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Chest X-Ray Examiner

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Abstract: ***The most common image taken in the medical field for diagnosis of any ailment affecting the chest is chest radiography (Chest X-ray). The most common image taken in the medical field for diagnosis of any ailment affecting the chest or neighboring area is chest radiography (Chest X-ray). The use of this approach has been limited due to a scarcity of qualified radiologists.***
To address this issue, we are developing a computer-aided diagnosis system for chest X-ray disease classification that employs DNN (Deep Neural Network) Transfer learning. CXE (Chest X-Ray Examiner) is a web-based program that works in conjunction with our machine learning console.
The most common image taken in the medical field for diagnosis of any ailment affecting the chest is chest radiography (Chest X-ray). There is a Rest API application that serves as a middleman between our user interface and machine learning applications. We used our machine learning console application produced by ML.NET to train our own model using the Mobile.Net v3 Image categorization method.
By obtaining X-Ray images from end users, the Chest X-Ray Examiner (CXE) can classify the chest disease name and forecast the accuracy level of that disease.
Keywords: Chest X-ray, DNN, API, ML.NET, Chest X-Ray Examiner

I. INTRODUCTION

Chest radiography (also known as chest X-ray) is the most popular imaging used in the medical sector to diagnose any ailment that affects the chest or the surrounding area in [02]. The use of this approach has been limited due to a scarcity of qualified radiologists. To solve this challenge, we've devised a plan to develop a computer-aided diagnosis for chest X-rays based on DNN Transfer learning. Deep neural networks (DNNs) are now widely employed in a variety of artificial intelligence (AI) applications, such as computer vision, speech recognition, and robotics [05]. When a representation model of a system does not exist or is too complex for practical purposes, artificial neural networks are deployed. Artificial neural networks have the advantage of being able to generate a system model directly from a set of samples. Furthermore, artificial neural networks can function even when the experimental data contains noise or distortion. Artificial neural networks have been utilized for pattern recognition, prediction, control, classification, and a variety of other applications in recent decades [06].

Transfer learning is a technique in which a model trained on one problem is applied in some way on a second problem that is connected to it [04].Transfer learning is a deep learning technique that involves training a neural network model on a problem that is similar to the one being solved. The trained model's layers are then employed in a new model trained on the problem of interest.Transfer learning can reduce the training time for a neural network model while also lowering the generalization error. CXE (Chest X-Ray Examiner) is a web-based program that allows the user to upload X-Ray images. The image is sent to our Rest API application by our BLAZOR UI application after it is uploaded. The image will be processed by our API application using our machine learning model that has been developed.Finally, our API application informs our web frontend application with the projected outcome. Using our machine learning console project, we created our own model to train. Machine learning is the concept that there are general algorithms that can teach us something useful about a piece of data without requiring us to build specialized code tailored to the situation. We give data to the generic algorithm instead of writing code, and it creates its own logic depending on the data.

II. OBJECTIVES

The main goals of this study, as stated above, are to determine the disease name from any X-Ray scans. Throughout our project, we will address the following three major issues:

1) How can a disease be diagnosed only based on an x-ray report?
2) How can we increase the efficiency of our CXE?
3) What can we do to make it more user-friendly?

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All disease identification will be 0.85 percent accurate after this experiment is completed. We created a prototype to represent the complete job on a small size.

No matter how much experience we have or how much we have accomplished, we can all use a little incentive now and then to keep going. Every guy wishes to produce something new for the betterment of society. In the current situation, we can see that Sickness Classifier of any kind of disease is not very modern or evolved in the medical area. In past years, we have seen a large number of death notices or undefined chest disease news on social media in our daily lives.

III.LITERATURE REVIEW

The most common image taken in the medical field for diagnosis of any ailment that can impact the chest or neighboring area is chest radiography (Chest X-ray). The use of this approach has been limited due to a scarcity of qualified radiologists. To solve this challenge, we've devised a plan to develop a convolutional neural network-based computer-aided diagnostic for chest X-rays (CNN). CNN is a supervised deep learning algorithm that has gained widespread recognition in the medical profession for its autonomous and adaptable learning capabilities.

In identifying medical conditions, it has proven to be more faster and more accurate than human radiologists. A huge amount of labeled dataset is required to create a precise resulting classifying neural network, however a pre-trained CNN utilizing a large labeled dataset can also be employed with some fine-tuning. In this study, we will build a deep learning neural network using CNN from scratch, which will analyze the chest X-ray and diagnose the disease and classify within the 15 classes, i.e., 05 pre-known lung diseases and a healthy pair of lungs, using a large number of frontal view X-ray images of unique patients each diagnosed with any one of the 14 lung diseases [38].

Electromagnetic waves are a form of radiation that includes X-rays. X-ray imaging provides images of your internal organs. The photos depict your body parts in various colours of black and white. Because various tissues absorb different amounts of radiation, this is the case. Because calcium absorbs the most x-rays, bones appear white. Fat and other soft tissues are less absorbent and appear gray. Because air absorbs the least, lungs appear black[09].

X-rays are most commonly used to look for fractures (broken bones), but they can also be utilized for other purposes. Chest x-rays, for example, can detect pneumonia.

X-rays are used in mammograms to look for breast cancer.Artificial intelligence (AI) is the simulation of human intelligence in robots that have been trained to think and act like humans. The phrase can also refer to any machine that demonstrates human-like characteristics like learning and problem-solving.

Artificial intelligence's finest feature is its ability to reason and take actions that have the best possibility of reaching a certain goal. Machine learning is a subset of artificial intelligence that relates to the concept of computer programs learning from and adapting to new data without the assistance of humans. Deep learning algorithms allow for this autonomous learning by absorbing large volumes of unstructured data including text, photos, and video.

Machine learning is an application of artificial intelligence (AI) that allows systems to learn and improve on their own without having to be explicitly programmed. Machine learning is concerned with the creation of computer programs that can access data and learn on their own.The learning process starts with observations or data, such as examples, direct experience, or instruction, in order to find patterns in data and make better decisions in the future based on the examples we provide. The main goal is for computers to learn without human involvement or aid and modify their activities accordingly.

When data resources are sparse, transfer learning is a prominent strategy in computer vision problems using deep neural networks. As a result, when we start a new task, we use pre-trained models that have solved comparable problems before. Due to the scarcity of real samples, this method is critical in medical image processing. Feature extraction is done in deep neural networks by sending raw data through models that specialize in other tasks.

Deep learning models like RESNET come to mind here, where the last layer knowledge is used as input to a new classifier. A typical strategy called pre-trained models approach can be used to accomplish transfer learning in deep learning situations. The goal of this project is to create an improved Chest X-ray Examiner (CXE) system that will make identifying illness names from X-ray data much easier [09]. Machine learning and AI will be used to implement the system. For both the user interface and backend development, we chose C# as the primary programming language.

The database was created with Microsoft SQL Server, and the simulation was displayed with Blazor UI. However, the real procedure will operate using an existing database and server.

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IV. PROJECT DESIGN

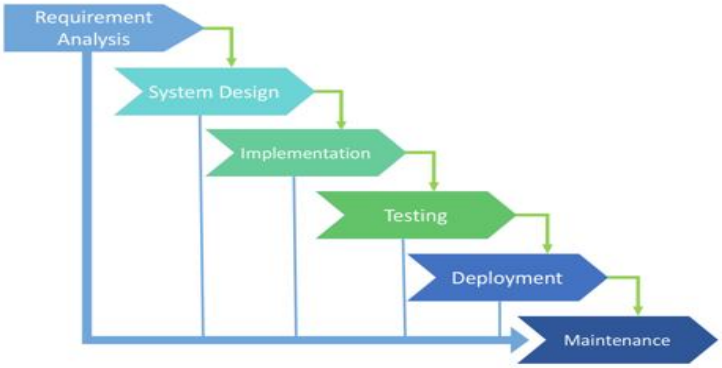


Fig.1: Six Face of Software Development Life Cycle

The system and software designs are created in this phase using the requirements specifications that were reviewed in the first phase. System design aids in the specification of hardware and system requirements, as well as the definition of overall system architecture. The system design specifications are used as input for the model's next phase. The testers create the Test strategy in this phase, which includes what to test and how to test. The work is separated into modules/units after getting the system design documentation, and actual coding begins. Because code is developed during this phase, it is the developer's primary emphasis. This is the most time-consuming stage of the software development process. After thoroughly testing the disease. Customers will conduct beta testing as soon as the product is handed over to them. They will notify the engineering team if any adjustments are required or if any bugs are discovered. The final deployment will take place once those adjustments have been made or the bugs have been fixed.

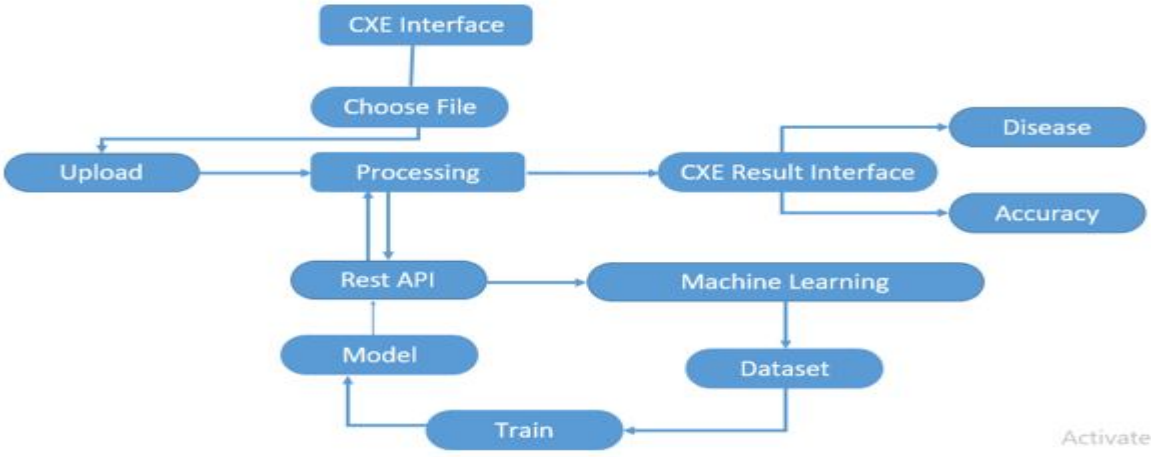


Fig.2: Data flow diagram of CXE

The steps outlined below are used to carry out our project.

1) In the first phase, users can upload their x-ray image through our blazor app (see figure 2).
2) Once their image has been uploaded, it will be sent to the rest API or backend server.
3) As a result, the image will be sent to the Rest API server by our blazor app. Our rest API will process the image using our machine learning model
4) After processing the image, the machine learning model will transmit the result back to the rest API server
5) The rest API will receive data such as disease name and accuracy. Our rest API server will provide the data to the Blazor app in JSON format.
6) The result will now be displayed in our Web-UI.

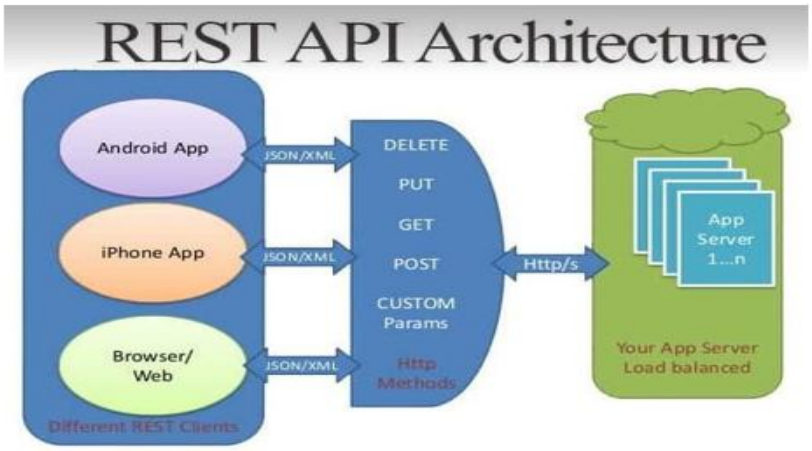


Fig.3: Rest API Architecture

After a successful upload, the image is transferred to an API or backend server to arrange the exact processes (figure 3). The data is called here for checking in the API part.

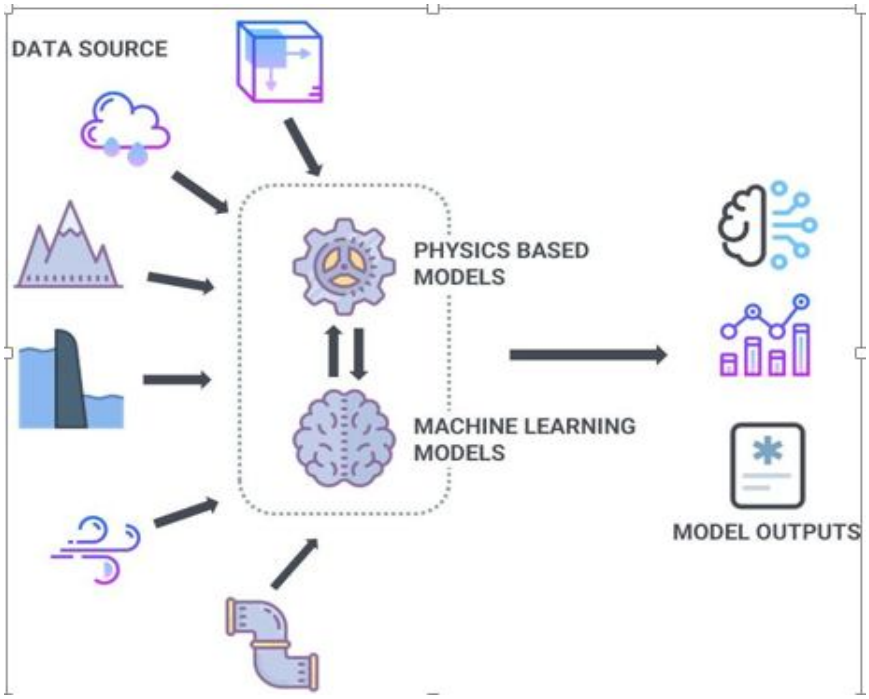


Fig.4: Machine learning model

The final steps are to train the image or data that users have input. Machine learning works by taking information and processing it to produce an output. So, how do we prepare? We construct five different disease datasets, and the system must learn how to recognize each one. Machine learning needs to be told the disease pattern.

Four image classification algorithms were utilized. These are the following:

1) Resnet 101
2) Resnet 50
3) Inception Version 3
4) Mobile.Net version 2

V. DESIGN & DEVELOPMENT

TensorFlow is a machine learning software library that is free and open-source. It can be used for a variety of tasks, but its main focus is on deep neural network training and inference. TensorFlow (figure 5) is a dataflow and differentiable programming-based symbolic math framework [13]. TensorFlow is an end-to-end platform that makes it simple to construct and deploy machine learning models, whether you're an expert or a beginner [14]. An comprehensive ecosystem to assist you in using machine learning to solve difficult, real-world challenges.From kaggle we downloaded the chest x ray data set. A Rest API deconstructs a transaction into a series of smaller modules. Each module focuses on a different aspect of the transaction. Although this modularity gives developers a lot of flexibility, designing a REST API from scratch can be difficult. Several businesses already provide models for developers to utilize; the most common are those supplied by Amazon S3, Cloud Data Management Interface (CDMI), and OpenStack Swift [26].

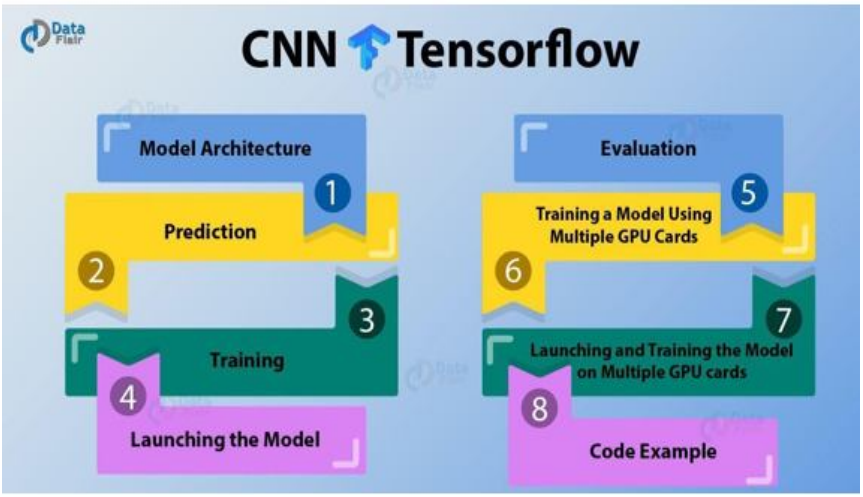


Fig.5: TensorFlow

VI. PROJECT OVERVIEW

The home screen is the first interface we view when we visit a website. Typically, the user will receive an overview of our website's features, such as login and uploading welcome remarks, on this main page. Figure 6 shows a general representation of the homepage.

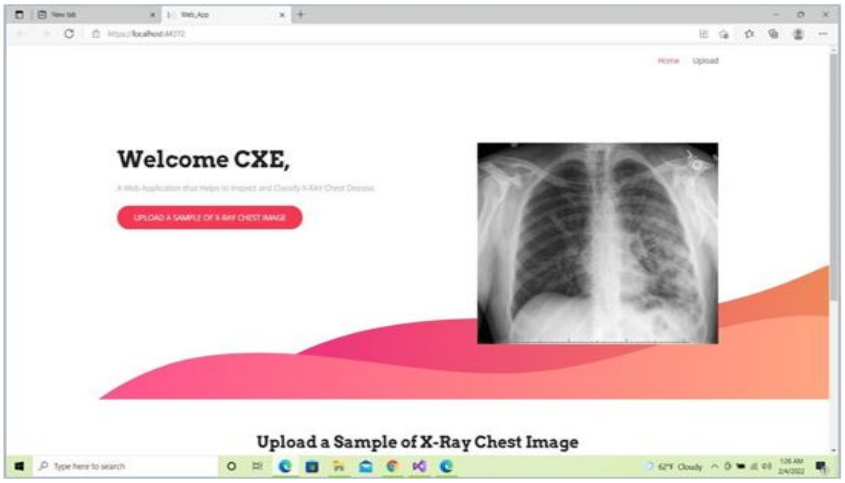


Fig.6: Home Page

The uploading screen appears after the user logs into his or her own account. The user can locate the Choose file option on the left side and the result dialogue box on the right side of this area. The user can upload his or her x-ray images by selecting the Choose file option. Figure 6.2 depicts what the input options will look like.

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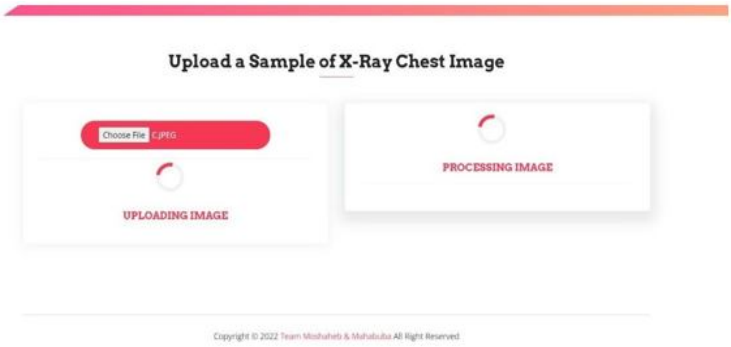


Fig.7: Input Option

When users select click to choose file this window will pop-up and will ask to choose the x-ray image. That the user wants to know the disease name. An image of the input window is shown in Figure 8 below.

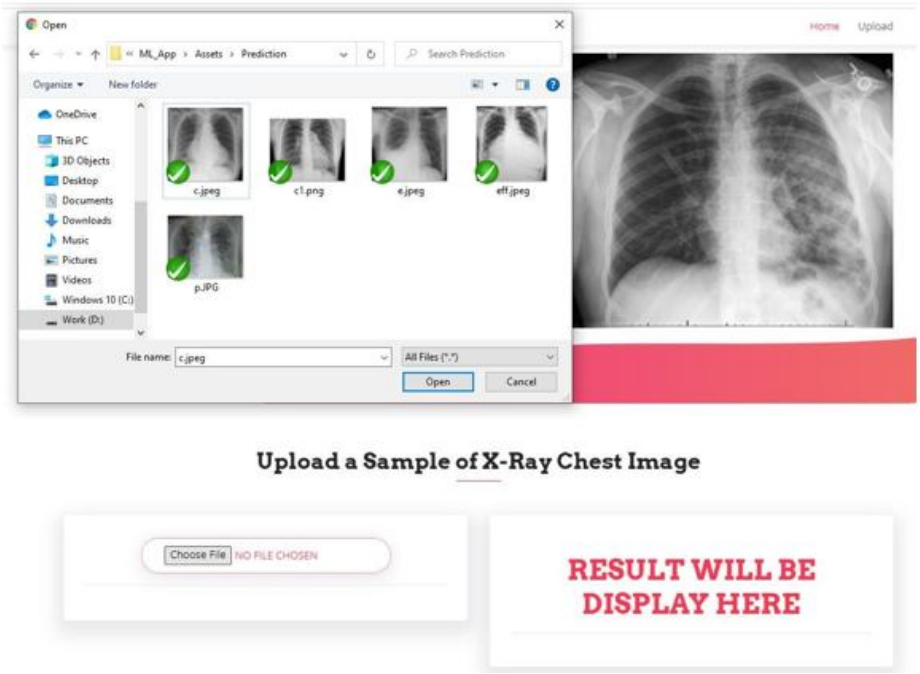


Fig.8: Input Window

This loading page will appear once you select the file. It indicates that the server is in the process of displaying the x-ray picture results. After uploading the required image, the processing window should appear like the one shown below.

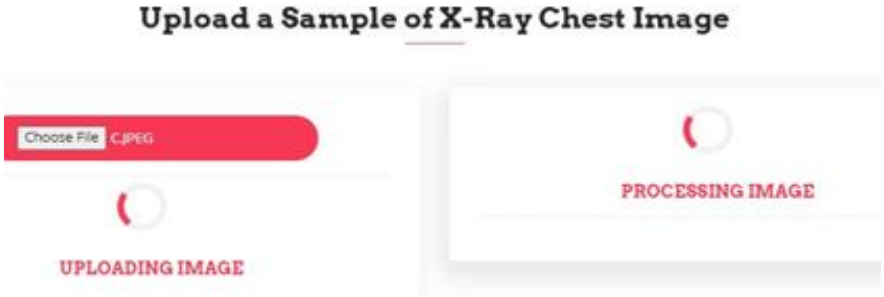


Fig.9: Processing Screen

Finally, on the homepage, the user will locate the result screen, which will have two types of results.

1) Name of the disease.

2) Accuracy of prediction

The image below depicts how our intended results window will appear.

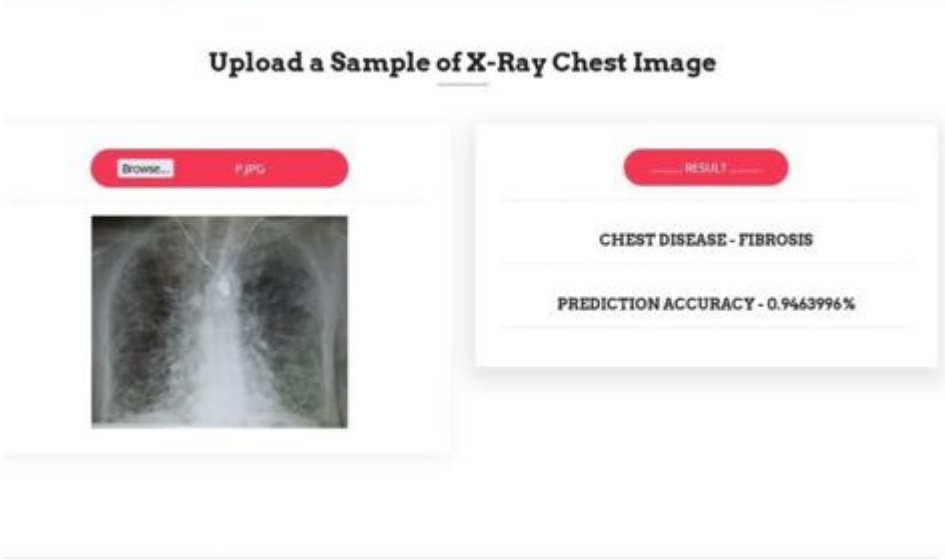


Fig.10: Results

After a certain period of time a user will be able to know his desired results. He will get two types of results, one is the name of his disease and the other is the accuracy of the disease.

VII. CONCLUSIONS

Many people suffer from chest disease, as seen by the daily life loops. They did a chest examination and received X-ray paper and results. Consider what someone would do if they wanted to know the results of that X-Ray sickness. Then we considered it and created our web application to benefit users. If someone chooses or uploads X-Ray images, our machine learning technology will display the disease name with precision. We are always growing closer to the digital world. As a result, our technologies are always changing. When it comes to machine learning, It's science's greatest achievement. Machine learning is making it possible to do previously unthinkable feats. In keeping with this, we have finished our projector using machine learning. And our project was completed successfully. We contributed the names and accuracy of five different forms of chest diseases to our project.

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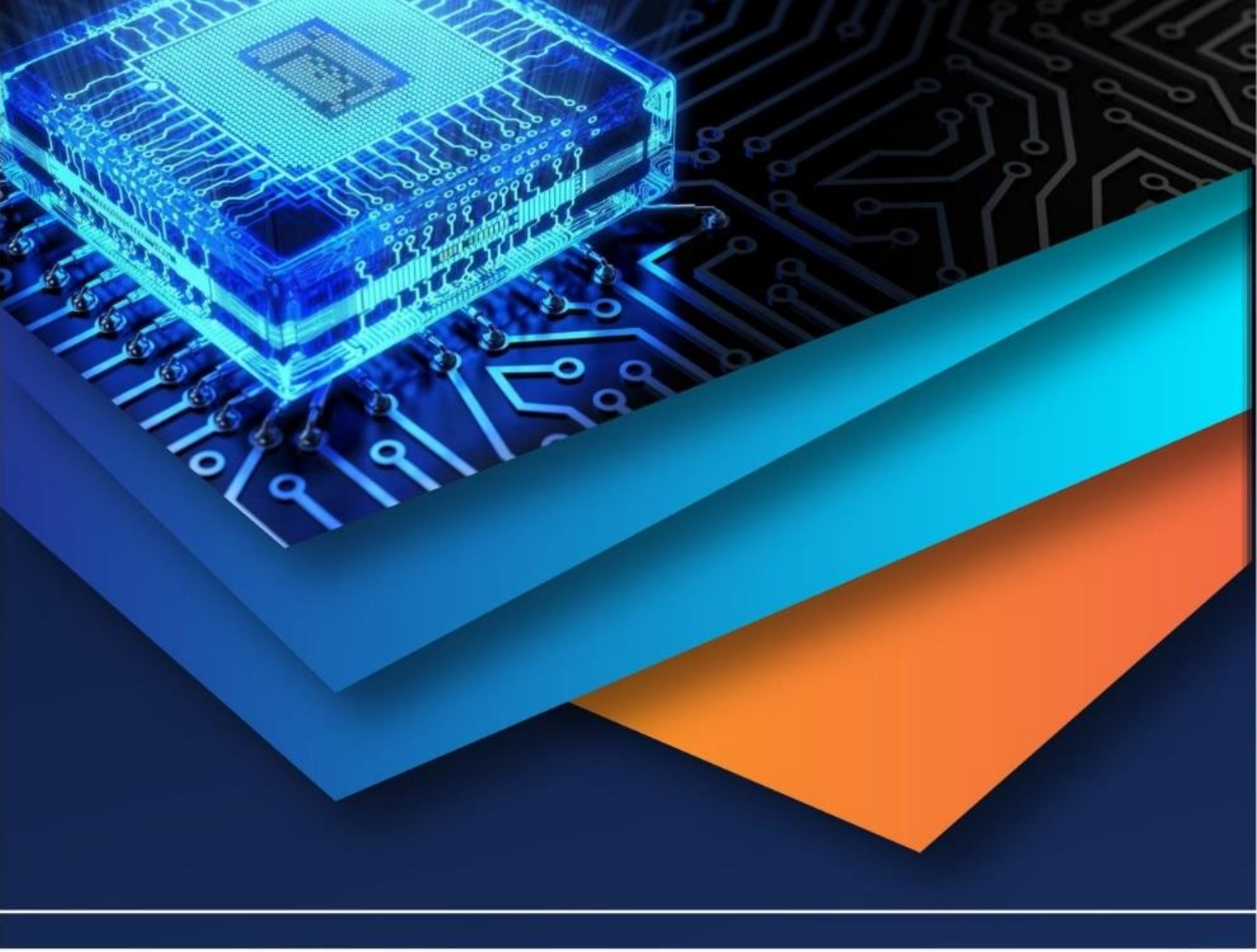
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