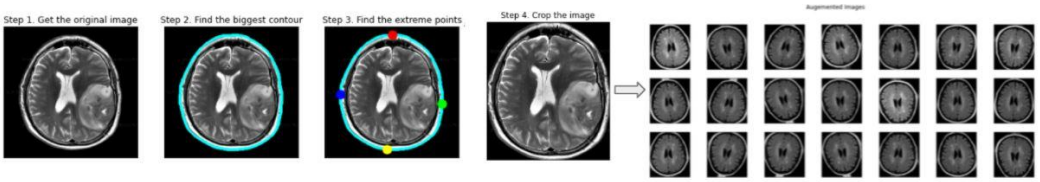
```
Best Validation AUC: 0.95
```

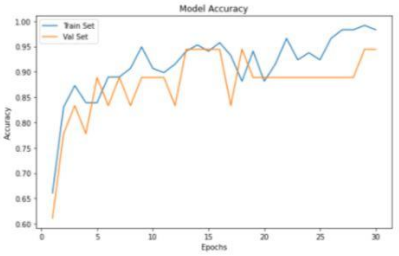
★ Brain Scans Classification [CT/MRI]

Special Data Aug with VGG16:

- Computer Vision techniques (Filtering, Contouring) for cropping brain images.
- 1:20 ration Image Augmentation for better training the model.
- VGG16 pre-trained model with Categorical_Crossentropy and nAdam optimizer.

OUTPUT






```
base_model = VGG16(
    weights=vgg16_weight_path,
    include_top=False,
    input_shape=IMG_SIZE + (3,)
)
```

IMP:

val_accuracy: 0.9444

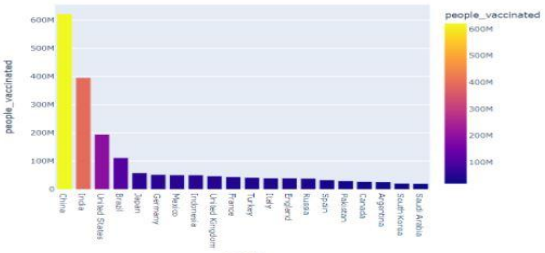
★ Vaccination Drive Forecasting

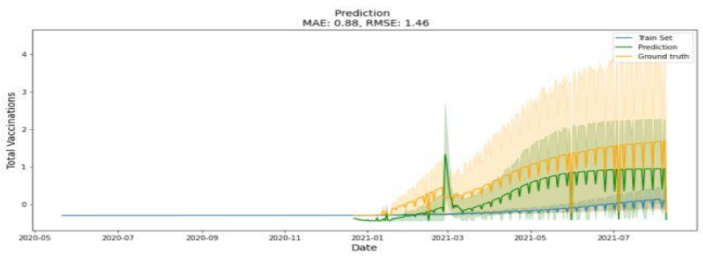
Model used to forecast the Vaccination Drive in different countries:

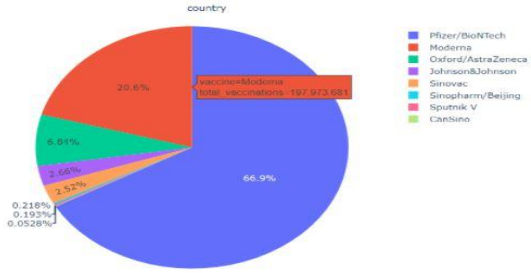
- FB-Prophet
- Auto-Arima
- LSTM

OUTPUT

```
model = pm.auto_arima(y_train, start_p=1, start_q=1,
                      test='adf',       # use adftest to find optimal 'd'
                      max_p=3, max_q=3, # maximum p and q
                      m=1,              # frequency of series
                      d=None,           # let model determine 'd'
                      seasonal=False,   # No Seasonality
                      start_P=0,
                      D=0,
                      trace=True,
                      error_action='ignore',
                      suppress_warnings=True,
                      stepwise=True)
```



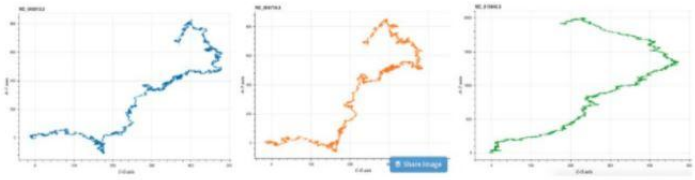




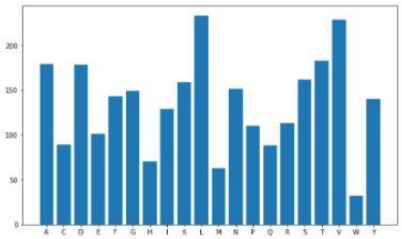
★ COVID Genome Data Visualization

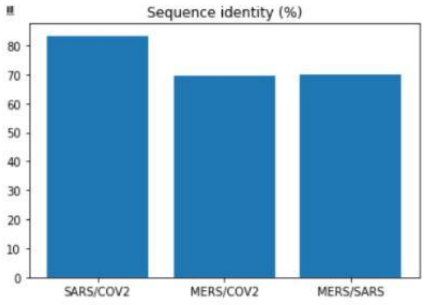
- Analyzing the COVID-19 DNA sequence data, and tried to get as many insights resulted in number of **Leucine(L)** and **Valines(V)** high in this protein
- **Pairwise sequence alignment** compares only two sequences at a time and provides the best possible sequence alignments.
- **Pairwise** is easy to understand and exceptional to infer from the resulting sequence alignment.

OUTPUT



DNA visualization each of COV2, SARS, and MERS respectively.

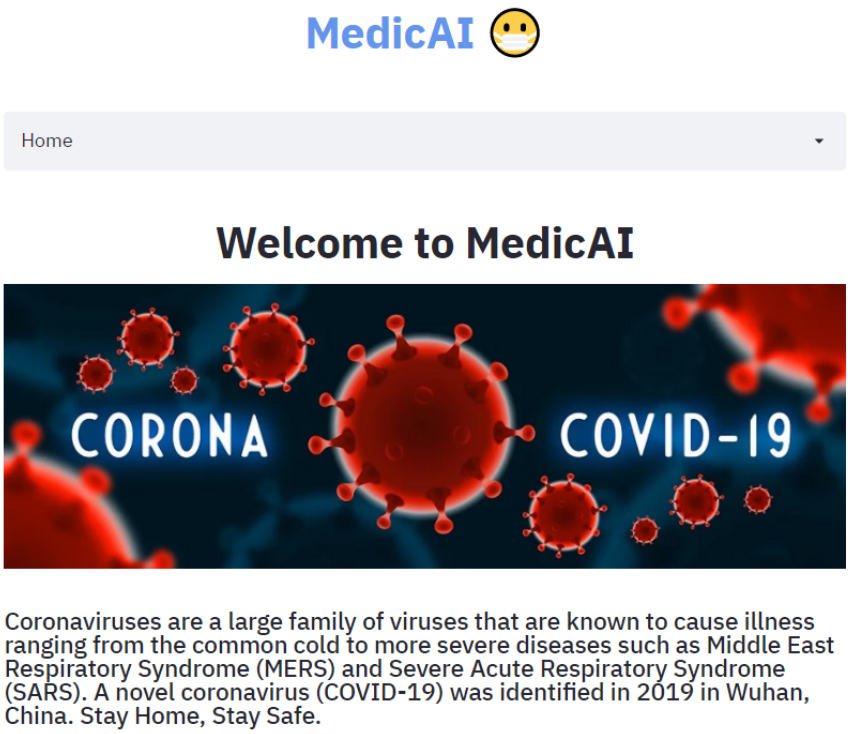





```
Similarity scores between

COVID-19 & SARS genome sequences:        20885.00000000038 (69.84%)
COVID-19 & MERS genome sequences:        15122.599999998136 (50.57%)
COVID-19 & Civet_SL_CoV genome sequences:        20616.90000000066 (68.95%)
COVID-19 & Bat_SL_CoV genome sequences:  20706.000000000255 (69.24%)
COVID-19 & Ebola genome sequences:       10233.39999999796 (34.22%)
COVID-19 & Camel_CoV genome sequences:   15134.599999998123 (50.61%)
COVID-19 & Malaria genome sequences:     8.800000000105774 (0.03%)
COVID-19 & HIV genome sequences:         5962.5999999990445 (19.94%)
COVID-19 & Hedgehog_CoV genome sequences:        15227.29999999811 (50.92%)
```

4.3 WEBPAGE INTERFACE



5. RESULTS

Dataset	Model Accuracy
Cough/Respiration Audio Signals Diagnosis	Accuracy : 0.94
IMPL 1 - Feature Extraction using EfficientNet and classify with LR	Accuracy : 0.9849
IMPL 2 - K Means clustering with DenseNet121 for classification	Accuracy : 0.89
Brain Scans Classification [CT/MRI] - Special Data Aug with VGG16	Accuracy : 0.9444
Vaccination Drive Forecasting	RMSE : 2.43(Prophet), 2.34(ARIMA), 1.46(LSTM)
Covid-19 Genome Dataset	Similarity : 0.69(SARS)

6. CONCLUSION

In this paper, AI based deep learning models have been worked upon, and Pre-trained models show a better and more heavily efficient model performance and accuracy over handmade CNN models. Pre-processing techniques using OpenCV have been used for better working of our model. Also, Pneumonia cases also are distinguished from usual COVID19 which was a serious concern in all previous research papers. Various ways to deal with models are applied for contextual investigations and experimentation has brought about great execution and precise outcomes. Future works have emerged from these referenced examination works. Deep Convolutional Neural Networks along with pre-trained models shows a better and more heavily efficient model performance and accuracy.

Additionally, a choice combination based methodology is likewise proposed, which consolidates the prediction of every one of the individual Deep Convolutional neural Network models, so as to improve the prescient exhibition.

Coronavirus is a worldwide issue, and it not just hugely affects the strength of residents yet additionally on the worldwide economy and how to recognize it utilizing lung CT examine pictures from the deliberately chosen information of lung CT check COVID19-contaminated patients from around the world.

Besides, despite the fact that the model's proposed technique shows extraordinary guarantee, there's even a lot of space for possibly improving the prescient exhibition of the methodology. As of late, thoughts like Image Augmentation, Transfer Learning. The thoughts need to be investigated as a feature of things to come to work.

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