HEALTHCURE: AN ALL-IN-ONE MEDICAL SOLUTION

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ABSTRACT

AI and machine learning have gained a lot of popularity and acceptance in recent years. With the onset of the Covid-19 pandemic, the situation changed even more. During the crisis, we witnessed a rapid digital transformation and the adoption of disruptive technology across different industries. Healthcare was one of the potential sectors that gained many benefits from deploying disruptive technologies. AI, machine learning, and deep learning have become an imperative part of the sector. Deep learning in healthcare has a huge impact and it has enabled the sector to improve patient monitoring and diagnostics.

In this project, we have tried to detect seven diseases by leveraging AI with just a few clicks at home with a good accuracy and no need to wait for days for the reports. Accordingly, these diseases can be treated quickly. This project will detect first four diseases using CNN (Convolutional Neural Networks) which will take input images, assign importance (learnable weights and biases) to various aspects/objects in the image, and be able to differentiate one from the other. The rest three diseases will be detected using two most popular classical machine learning algorithms, Random Forest and XGBoost. With time, more datasets will be available which will improve the accuracy of this project. This project can be expanded to any number of diseases in the future as well.

1. INTRODUCTION

Healthcare organizations of all sizes, types, and specialties are becoming increasingly interested in how artificial intelligence can support better patient care while reducing costs and improving efficiencies. Over a relatively short period of time, the availability and sophistication of AI has exploded, leaving providers, payers, and other stakeholders with a dizzying array of tools, technologies, and strategies to choose from.

Understanding exactly how data is ingested, analyzed, and returned to the end user can have a big impact on expectations for accuracy and reliability, not to mention influencing any investments necessary to whip an organization's data assets into shape. In order to efficiently and effectively choose between vendor products or hire the right data science staff to develop algorithms in-house, healthcare organizations should feel confident that they have a firm grasp on the different flavors of artificial intelligenceand how they can apply to specific use cases.

Deep learning is a good place to start. This branch of artificial intelligence has very quickly become transformative for healthcare, offering the ability to analyze data with a speed and precision never seen before. Many of the industry's deep learning headlines are currently related to small-scale pilots or research projects in their pre-commercialized phases. However, deep learning is steadily finding its way into innovative tools that have high-value applications in the real-world clinical environment. Some of the most promising use cases include innovative patient-

facing applications as well as a few surprisingly established strategies for improving the health IT user experience. One type of deep learning, known as convolutional neural networks (CNNs), is particularly well-suited to analyzing images, such as MRI results or x-rays.

CNNs are designed with the assumption that they will be processing images, according to computer science experts at Stanford University, allowing the networks to operate more efficiently and handle larger images [1]. As a result, some CNNs are approaching –or even surpassing – the accuracy of human diagnosticians when identifying important features in diagnostic imaging studies

2. LITERATURE SURVEY AND RELATED WORK

Numerous research works have been carried out for the prediction of the diseases based on the symptoms shown by an individual using machine learning algorithms. Monto et al. [6] designed a statistical model to predict whether a patient had influenza or not. They included 3744 unvaccinated adults and adolescent patients of influenza who had fever and at least 2 other symptoms of influenza. Out of 3744, 2470 were confirmed to have influenza by the laboratory. Based on this data, their Table 2 Comparison of the methodologies reported in existing literature Fig. 4 Comparison of the accuracy values of the different ML algorithms.

The Weighted KNN model gave the highest accuracy as compared to the other ML algorithms. The RUS Boosted trees were the least accurate model. The Fine KNN performed better than the Subspace, Medium, and Coarse KNN models. The least efficient KNN model was coarse KNN. The Gaussian and the Kernel Naïve Bayes algorithm had a comparable accuracy with each other though less than the KNN models. The Fine tree had a higher accuracy than the medium and the coarse decision tree models. model gave an accuracy of 79 %. Sreevalli et al. [7] used the random forest machine-learning algorithm to predict the disease based on the symptoms. The system resulted in low time consumption and minimal cost for the prediction of diseases. The algorithm resulted in an accuracy of 84.2 %. Various tools were developed by Langbehn et al. [8] to detect Alzheimer's disease.

Data for 29 adults were used for the training purpose of the ML algorithm. They had developed classification models to detect reliable absolute changes in the scores with the help of Smote BOOST and wRACOG algorithms. A variety of ML techniques such as artificial neural networks (ANNs), Bayesian networks (BNs), support vector machines (SVMs) and decision trees (DTs) have been widely applied in cancer research for the development of predictive models, resulting in effective and accurate decision making [9]. Karayilan et al. [10] proposed a heart disease prediction system that uses the artificial neural network backpropagation algorithm. 13 clinical features were used as input for the neural network and then the neural network was trained with the backpropagation algorithm to predict absence or presence of heart disease with an accuracy of 95 %.

Various machine learning algorithms were streamlined for the effective prediction of a chronic disease outbreak by Chen et al. [11]. The data collected for the training purpose was incomplete. To overcome this, a latent factor model was used. A new convolutional neural network-based multimodal disease risk prediction (CNN-MDRP) was structured. The algorithm reached an accuracy of around 94.8 %. Chae et al. [12] used 4 different deep learning models namely deep neural networks (DNN), long short-term memory (LSTM), ordinary least squares (OLS), an autoregressive

integrated moving average (ARIMA) for monitoring 80 infectious diseases in 6 groups. Of all the models used, DNN and LSTM models had a better performance. The DNN model performed better in terms of average performance and the LSTM model gave close predictions when occurrences were large. Haq et al. [13] used a database that contained information about patients having any heart disease. They extracted features using three selection algorithms which are relief, minimum redundancy, and maximum relevance (mRMR), and least absolute shrinkage and selection operator which was cross-verified by the K-fold method. The extracted features were sent to 6 different machine learning algorithms and then it was classified based on the presence or absence of heart disease. An effective heart disease prediction system was developed by Mohan et al. [4].

Disease prediction from various symptoms using machine learning 5 They achieved an accuracy level of 88.4 % through the prediction model for heart disease with the hybrid random forest with a linear model (HRFLM). Mannerizing et al. [14] classified the diabetes disease using ML algorithms. Logistic regression (LR) was used to identify the risk factors for diabetes disease. The overall accuracy of the ML-based system was 90.62 %

3. EXISTING SYSTEM

The existing system predicts the chronic diseases which are for a particular region and for the particular community. Only particular diseases are predicted by this system. In this System, Big Data & CNN Algorithm is used for Disease risk prediction. For S type data, the system is using Machine Learning algorithm i.e., K nearest Neighbours, Decision Tree, Naïve Bayesian. The accuracy of the existing System is up to 94.8%. In the existing paper, they streamline machine learning algorithms for the effective prediction of chronic disease outbreak in disease-frequent communities. They experiment with the modified prediction models over real life hospital data collected from central China. They propose a convolutional neural network-based multimodal disease risk prediction(CNN-MDRP) algorithm using structured and unstructured data from the hospital.

4. PROPOSED SYSTEM

Most of the diseases are predicted by our system. It accepts the structured type of data as input to the machine learning model. This system is used by end-users i.e., patients/any user. In this system, the user will enter all the symptoms from which he or she is suffering. These symptoms then will be given to the machine learning model to predict the disease. Algorithms are then applied to which gives the best accuracy. Then System will predict disease on the basis of symptoms. This system uses Machine Learning Technology. Naïve Bayes algorithm is used for predicting the disease by using symptoms, for classification KNN algorithm is used, Logistic regression is used for extracting features which are having most impact value, the Decision tree is used to divide the big dataset into smaller parts. The final output of this system will be the disease predicted by the model**.**

5. METHODOLOGIES

Artificial Intelligence

Artificial intelligence (AI) is intelligence demonstrated by machines, as opposed to the natural

intelligence displayed by animals including humans. AI research has been defined as the field of study of intelligent agents, which refers to any system that perceives its environment and takes actions that maximize its chance of achieving its goals.

The term "artificial intelligence" had previously been used to describe machines that mimic and display "human" cognitive skills that are associated with the human mind, such as "learning" and "problem-solving". This definition has since been rejected by major AI researchers who now describe AI in terms of rationality and acting rationally, which does not limit how intelligence can be articulated.

Machine Learning

Machine learning (ML) is a field of inquiry devoted to understanding and building methods that 'learn', that is, methods that leverage data to improve performance on some set of tasks. 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.

Random Forest

Random forests or random decision forests is an ensemble learning method for classification, regression and other tasks that operates by constructing a multitude of decision trees at training time. For classification tasks, the output of the random forest isthe class selected by most trees. For regression tasks, the mean or average prediction of the individual trees is returned. Random decision forests correct for decision trees' habit of overfitting to their training set. Random forests generally outperform decision trees, but their accuracy is lower than gradient boosted trees. However, data characteristicscan affect their performance.

6. RESULTS AND DISCUSSION SCREEN SHOTS

Homepage

COVID-19 - Coronavirus disease 2019 (COVID-19) is a contagious disease caused by a virus, the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The first known case was identified in Wuhan, China, in December 2019. The disease spread worldwide, leading to the COVID-19 pandemic. COVID-19 transmits when people breathe in air contaminated by droplets and small airborne particles containing the virus. The risk of breathing these in is highest when people are in close proximity, but they can be inhaled over longer distances, particularly indoors.

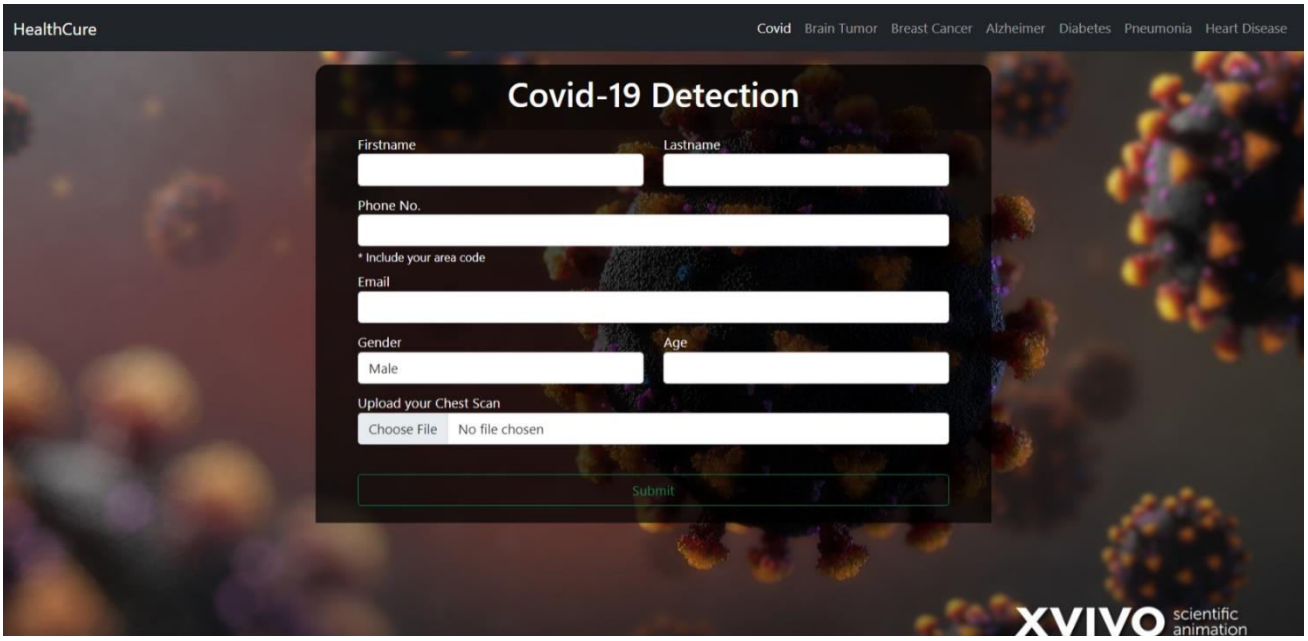


Fig.1 : COVID-19 Detection Page

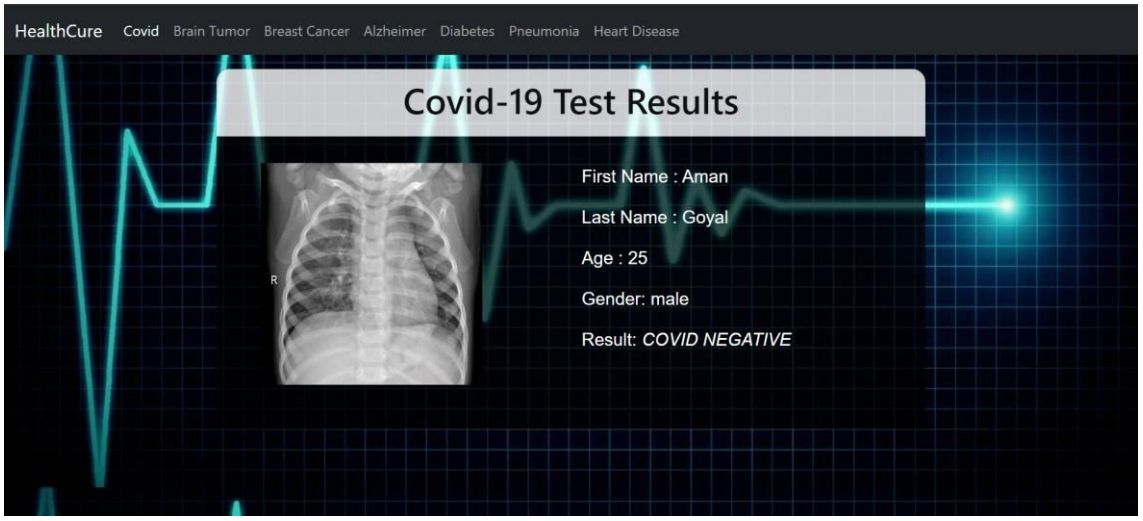


Fig. 2: COVID-19 Results Page

Brain Tumor - A brain tumor occurs when abnormal cells form within the brain. There are two main types of tumors: malignant tumors and benign (non-cancerous) tumors. These can be further classified as primary tumors, which start within the brain, and secondary tumors, which most commonly have spread from tumors located outside the brain, known as brain metastasis tumors.

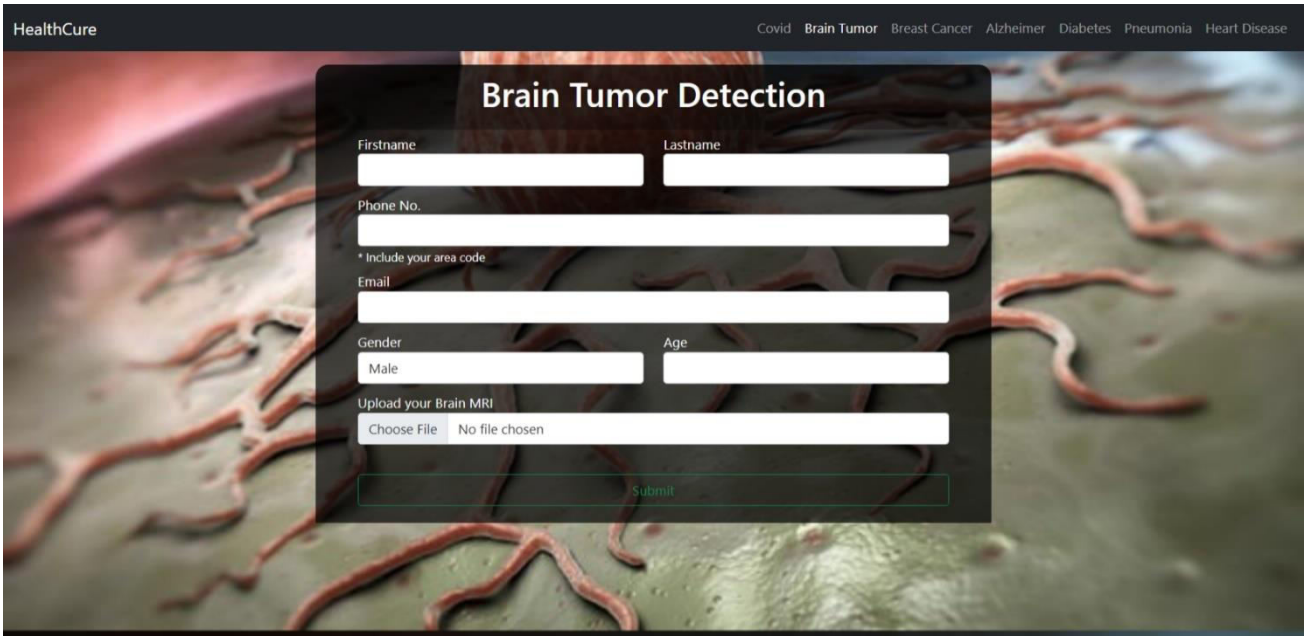


Fig 3 : Brain Tumour Detection Page

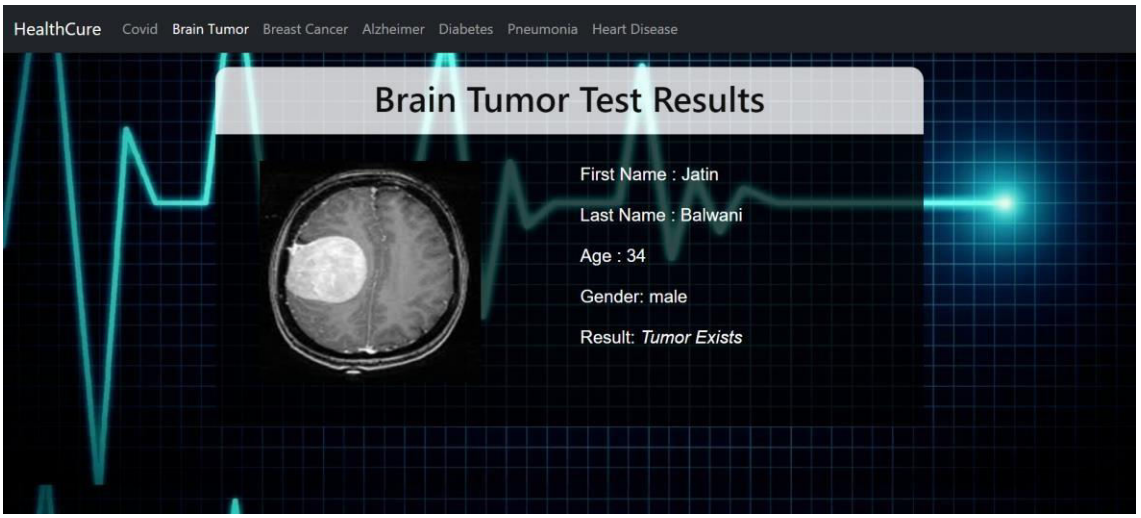


Fig 4 Brain Tumour Results Page

Breast Cancer - Breast cancer is cancer that develops from breast tissue. Signs of breast cancer may include a lump in the breast, a change in breast shape, dimpling of the skin, fluid coming from the nipple, a newly inverted nipple, or a red or scaly patch of skin. In those with distant spread of the disease, there may be bone pain, swollen lymph nodes, shortness of breath, or yellow skin. Breast cancer most commonly develops in cells from the lining of milk ducts and the lobules that supply these ducts with milk. The diagnosis of breast cancer is confirmed by taking a biopsy of the concerning tissue.

Alzheimer - Alzheimer's disease (AD) is a neurodegenerative disease that usually starts slowly and progressively worsens. It is the cause of 60–70% of cases of dementia. The most common early symptom is difficulty in remembering recent events. As the disease advances, symptoms can include problems with language, disorientation (includingeasily getting lost), mood swings, loss of motivation, self-neglect, and behavioral issues.As a person's condition declines, they often withdraw from family and society.

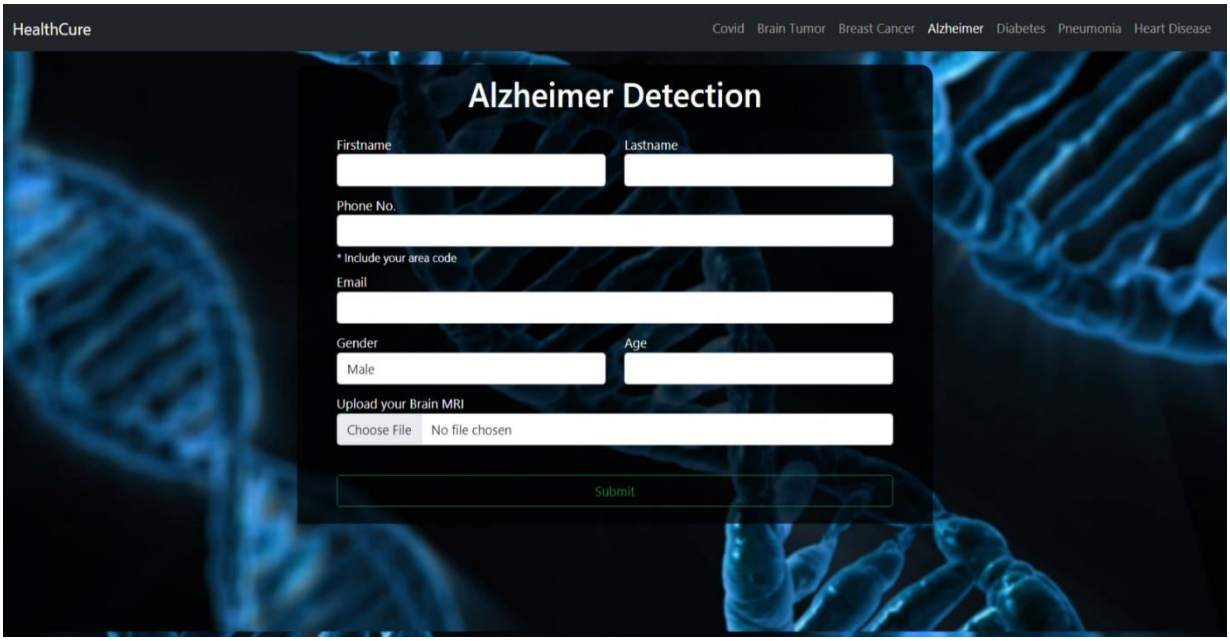


Fig. 5 Alzheimer Detection Pa

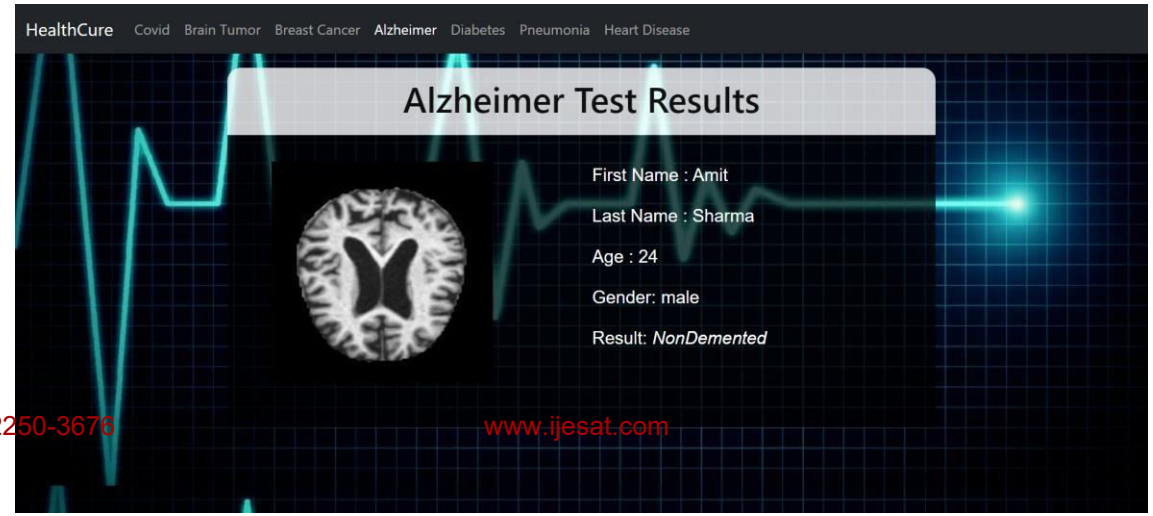


Fig. 6 Alzheimer Results Page

Diabetes - Diabetes mellitus, commonly known as diabetes, is a group of metabolic disorders characterized by a high blood sugar level (hyperglycemia) over a prolonged period of time. Symptoms often include frequent urination, increased thirst and increased appetite. If left untreated, diabetes can cause many health complications. Acute complications can include diabetic ketoacidosis, hyperosmolar hyperglycemic state, or death. Serious long-term complications include cardiovascular disease, stroke, chronic and kidney disease.

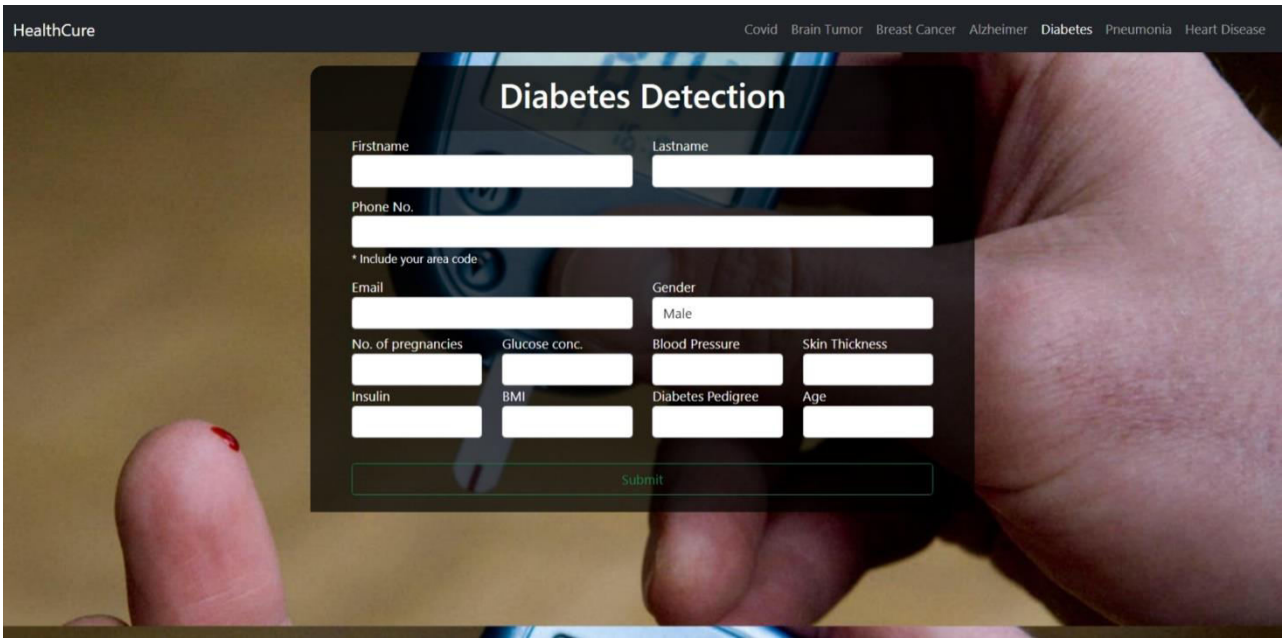
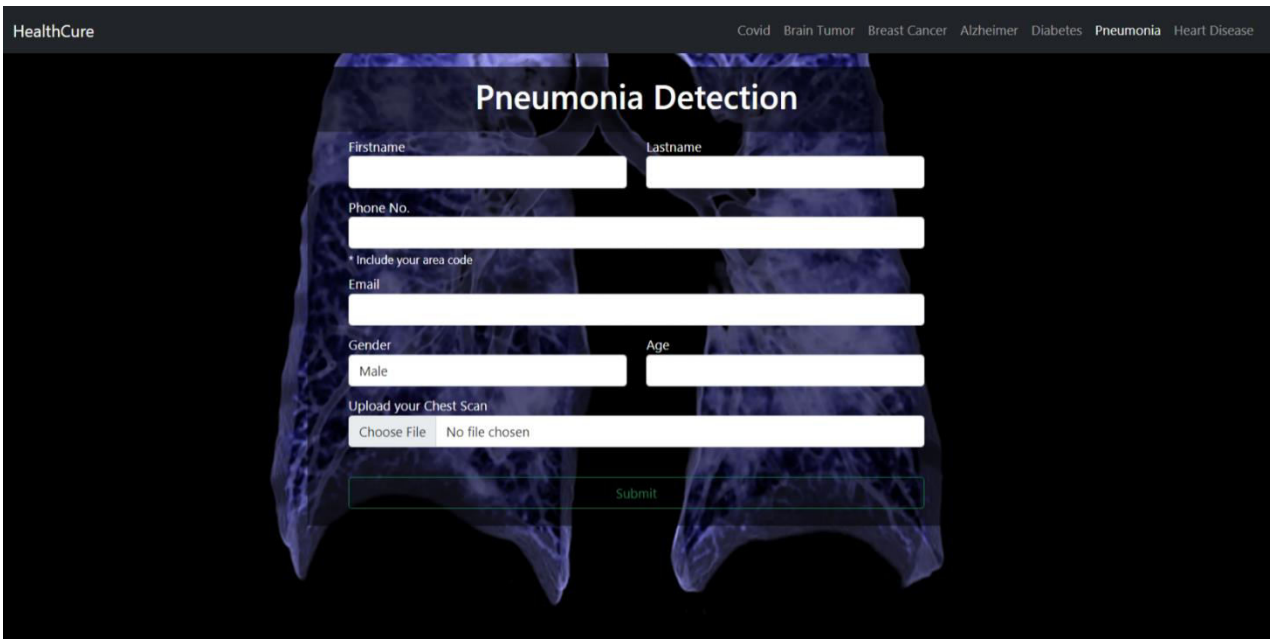


Fig. 7 Diabetes Detection Page

Fig. 8 Diabetes Results Page

Pneumonia - Pneumonia is an inflammatory condition of the lung primarily affecting the small air sacs known as

alveoli. Symptoms typically include some combination of productive or dry cough, chest pain, fever, and difficulty breathing. The severity of the condition is variable. Pneumonia is usually caused by infection with viruses or bacteria, and less commonly by other microorganisms



.**Fig.9 : Pneumonia Detection Page**

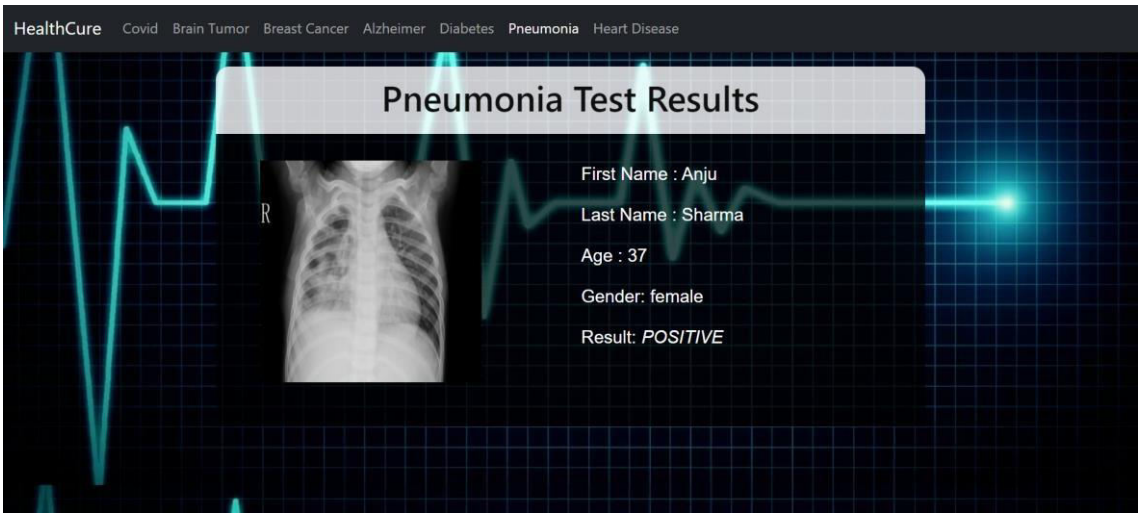


Fig. 5.2.13: Pneumonia Results Page

7. CONCLUSION AND FUTURE SCOPE

Traditional machine learning methods (such as multilayer perception machines, support vector machines, etc.) mostly use shallow structures to deal with a limited number of samples and computing units. When the target objects have rich meanings, the performance and generalization ability of complex classification problems are obviously insufficient. The convolution neural network (CNN) developed in recent years has been widely used in the field of image processing because it is good at dealing with image classification and recognition problems and has brought great improvement in the accuracy of many machine learning tasks. It has become a powerful and universal deep learning model.

Deep convolution neural networks are used to identify scaling, translation, and other forms of distortion-invariant images. In order to avoid explicit feature extraction, the convolutional network uses feature detection layer to learn from training data implicitly, and because of the weight sharing mechanism, neurons on the same feature mapping surface have the same weight. The ya training network can extract features by W parallel computation, and its parameters and computational complexity are obviously smaller than those of the traditional neural network. Its layout is closer to the actual biological neural network. Weight sharing can greatly reduce the complexity of the network structure. Especially, the multi-dimensional input vector image WDIN can effectively avoid the complexity of data reconstruction in the process of feature extraction and image classification. Deep convolution neural network has incomparable advantages in image feature representation and classification. However, many researchers still regard the deep convolutional neural network as a black box feature extraction model. To explore the connection between each layer of the deep convolutional neural network and the visual nervous system of the human brain

How to make the deep neural network incremental, as human beings do, to compensate for learning, and to increase understanding of the details of the target object, further research is needed.

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