Classification of Covid and Non Covid using DFnet and Machine learning Technique

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***Abstract*—** *Deep Learning has improved multi-fold in recent years and it has been playing a great role in image classification which also includes medical imaging. Convolutional Neural Networks (CNN) has been performing well in detecting many diseases including Coronary Artery Disease, Malaria, Alzheimer's disease, different dental diseases, and Parkinson's disease. Like other cases, CNN has a substantial prospect in detecting COVID-19 patients with medical images like chest Xrays and CTs. Coronavirus or COVID-19 has been declared a global pandemic by the World Health Organization (WHO). In this paper, a system is created that helps to identify and detect Covid-19 disease through X-ray radiation. Here, we can use both deep learning as well as machine learning algorithm is Deep Fusion Net and KNN of the system. Good results have been obtained in detecting Covid- 19 condition of patient normal and abnormality of the system.*

I. INTRODUCTION

SARS-CoV-2 pandemic has affected millions of people worldwide. To date, several million people have gone to the valley of death and many more are getting affected by it on daily bases. Hundreds of subjects don't get diagnosed with COVID-19 at their early stage due to the shortage of testing equipment. When these undiagnosed early stage subjects with no physical symptoms come in contact with the healthy individuals, they transfer the virus to healthy people and this chain continues. The current approach to test COVID-19 is by using reverse transcription-polymerase chain reaction (RT-PCR). Patient's specimen is collected through subject's nose or throat and then sent to the laboratories for diagnostic purpose. This process is time consuming and due to its huge demand, there is a shortage of these kits. Round the globe, researchers are trying to find alternative techniques to diagnose corona virus in affected people. Radiological equipment such as X-ray and CT-scan came up as potential alternatives for COVID-19 diagnosis. A healthy patients, COVID-19, and viral pneumonia cases.

Deep learning is a machine learning method. It allows us to train artificial intelligence to predict outputs with a given data set. Both supervised and unsupervised learning can be used to train artificial intelligence. Deep learning is used in voice and face recognition, disease detection, defense, and security areas. The word deep in deep learning represents artificial neural networks. Artificial neural networks are inspired by the human brain. Just like the human brain, it consists of neurons. The difference between them is the amount and speed of learning. In other words, data set and processing power are needed to train artificial neural networks. The quality of machine learning methods depends on choosing the right features. Various preprocesses, size reduction, feature selection, etc. transactions are made. In order to reduce the cost at this stage, it is necessary to get rid of the dependence on features. This is where deep learning comes into play. Deep learning takes care of these things we do in machine learning. Deep learning uses many nonlinear layers for feature extraction and feature modification. In sequential layers, the exit of the previous one is the entrance of the next. Deep learning makes a hierarchical selection that best represents the data, rather than manual feature selection. At the present, the world is going through the Corona pandemic, which stopped the world in various fields. Because the epidemic is spreading rapidly in narrow places, many places have been closed to prevent the spread of the epidemic. The discovery of Corona disease in its early stages makes the disease's recovery rate higher, therefore many studies have been conducted regarding the discovery of the covid-19 disease. The deep learning model achieved high performance in disease diagnosis and detection. Deep learning models have achieved good results in recognition and discovery processes. During the diagnosis of Covid-19 disease. Many studies have researched the properties of radiography in aid in diagnosis and treatment.

1.1 The Main Contribution

- Here, the datas can be taken in the CT scan image to predict the disease by using Image Processing techniques.
- Steps are Preprocessing, Segmentation, Feature Extraction and Classification followed to show the results based on the Software part are age of the brain image.
- Here, we can the Deep Fusion Neural network as well as the machine learning techniques are used to show the result.

- In the Pre Processing, we can use the Gaussian method are used
- In the Segmentation, we can use the FCM method are used
- In the Feature Extraction Part, we can use the DWT and GLCM method are used
- In the Classification part, we can use the KNN model

1.2 Image Processing:

Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image. Nowadays, image processing is among rapidly growing technologies. It forms core research area within engineering and computer science disciplines too.

Image processing basically includes the following three steps:

- Importing the image via image acquisition tools;
- Analysing and manipulating the image;
- Output in which result can be altered image or report that is based on image analysis.

There are two types of methods used for image processing namely, analogue and digital image processing. Analogue image processing can be used for the hard copies like printouts and photographs. Image analysts use various fundamentals of interpretation while using these visual techniques. Digital image processing techniques help in manipulation of the digital images by using computers. The three general phases that all types of data have to undergo while using digital technique are pre-processing, enhancement, and display, information extraction.

Digital image processing is the use of a digital computer to process digital images through an algorithm. As a subcategory or field of digital signal processing, digital image processing has many advantages over analog image processing. It allows a much wider range of algorithms to be applied to the input data and can avoid problems such as the build-up of noise and distortion during processing. Since images are defined over two dimensions (perhaps more) digital image processing may be modeled in the form of multidimensional systems. The generation and development of digital image processing are mainly affected by three factors: first, the development of computers; second, the development of mathematics (especially the creation and improvement of discrete mathematics theory); third, the demand for a wide range of applications in environment, agriculture, military, industry and medical science has increased. Digital Image Processing means processing digital image by means of a digital computer. We can also say that it is a use of computer algorithms, in order to get enhanced image either to extract some useful information. A image is defined as a two-dimensional function, **F(x,y),** where x and y are spatial coordinates, and the amplitude of **F** at any pair of coordinates (x,y) is called the **intensity** of that image at that point. When x,y, and amplitude values of **F** are finite, we call it a **digital image**. In other words, an image can be defined by a two-dimensional array specifically arranged in rows and columns. Digital Image is composed of a finite number of elements, each of which elements have a particular value at a particular location. These elements are referred to as picture elements, image elements, and pixels. A Pixel is most widely used to denote the elements of a Digital Image.

1.3 Types of an image

- **BINARY IMAGE–** The binary image as its name suggests, contain only two pixel elements i.e 0 & 1,where 0 refers to black and 1 refers to white. This image is also known as Monochrome.
- **BLACK AND WHITE IMAGE–** The image which consist of only black and white color is called BLACK AND WHITE IMAGE.
- **8 bit COLOR FORMAT–** It is the most famous image format. It has 256 different shades of colors in it and commonly known as Grayscale Image. In this format, 0 stands for Black, and 255 stands for white, and 127 stands for gray.
- **16 bit COLOR FORMAT–** It is a color image format. It has 65,536 different colors in it. It is also known as High Color Format. In this format the distribution of color is not as same as Gray scale image.

1.4 Machine Learning

Machine learning (ML) is a type of artificial intelligence (AI) that allows software applications to become more accurate at predicting outcomes without being explicitly programmed to do so. Machine learning algorithms use historical data as input to predict new output values. Recommendation engines are a common use case for machine learning. Other popular uses include fraud detection, spam filtering, malware threat detection, business process automation (BPA) and predictive maintenance. Machine learning is important because it gives enterprises a view of trends in customer behavior and business operational patterns, as well as supports the development of new products. Many of today's leading companies, such as Facebook, Google and Uber, make machine learning a central part of their operations. Machine learning has become a significant competitive differentiator for many companies.

Machine learning (ML) is the study of computer algorithms that can improve automatically through experience and by the use of data. It is seen as a part of artificial intelligence. Machine learning algorithms build a model based on sample data, known as "training data", in order to make predictions or decisions without being explicitly programmed to do so. Machine learning algorithms are used in a wide variety of applications, such as in medicine, email filtering, speech recognition, and computer vision, where it is difficult or unfeasible to develop conventional algorithms to perform the needed tasks. A subset of machine learning is closely related to computational statistics, which focuses on making predictions using computers; but not all machine learning is statistical learning. The study of mathematical optimization delivers methods, theory and application domains to the field of machine learning. Data mining is a related field of study, focusing on exploratory data analysis through unsupervised learning. Some implementations of machine learning use data and neural networks in a way that mimics the working of a biological brain. In its application across business problems, machine learning is also referred to as predictive analytics.

1.4.1 Types of Machine Learning

- **Supervised learning:** In this type of machine learning, data scientists supply algorithms with labeled training data and define the variables they want the algorithm to assess for correlations. Both the input and the output of the algorithm is specified.
- **Unsupervised learning:** This type of machine learning involves algorithms that train on unlabeled data. The algorithm scans through data sets looking for any meaningful connection. The data that algorithms train on as well as the predictions or recommendations they output are predetermined.
- **Semi-supervised learning:** This approach to machine learning involves a mix of the two preceding types. Data scientists may feed an algorithm mostly labeled training data, but the model is free to explore the data on its own and develop its own understanding of the data set.
- **Reinforcement learning:** Data scientists typically use reinforcement learning to teach a machine to complete a multi-step process for which there are clearly defined rules. Data scientists program an algorithm to complete a task and give it positive or negative cues as it works out how to complete a task. But for the most part, the algorithm decides on its own what steps to take along the way.

1.4.2 Main Parts of Machine Learning

- **A Decision Process:** In general, machine learning algorithms are used to make a prediction or classification. Based on some input data, which can be labelled or unlabeled, your algorithm will produce an estimate about a pattern in the data.
- **An Error Function:** An error function serves to evaluate the prediction of the model. If there are known examples, an error function can make a comparison to assess the accuracy of the model.
- **An Model Optimization Process**: If the model can fit better to the data points in the training set, then weights are adjusted to reduce the discrepancy between the known example and the model estimate. The algorithm will repeat this evaluate and optimize process, updating weights autonomously until a threshold of accuracy has been met.

1.5 Deep Learning

A class of machine learning techniques that exploit many layers of non-linear information processing for supervised or unsupervised feature extraction and transformation, and for pattern analysis and classification. “A sub-field within machine learning that is based on algorithms for learning multiple levels of representation in order to model complex relationships

among data. Higher-level features and concepts are thus defined in terms of lower-level ones, and such a hierarchy of features is called a deep architecture. Most of these models are based on unsupervised learning of representations." "A sub-field of machine learning that is based on learning several levels of representations, corresponding to a hierarchy of features or factors or concepts, where higher level concepts are defined from lower-level ones, and the same lower-level concepts can help to define many higher-level concepts. Deep learning is part of a broader family of machine learning methods based on learning representations. An observation (Eg. an image) can be represented in many ways, but some representations make it easier to learn tasks of interest (e.g., is this the image of a human face?) from examples, and research in this area attempts to define what makes better representations and how to learn them. Deep learning is a set of algorithms in machine learning that attempt to learn in multiple levels, corresponding to different levels of abstraction. It typically uses artificial neural networks. The levels in these learned statistical models correspond to distinct levels of concepts, where higher-level concepts are defined from lower-level ones, and the same lower-level concepts can help to define many higher-level concepts."

1.5.1 Three Categories of DL

Deep networks for unsupervised or generative learning, which are intended to capture high-order correlation of the observed or visible data for pattern analysis or synthesis purposes when no information about target class labels is available. Unsupervised feature or representation learning in the literature refers to this category of the deep networks. When used in the generative mode, may also be intended to characterize joint statistical distributions of the visible data and their associated classes when available and being treated as part of the visible data. In the latter case, the use of Bayes rule can turn this type of generative networks into a discriminative one for learning.

2) Deep networks for supervised learning, which are intended to directly provide discriminative power for pattern classification purposes, often by characterizing the posterior distributions of classes conditioned on the visible data. Target label data are always available in direct or indirect forms for such supervised learning. They are also called discriminative deep networks.

3) Hybrid deep networks, where the goal is discrimination which is assisted, often in a significant way, with the outcomes of generative or unsupervised deep networks.

1.5.2 Algorithm of DL

Convolutional Neural Networks (CNNs) CNNs adopt the Bacak-propogation to update the weights between every two adjacent layers. Therefore, one entire CNNs procedure helps to calculate the weight update. We should run this procedure several times until convergence is reached. Other improvements like using Fast Fourier Transform (FFT) algorithms to filter the input data or using max-pooling to sub sampling are related to either the convolution process or sub sampling process. Most of them are based on the classical methods in signal processing.

Deep Belief Networks (DBNs) Hinton and his group raised five learning strategies for the multi-layer networks, where the last strategy is used in training a DBNs which was designed to allow higher-level feature detectors to communicate their needs to lower-level ones whilst also being easy to implement in layered networks of stochastic, binary neurons that have activation states of 1 or 0 and turn on with a probability that is a smooth non-linear function of the total input they received. The learning procedures of DBNs consist of the pre-training phase and fine tuning phase.

2.1 PROBLEM DEFINITION

- In our Existing method, the paper demonstrated to detect the covid condition by using Machine Learning techniques.
- Segmentation of brain tissues like Fuzzy C-mean along with the tumor region using our previous approach.
- Some drawback can be came, to overcome this drawback we implemented the Proposed method of the system.

2.2 DRAWBACKS

- Segmentation region will get less accurate
- It gives train for limited amount of data.

II. DEVELOPMENT PROCESS

2.1 Input Design

The input design is the link between the information system and the user. It comprises the developing specification and procedures for data preparation and those steps are necessary to put transaction data in to a usable form for processing can be achieved by inspecting the computer to read data from a written or printed document or it can occur by having people keying the data directly into the system. The design of input focuses on controlling the amount of input required, controlling the errors, avoiding delay, avoiding extra steps and keeping the process simple. The input is designed in such a way so that it provides security and ease of use with retaining the privacy. Input Design considered the following things:

- What data should be given as input?
- How the data should be arranged or coded?
- The dialog to guide the operating personnel in providing input.
- Methods for preparing input validations and steps to follow when error occur.

2.2 Objectives

1. Input Design is the process of converting a user-oriented description of the input into a computer-based system. This design is important to avoid errors in the data input process and show the correct direction to the management for getting correct information from the computerized system.

2. It is achieved by creating user-friendly screens for the data entry to handle large volume of data. The goal of designing input is to make data entry easier and to be free from errors. The data entry screen is designed in such a way that all the data manipulates can be performed. It also provides record viewing facilities.

3. When the data is entered it will check for its validity. Data can be entered with the help of screens. Appropriate messages are provided as when needed so that the user will not be in maize of instant. Thus, the objective of input design is to create an input layout that is easy to follow.

4. For automatic detection of diabetic retinopathy in retinal images by using Machine Learning

2.3 Output Design

A quality output is one, which meets the requirements of the end user and presents the information clearly. In any system results of processing are communicated to the users and to other system through outputs. In output design it is determined how the information is to be displaced for immediate need and also the hard copy output. It is the most important and direct source information to the user. Efficient and intelligent output design improves the system's relationship to help user decision-making.

1. Designing computer output should proceed in an organized, well thought out manner; the right output must be developed while ensuring that each output element is designed so that people will find the system can use easily and effectively. When analysis design computer output, they should Identify the specific output that is needed to meet the requirements.

2. Select methods for presenting information.

3. Create document, report, or other formats that contain information produced by the system.

The output form of an information system should accomplish one or more of the following objectives.

- Convey information about past activities, current status or projections of the
- Future.
- Signal important events, opportunities, problems, or warnings.
- Trigger an action.
- Confirm an action.

III. PROPOSED METHOD

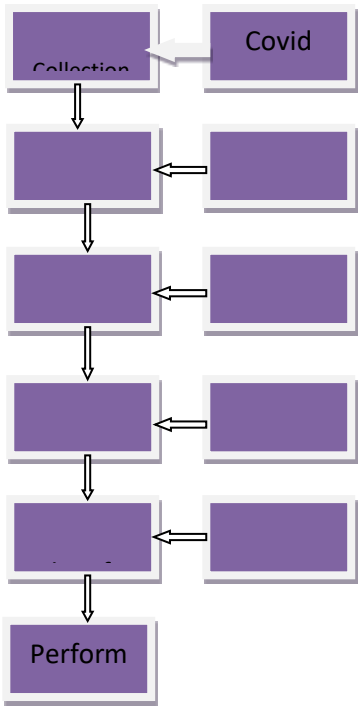
- In our Proposed method, to detect the covid condition based on the normal and abnormal condition of the patient by using both machine learning as well as the deep learning techniques.

- Steps are Collection of datas, Pre-Processing, Segmentation, Feature Extraction, Classification and Performance metrics can be calculated.
- All the Process can be completed, finally results are employed to show the results in the normal and abnormal condition of the patient of the system.

Advantages

- Better Performance.
- Accuracy is more
- Precision is more

IV. SYSTEM ARCHITECTURE



Modules Used

- **Input Image:** A Collection of data is called datasets. Let us consider, Brain CT Image databases namely, normal and abnormal prediction of the patient of Covid. Here, an input data can be obtained in the image format to predict the disease of the system.
- **Preprocessing:** Data cleaning, smoothing, grouping or Filtering the image. Data can require preprocessing techniques to ensure accurate, efficient, or meaningful analysis. Data cleaning refers to methods for finding, removing, and replacing bad or missing data. Here, the Gaussian method is used in the Preprocessing techniques. A Gaussian filter is used to reduce the noise in the input image of the system.
- **Network Creating:** Here, we can create the network are DFNN deep fusion neural network are used of the system. Deep image completion usually fails to harmonically blend the restored image into existing content, especially in the boundary area. Deep Fusion uses advanced machine learning to do pixel-by-pixel processing of photos, optimizing for texture, details and noise in every part of the photo.
- **Segmentation:** Image segmentation is the process of partitioning a image into multiple segments (sets of pixels, also known as image objects). The goal of segmentation is to simplify or change the representation of an image into something that is more meaningful and easier to analyze. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. More precisely, image segmentation is the process of assigning a label to

every pixel in an image such that pixels with the same label share certain characteristics. Here, segmentation can be used in the FCM of the system. A FCM is a one type of technique is used to segment the image from the input data.

- **Feature Extraction:** Feature extraction involves reducing the number of resources required to describe a large set of data. When performing analysis of complex data one of the major problems stems from the number of variables involved. Analysis with a large number of variables generally requires a large amount of memory and computation power, also it may cause a classification algorithm to overfit to training samples and generalize poorly to new samples. Feature extraction is a general term for methods of constructing combinations of the variables to get around these problems while still describing the data with sufficient accuracy. Here, Feature Extraction method can be obtained in the DWT and GLCM.
- **Classification:** Classification is a term used both about the process to classify disease based on the normal and abnormal of the patient. A classification process can be obtained to training the network of the system. Here, classifications techniques can be obtained from using are KNN model used to classify the result of the model. Finally, the performance of the system can be analysed.

V. APPLICATION

The utility of open-access brain morphology data is numerous, ranging from observing novel patterns of age-related differences in subcortical structures to the development of more robust cortical parcellation atlases, with these advances being translatable to improved methods for characterizing clinical disorders. Moreover, structural CT are generally more robust than functional MRIs, relative to potential artifacts and in being not task-dependent, resulting in large potential yields. Medical images will also benefit a wide range of applications in other industrial fields, including civil infrastructures like tunnels, bridges, and dams, as well as metallic surface and rock surface. Detection efficiency can be obtained in the tunnel application, thousands of images are collected, making the processing of so many images a huge task. Therefore, the image processing process must be fast and efficient.

- Image sharpening and restoration
- Medical field
- Remote sensing
- Transmission and encoding
- Machine/Robot vision
- Color processing
- Pattern recognition
- Video processing
- Microscopic Imaging

Image sharpening and restoration

Image sharpening and restoration refers here to process images that have been captured from the modern camera to make them a better image or to manipulate those images in way to achieve desired result. It refers to do what Photoshop usually does. This includes Zooming, blurring , sharpening , gray scale to color conversion, detecting edges and vice versa , Image retrieval and Image recognition.

Medical field

The common applications of DIP in the field of medical is

- Gamma ray imaging
- PET scan
- X Ray Imaging
- Medical CT

- UV imaging

UV imaging

In the field of remote sensing , the area of the earth is scanned by a satellite or from a very high ground and then it is analyzed to obtain information about it. One particular application of digital image processing in the field of remote sensing is to detect infrastructure damages caused by an earthquake. As it takes longer time to grasp damage, even if serious damages are focused on. Since the area effected by the earthquake is sometimes so wide , that it not possible to examine it with human eye in order to estimate damages. Even if it is , then it is very hectic and time-consuming procedure. So, a solution to this is found in digital image processing. An image of the affected area is captured from the above ground and then it is analyzed to detect the various types of damage done by the earthquake.

VI. CONCLUSION

Mass testing and early detection of COVID-19 play an important role in preventing the spread of this recent global pandemic. Time, cost, and accuracy are the few major factors in any disease detection process specially COVID-19. To address these issues, a Deep Fusion Network based model is proposed in this paper for detecting COVID-19 cases from patients' chest Xrays. A deep learning technology as well as the machine learning technology was used to detect the emerging disease Covid-19 via chest X-ray, two models are used for system. The models showed good performance in the diagnostic process, as the training time are good prediction result of the system. A chest X-ray images have been examined for the diagnosis of COVID-19 using deep learning methods and machine learning model like Deep Fusion network and KNN model are used. Finally, all the model are successfully designed and implemented

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