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MyPulse – A health monitoring system

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ABSTRACT :

This project presents a real- time health monitoring system that utilizes facial analysis and deep learning techniques. Facial landmark detection (Dlib) is used to identify eyebrow positions, and Euclidean distance (SciPy) is computed to measure changes in eyebrow spacing. A Convolutional Neural Network (CNN) based on the Mini-XCEPTION model classifies emotions from the FER2013 dataset, identifying stress-related emotions. Additionally, the Eye Aspect Ratio (EAR) method is employed for blink detection, Furthermore, the system includes a doctor recommendation module that dynamically scrapes real-time doctor details from the Practo website based on location, specialization, and fees.

Keywords: Facial landmark detection (Dlib), Euclidean distance (SciPy),Convolutional Neural Network (CNN),FER2013 dataset ,Eye Aspect Ratio (EAR),doctor recommendation module, Practo website.

INTRODUCTION

The rise of mobile technology and artificial intelligence has significantly transformed healthcare management, making it possible to monitor health in real-time and provide personalized insights directly to users. It leverages facial expression analysis, real-time video processing, and doctor search functionalities to provide an integrated health support system. AI systems have the potential to anticipate problems or deal with issues as they come up and, as such, operate in an intentional, intelligent and adaptive manner. AI's strength is in its ability to learn and recognise patterns and relationships from large multidimensional and multimodal datasets [1].The role of computers, algorithms, and early AI information systems in medicine, especially in clinical decision making, has been under exploration since the 1960s. Especially with recent advances in AI, machine learning and deep learning computer programs are now able to simulate the neural activity of the neocortex in the brain where most of the reasoning, thinking, and cognitive functions happen[2].

The dataset used for this project for the purpose of stress detection is-FER2013 Dataset which is a collection of 35,887 grayscale facial images (48x48 pixels) used for emotion classification and Dlib's Shape Predictor which is another pre- trained model that identifies 68 facial landmarks, particularly useful for detecting eyebrow movement and eye blinks and to find the location of doctor it uses Practo Doctor Search Data which Scrapes real-time doctor details from the Practo website based on location, specialization, and fees. including User Input Filters which allows users to refine their search using location, specialization, and price range. Artificial Intelligence (AI) has established a substantial footprint in the healthcare sector, offering promising avenues for improving patient outcomes and optimising clinical workflows. AI encompasses various technologies, such as machine learning and natural language processing, and finds applications in diverse areas[3].

AI encompasses machine learning algorithms and computational models that can analyze vast amounts of data, identify patterns, and generate insights to inform medical decision-making. AI's introduction to healthcare has transformed the landscape by offering tools and technologies that enhance diagnostic accuracy, treatment efficacy, and overall patient care[4]. The main algorithm used for stress management is - Eyebrow Detection Algorithm which Uses Euclidean distance calculations to measure the distance between eyebrows and infer stress levels. Shorter distances indicate stress (furrowed brows) and the second one is Emotion Recognition Algorithm which Employs a Mini- XCEPTION CNN model to classify emotions from facial expressions, refining stress detection when emotions like "scared" or "sad" are detected and another is Blink Detection Algorithm which is used to implements the Eye Aspect Ratio (EAR) method to measure blinking frequency, which decreases under stress.

Machine learning is a branch of AI that allows computers to learn from data without being explicitly programmed. Machine learning has a wide range of applications in healthcare, including image analysis, diagnosis, and treatment planning.Machine learning has indeed revolutionized various aspects of healthcare, including image analysis, diagnosis, and treatment planning. With the ability to learn patterns and make predictions from large amounts of data, machine learning algorithms have shown great potential in improving healthcare outcomes[5]. The project's significance lies in its ability to provide a multi- functional health monitoring system that is both user-friendly and scientifically grounded.

LITERATURE REVIEW

The integration of artificial intelligence (AI) and machine learning (ML) into healthcare has transformed traditional approaches to disease diagnosis, monitoring, and preventive care. In this a system is developed which is able to extract the facial landmarks like jaw, eyebrows, nose, eye and mouth from human face. This is generally done in order to use the extracted data for analysis of the emotions that is depicted in human face. We have used openCV and Dlib library to detect the facial landmarks. The Pre- trained file that we used to detect the facial landmarks was trained with an Ensemble of R egression Trees. Using the shape predictor of Dlib we passed the file over the input image and the detection was estimated through pixel intensity. The extracted pixel values were stored using pickle C object in python. Any suitable neural network may be farther used to train a model, from the extracted data from dataset/datasets, which is able to analyse the different emotions on human face[6].

People in today's society are less concerned with their health and believe that their busy schedules and numerous commitments prevent them from getting regular checkups. Because of this, people overlook any discomfort their bodies express until it develops into a serious and uncomfortable health issue. The system, in the opinion of medical specialists, can help patients who are unsure of where they will obtain the required care. This paper discussed the design and implementation of a health chatbot application and examined, through an end-user survey, the factors that drove its adoption and usage. The reason for the proposed well-being is to rapidly evaluate side effects and hazard factors for the individuals who are worried about their well-being status and to give direction and data about future advances [7].

Stress is defined as a person's physical, mental, and emotional reaction to a certain stimuli, often known as a "stressor." Stress is our bodies' way of responding to any type of demand.1 An agent or stimulus that creates stress is referred to as a stressor. Noises, disagreeable people, a speeding car, a job, finances, and family difficulties are some of the stressors. Any situation might cause stress. The feeling is first affected by stress, which leads to psychological disorders. Anxiety, distracting anxiety, excessive worry, changes in sleep patterns, impatience, anger, sadness, intolerance, thoughts of harming oneself or others, palpitation, stress headache, and internal pressure are all early sign of stress [8].

It can last for a short or long period of time, but it has a mental impact and can lead to a variety of health problems. The surprising result that approximately 86% of Chinese employees are stressed at workplace it is the world record. Individuals over the age of 72 have the lowest level of stress.These reports show how the country will be in the future, with nearly 25% of people experiencing stress during the holidays[9].

The architecture of the system involves the use of a camera to capture near-frontal views of individuals, typically working in front of computers. Captured videos undergo segmentation into equal-length sections, with subsequent extraction and analysis of image frames. Image processing techniques are then applied to determine the displacement of the eyebrow from its mean position, serving as a key parameter for stress detection based on facial expressions. Moreover, the system integrates modules for image preprocessing, stress detection, and deep learning, where the latter is utilized to train models and predict stress levels based on analyzed facial expressions[10].

METHODOLOGY

Health monitoring apps play a crucial role in modern healthcare by providing real-time insights into stress levels and helping users find suitable doctors. This app integrates two key modules: Stress Detection and Doctor Finder. The Stress Detection Module utilizes facial expression analysis, eyebrow movement tracking, and blink detection to assess stress levels using real-time video processing and deep learning techniques. Meanwhile, the Doctor Finder Module leverages web scraping and user input filters to help users locate doctors based on their specialization, location, and consultation fees.

Table 1.1: Summarizing the datasets used in the reference papers along with their limitations :-

	Reference Paper	**Dataset used**	**Limitation**
1.	**Doctor Consultation through Mobile Applications in India [11]**	**Google Play Store data (collected from 250 health- related apps).**	**Limited to apps available in India.** **No standardized dataset for doctor availability.** **Data accuracy depends on app descriptions.**
2.	**Doctor Finder: Find Doctors on the Go [12]**	**Custom database of doctors (collected via user inputs and web scraping).**	**Data quality depends on user-generated inputs.** **Incomplete or outdated doctor information.** **Privacy concerns regarding user data.**

3.	Unveiling Stress through Facial Expressions[13]	Autonomous Blink Detection (ABD). Database for Emotion Analysis using Physiological Signals (DEAP). Ryerson Audio-Visual Database of Emotional Speech and Song (RAVDESS).	YEC and ABD may not generalize well due to dataset biases. - DEAP and RAVDESS focus on controlled lab conditions, making real- world applicability challenging.

Below is a comparative analysis of our methodology with the approaches discussed in the reference papers.

Table 1.2: Comparison of Your Methodology with Reference Papers

FEATURE	OUR METHODOLOGY	REFERENCE PAPER METHODOLOGY
Doctor Finder : Data Collection	Uses real-time web scraping from Practo and User inputs location, specialization, and price range	Uses pre-existing app data from Google Play Store. Relies on user-generated inputs and database storage.
Doctor Finder - Data Processing	BeautifulSoup & Selenium for scraping doctor details. Data cleaning and structuring with pandas	No explicit mention of data preprocessing techniques. - Uses database-driven approach for doctor recommendations.
Doctor Finder – Result Display & Booking	Displays doctor profiles with details. - Redirects to Practo for booking.	Provides doctor suggestions but lacks real-time redirection for booking.
Stress Detection – Real-Time Processing	Uses OpenCV for real-time video capture. Converts frames to grayscale for efficiency.	Uses real-time emotion recognition models but mostly trained on pre-existing datasets .
Stress Detection – Facial Landmark Detection	Dlib's 68 facial landmarks to extract eye, eyebrow, and mouth data.	Uses CNN models and Haar cascade classifiers for face detection.
Stress Detection – Feature Extraction	Eyebrow Distance Calculation: Uses Euclidean distance to measure stress. Emotion Recognition: Mini- XCEPTION CNN on FER2013 dataset. Blink Detection: Eye Aspect Ratio (EAR).	Uses FER2013 and other datasets like YEC, ABD, DEAP, and RAVDESS. - Employs deep learning models (CNNs, SVM, LSTMs) for emotion and stress detection.

RESULT

The health monitoring app successfully integrates real-time stress detection and an intelligent doctor finder system, offering a comprehensive healthcare solution. The stress detection module effectively identifies stress levels using facial landmarks, blink detection, and emotion recognition through deep learning.

The doctor finder module enhances healthcare accessibility by dynamically scraping real-time doctor data from Practo, processing it with custom ranking algorithms, and displaying relevant results based on location, specialization, and fees.

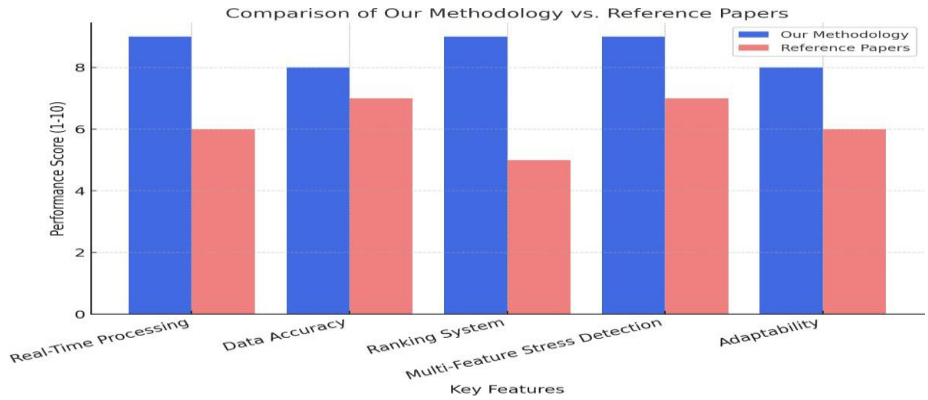

Figure 1: Performance Score vs Key Features with respect to reference papers.

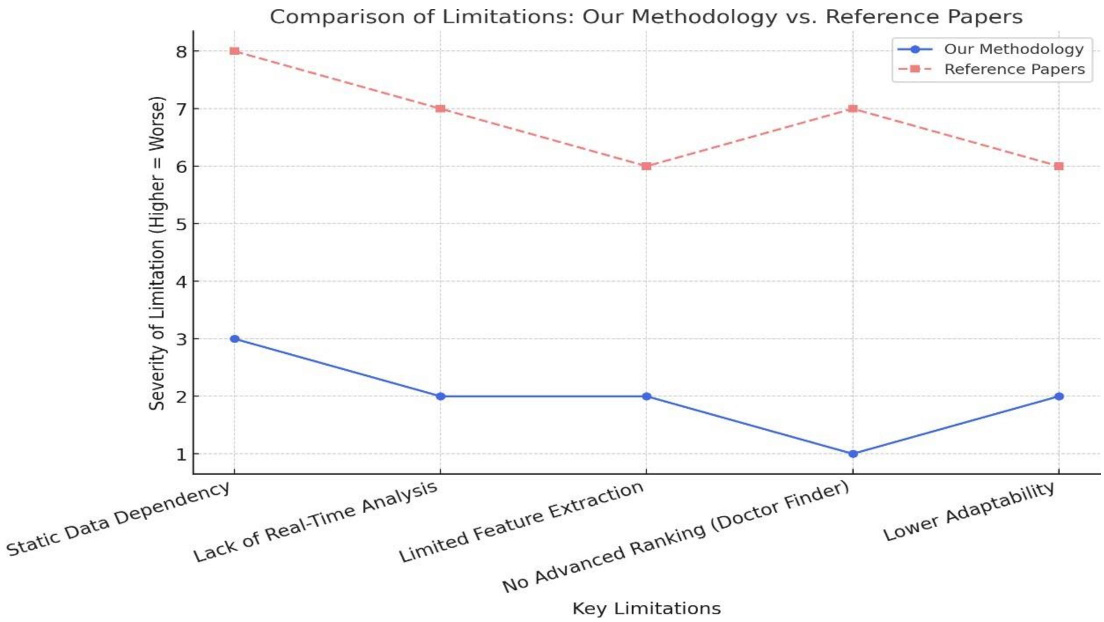

Figure 2: Comparison of limitations

CONCLUSION

The Intent of this paper is to increase the awareness of health among the people. In current days, many people show their lazy behavior and don't consult a doctor during a time of illness so the implementation of a chatbot will help them people to diagnose the disease without consulting a doctor. The chatbot will act as a virtual doctor. The user will prescribe their symptoms of their illness and the chatbot will analyze the disease and suggest the necessary healthcare steps that need to be taken.

In future work, smiley, like and dislike symbols can be considered for categorization of collected data, as it has major contribution to expresses feelings. This system will be developed for wearables too focusing on various heart relates parameters and able to detect blood group using fingerprint.

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