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Multi Disease Prediction

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Abstract: Artificial intelligence (AI) is progressively reshaping medical practice, leveraging advancements in digitized data acquisition, machine learning, and computing infrastructure. Previously exclusive to human experts, AI applications now permeate diverse biomedical domains. This Review Article delineates recent AI breakthroughs, their biomedical implications, challenges hindering further progress in medical AI systems, and the economic, legal, and social ramifications of AI in healthcare. Our approach incorporates Python, benefiting from its extensive array of freely available packages spanning various domains. Key scientific Python libraries, including NumPy, SciPy, and pandas, offer efficient implementations of numerical operations, catering to common scientific and engineering tasks. These libraries provide a robust foundation for developing advanced scientific software without delving into low-level algorithms. Furthermore, domain-specific packages tailored to meteorological requirements supplement our methodology. Leveraging Convolutional Neural Networks, we classify diverse diseases alongside state-of-the-art Machine Learning algorithms.

Keywords: Machine Learning, Convolutional neural network (CNN), Random Forest

1.Introduction

As society progresses, shifts in people's lifestyles and environmental conditions lead to a hidden increase in the risk of various diseases. Globally impactful illnesses such as Covid-19, brain tumors, diabetes, and pneumonia highlight the significance of disease prediction. The primary aim is to anticipate an individual's likelihood of developing a specific ailment in the future. Addressing this task manually is arduous and resource-intensive, given the multitude of influencing factors across diverse populations and the extensive range of features to consider.

Societal advancements have facilitated easier access to medical datasets, encompassing basic patient information, electronic health records (EHR), electronic medical records (EMR), image data, and medical instrument data. The application of deep learning in disease prediction has garnered considerable interest and yielded notable results. From the fundamental detection of conditions like diabetes or breast cancer using simple machine learning models to intricate tasks such as coronavirus or brain tumor detection employing segmentation and advanced techniques, artificial intelligence (AI) has surpassed expectations.

Motivated by the breadth of AI's capabilities, we conceptualized an online platform to consolidate various disease detection methodologies. This platform encompasses both rudimentary and advanced detection methods, leveraging a comprehensive array of machine learning techniques, including deep learning. Amid challenging times when disease prevalence is widespread, the platform's convenience lies in enabling individuals to obtain test results from the comfort of their homes with just a few clicks. While acknowledging that these results may not be flawless, our endeavor represents an experimental step forward that holds potential for revolutionizing healthcare in the future.

2.System Architecture

The system architecture for multiple disease predictions is designed to facilitate the efficient and accurate detection of various medical conditions using machine learning algorithms. This architecture encompasses several key components that work together seamlessly to process input data and provide predictive insights to users. Below is an introduction to the system architecture:

Front-end interface: Designed the interface using Html, CSS, and JavaScript

Back-end: Deployed using Flask, and python web framework.

Computer vision: OpenCV (Open-Source Computer Vision Library) is a powerful open-source library for tasks such as object detection, image filtering, and feature extraction.

Multiple disease prediction module: It includes VGG16 for image uploads, Convolutional Neural Networks, Random Forest, Logistic regression for making multiple disease predictions

Data Processing: The backend preprocesses the input data or images before passing them to the machine learning models for inference. Preprocessing involves tasks like resizing images, normalization, and feature extraction.

Deployment: Utilized flask for resource constraints, latency requirements, and security considerations during deployment. The project can be deployed locally on a machine using the provided instructions. Deployment on cloud platforms like Heroku or PythonAnywhere is also possible, allowing broader accessibility.

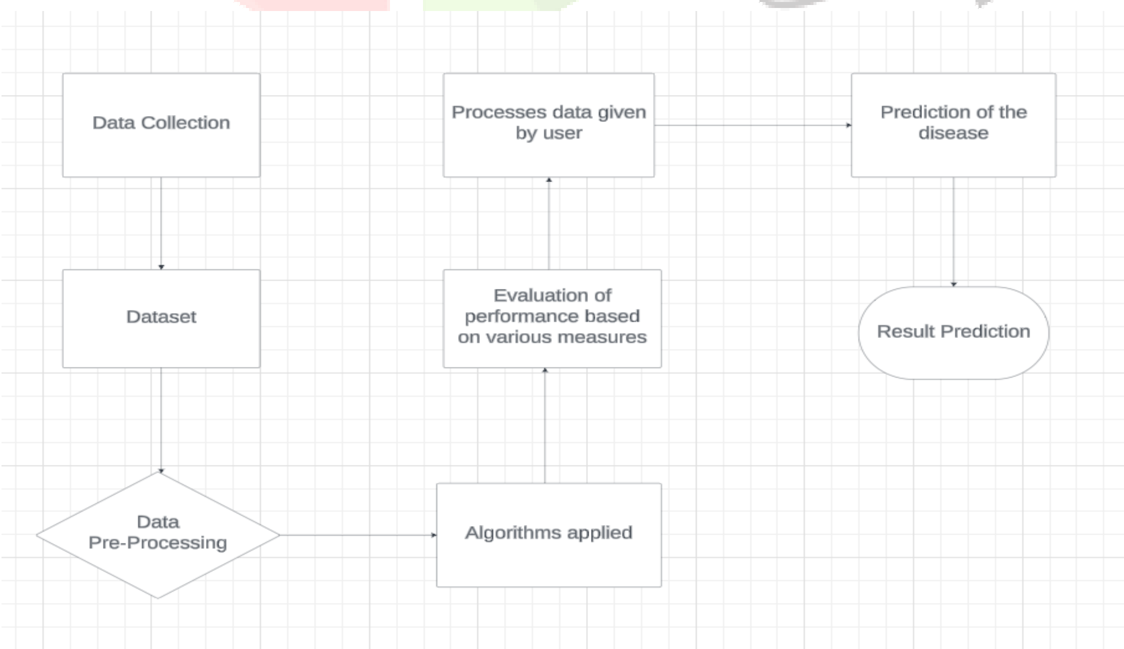

Figure: System Architecture

3.Methodology

In this system methodology, flow of system modules is shown. Figure 2, Figure3 displays the flow of modules in real time and non-real time cases.

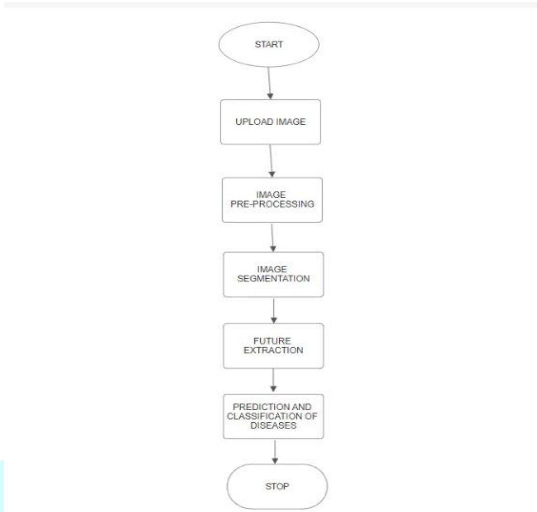

Fig2: Disease prediction by using image

Description of figure2:

The structure of machine learning involves several stages. Initially, the algorithm preprocesses the data, followed by extracting relevant portions based on expert input. Concurrently, suitable features are chosen from the dataset to represent the image. Finally, a specific function completes the image modeling process. Figure 2 illustrates the machine learning framework.

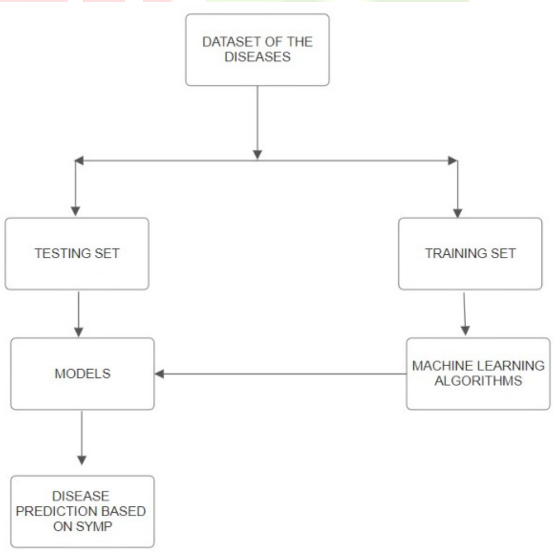

Figure3: Disease prediction from symptoms

Description of Figure3:

Utilizing computational techniques, particularly in the domain of machine learning and artificial intelligence, disease prediction from symptoms involves analyzing reported symptoms to anticipate the likelihood or presence of specific medical conditions. The process commences with gathering symptom data, either from individuals' self-reports or through medical professionals.

Subsequently, algorithms are trained on this data to identify patterns and correlations between reported symptoms and known diseases. These algorithms employ various methods such as decision trees, neural networks, or support vector machines to effectively learn from the data and make predictions.

Once trained, the predictive model can be deployed to evaluate new cases and offer insights into potential diseases or conditions based on reported symptoms. This methodology supports healthcare professionals in early diagnosis, treatment planning, and intervention strategies, thus enhancing patient outcomes and healthcare provision. Moreover, it holds promise for advancing remote healthcare services and empowering individuals to proactively assess their health status.

Nevertheless, it's essential to acknowledge that while these predictive models can be highly accurate, they should always complement clinical judgment and medical expertise for precise diagnosis and treatment decisions.

4.Implementation

In the implementation phase of the project, our goal was to integrate various machine learning models capable of detecting multiple diseases using different types of medical data. The implementation process can be divided into several key components:

Data Collection and Preprocessing:

We began by collecting diverse datasets relevant to each disease under consideration. This involved sourcing medical imaging data, clinical records, and other relevant information from publicly available repositories and healthcare institutions. The collected data underwent preprocessing steps to ensure uniformity and compatibility across different models. Preprocessing tasks included data cleaning, normalization, and feature extraction tailored to each disease detection task.

Model Selection and Training:

For each disease detection task, we carefully selected appropriate machine learning algorithms based on the nature of the data and the complexity of the problem.

- Convolutional Neural Networks (CNNs) were chosen for image-based detections such as Covid-19, Brain Tumor, and Pneumonia.
- Random Forest and XG Boost algorithms were employed for tabular data-based detections like Diabetes.

The selected models were trained using preprocessed datasets, optimizing hyperparameters and model architectures to achieve optimal performance.

Model Evaluation and Validation:

Following training, we conducted rigorous evaluation and validation procedures to assess the performance and generalization capabilities of each model. Performance metrics such as accuracy, precision, recall, and F1 score were computed for quantitative assessment. Additionally, cross-validation techniques and holdout datasets were utilized to ensure robustness and mitigate overfitting.

Integration and Deployment:

Once individual models were trained and validated, we integrated them into a unified system capable of performing multiple disease predictions. The backend of the system was developed using the Flask web framework, facilitating communication between the front-end interface and the machine learning models.

User Interface and Result Visualization:

A user-friendly interface was designed to enable users to input medical data or images for disease detection.

5.Results

Covid 19 disease prediction:

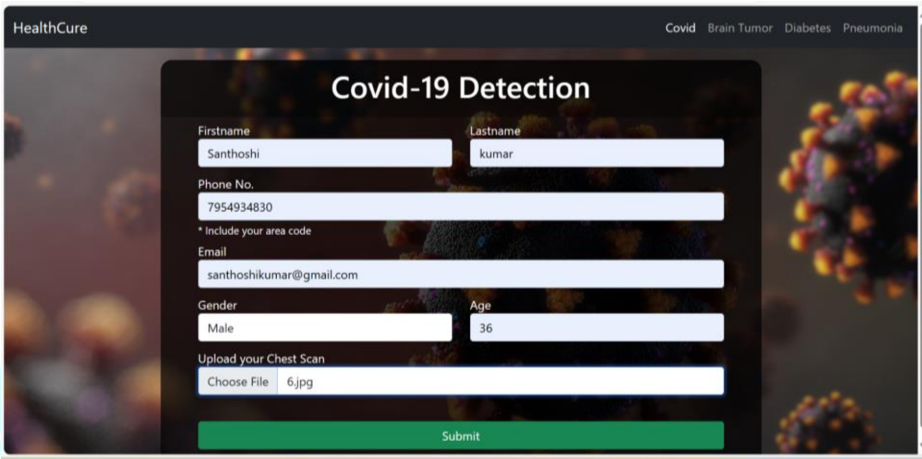

Figure: covid 19 prediction input page

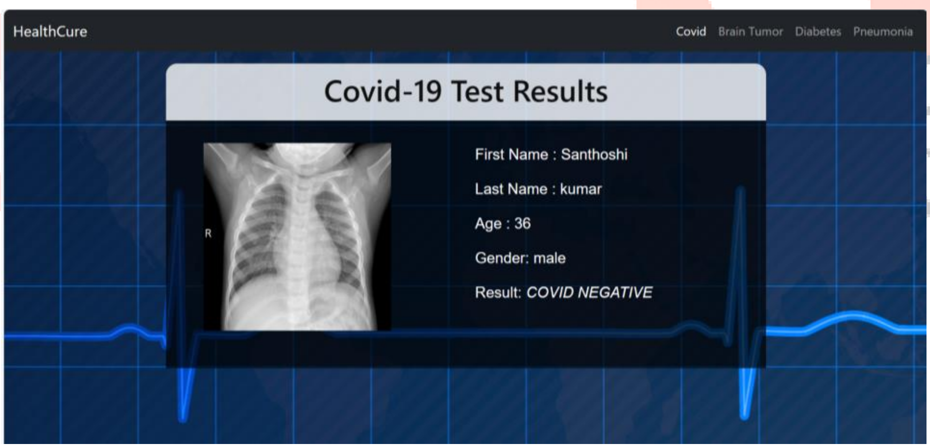

Figure: preview of prediction in result page

Brain Tumor Detection:

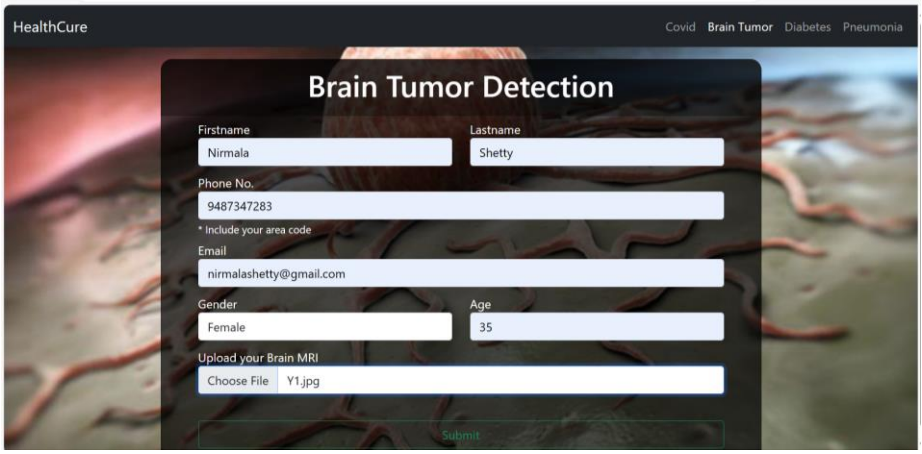

Figure: Brain Tumor Detection input page

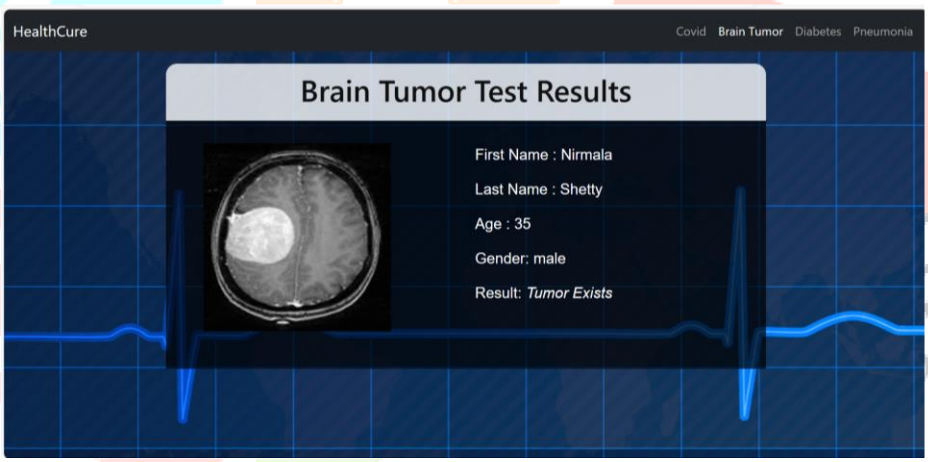

Figure: preview of Detection in result page

Diabetes Detection

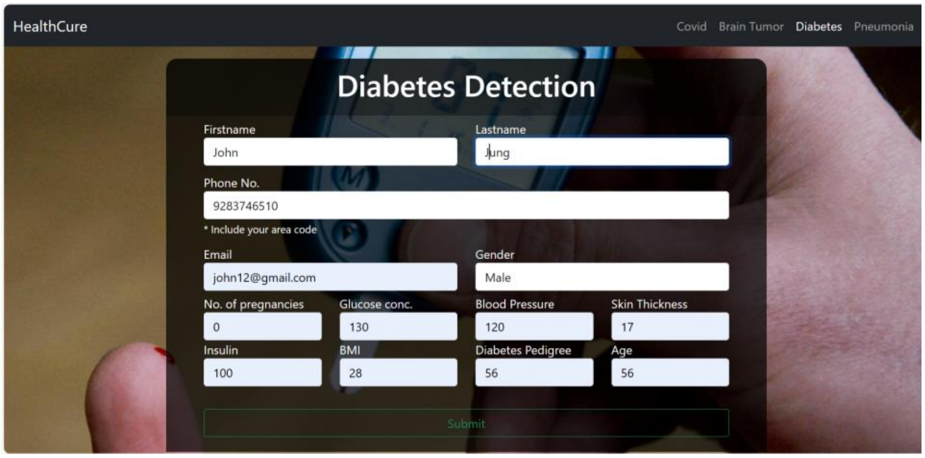

Figure: Diabetes Detection input page

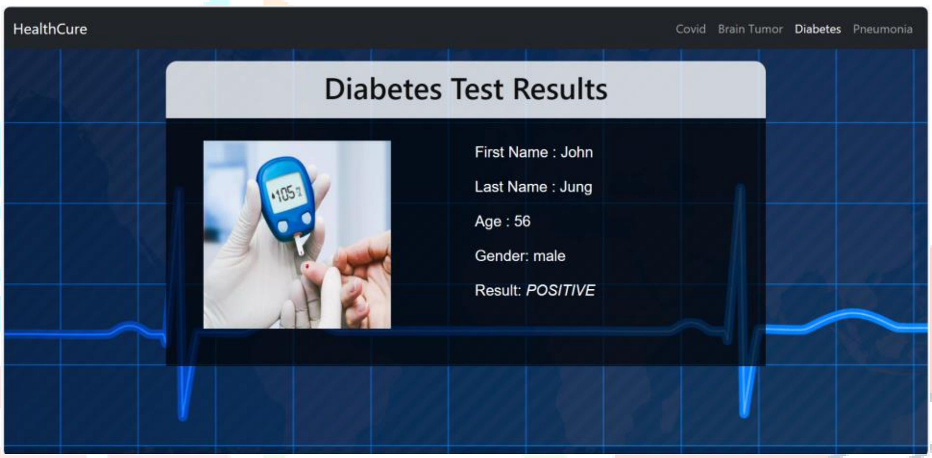

Figure: preview of Detection in result page

Pneumonia Detection:

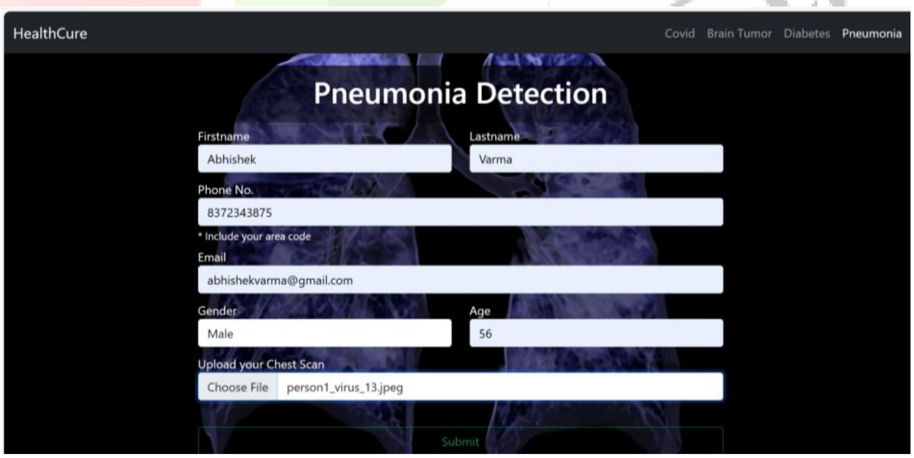

Figure: Diabetes Detection input page

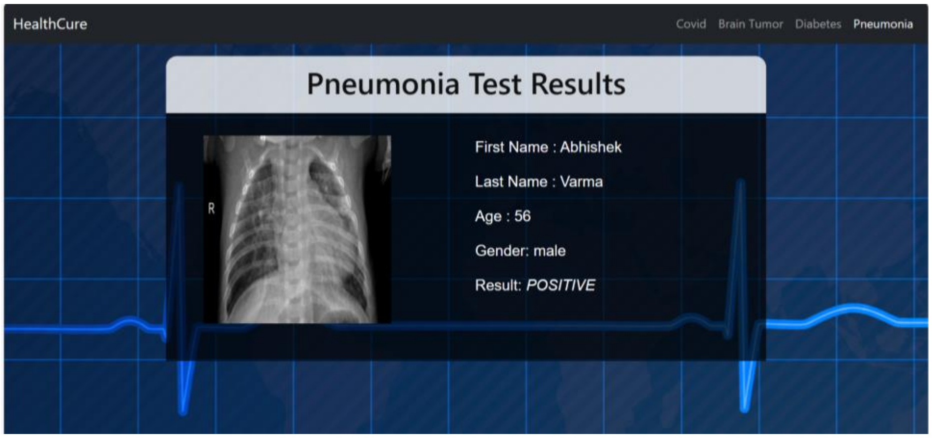

Figure: preview of Detection in result page

6.Conclusion and Future Scope

Over time, we aim to enhance the accuracy of our models by leveraging increasingly available data for training purposes. Additionally, we intend to expand our range of disease detections, incorporating those detectable through X-ray scans or simple numerical input.

Furthermore, we plan to introduce additional features such as providing users with precautionary measures and self-care instructions in case of positive detection. Additionally, we will implement a system to store detection records for future reference.

These represent some of the planned future enhancements and additions to our platform.