

XAI Yoga Guru

(Explainable AI-Based Yoga)

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Abstract: The evolution of yoga has been remarkable and beneficial over the years as it is a discipline focused on an individual's physical, mental, and overall emotional well-being. It is very common in today's world but still follows a traditional one-size-fits-all method. This can be problematic as it does not accommodate the broad range of diverse individual per practitioner's health conditions, limitations, or needs. To address that, our current work presents XAI Yoga Guru, a personalized yoga pose suggesting system that uses Machine Learning, Explainable Artificial Intelligence (XAI) and Retrieval-Augmented Generation (RAG). The system gathers a user's medical information along with their preferences and suggests unique yoga poses fit for their requirements. Most importantly, each recommendation given is accompanied by an interpretable explanation that shows why the recommendation was made, which improves user trust, safety, and understanding. The blend of personalization with explainability enables users to practice yoga more safely while helping them achieve their wellness goals effectively. The approach taken XAI alongside yoga shows there is a possibility of developing new advanced technologies in wellness catered for specific users' needs.

Keywords: Machine Learning, Explainable AI (XAI), Retrieval-Augmented Generation (RAG), Streamlit.

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I. INTRODUCTION

Yoga arrived from India with its origins in ancient times and people have recognized multiple physical mental emotional advantages throughout many years. Throughout many centuries yoga started as a spiritual practice that became a worldwide health practice for complete wellness. Participating in regular yoga practice leads to development of physical flexibility together with muscular strength and results in clearer mental state while enhancing people's ability to manage stress and raising their lifespan quality [1]. Present-day awareness about preventive healthcare drives more people from various demographic groups to adopt yoga as their choice of exercise worldwide.

The widespread use of traditional yoga does not address personal needs and health conditions when delivering standardized practices to individuals with differing levels of ability. Different yoga postures require different approaches due to individual needs which include age range as well as fitness stage together with medical history and personal targets [2]. When yoga recommendations are general in nature they may not produce effective results and could potentially lead to bodily injuries. The challenge to develop yoga programs which evaluate each participant's unique characteristics

emerges because it allows for protective measures and optimal results and enduring participation.

The system we introduce as XAI Yoga Guru creates an innovative solution for custom yoga pose recommendations. Users can avoid limitation of static fitness programming present in regular yoga applications by using XAI Yoga Guru because it analyzes personal health information such as pre-existing conditions and fitness goals along with lifestyle choices. The system provides poses to users according to their individual needs after analyzing their specific requirements. XAI together with RAG technologies allows the system to deliver custom recommendations that users can understand fully. The system explains each pose recommendation to users while building trust and ensuring safety as well as providing them with the information needed for making informed decisions.

The core technology foundation of XAI Yoga Guru features Python for backend services together with Streamlit to build the intuitive user interface alongside LangChain for deployment of retrieval-based intelligent generation technology. The combination of these technological elements creates an ideal user experience with high accessibility and improved operability while allowing the platform to maintain excellent scalability. The

addition of explainability functions to recommendations systems helps users understand and confirm decisions from the AI health system.

XAI Yoga Guru establishes a transformation in individual wellness technology that improves the field dramatically. Through its integration of explainable AI components with user-centric approaches the system presents users with a better and safer method for receiving yoga guidance than traditional approaches. The system enhances user participation with custom suggestions at the same time as providing users understanding into their wellness path. The growing requirement for personalized and transparent wellness solutions will be defined by XAI Yoga Guru in the coming future.

II. LITERATURE SURVEY

Classic yoga platforms present users with two options which are static pose sequences alongside pre-recorded videos guided by instructors [3]. The yoga applications Daily Yoga and Down Dog provide their users with two basic functionalities between them: static yoga sequences and simple filtering options dependent on user-selected difficulty or goal preferences. Such models lack the ability to consider comprehensive health records or record past injuries or present medical problems which hinder custom solutions and secure practice. Such systems display an important weakness when it comes to current digital yoga products because they lack dynamic response capabilities.

Research teams during the last few years have studied the incorporation of artificial intelligence (AI) into wellness and fitness applications to advance individualized user experiences [2]. Different machine learning applications exist for automatic yoga pose suggestions in which personal preferences and past habits and user feedback schemes play significant roles. The systems overcome basic static routines because they allow users to personalize their experience. Several machine learning models act as unexplainable programs because they generate recommendations without clearly showing what logic or reasoning led to the proposed solutions. Such AI-driven wellness tools present challenges to user trust in important health domains since users have difficulty understanding their operation.

The essential advancement in this field has been Explainable AI techniques which work to reduce the current trust gap [4]. The focus of XAI lies in building predictive or recommendatory models which produce straightforward explanations regarding decision-making processes. User safety together with well-being requires explainability as the principal requirement for medical and wellness applications. Explainable AI techniques improve user trust along with their acceptance rates through transparent recommendation-making processes which match healthcare standards or individual clinical experiences.

The functions of AI systems have experienced a significant jump through recent Retrieval-Augmented Generation (RAG) model developments which improve contextual abilities. RAG models unite large language models (LLMs) with external document retrieval systems that enable them to work with external knowledge bases before generating responses [5]. RAG augmentation brings more accurate recommendations which lead to better quality evidence-based choices. The retrieval and integration of current health guidelines as well as yoga research and safety precautions happens dynamically through RAG applications in wellness domains.

The XAI Yoga Guru framework presents a unique platform that combines RAG with XAI features into its structure. Previous static recommendation models alongside basic personalization features are overcome by the XAI Yoga Guru because it uses user health data to pull relevant information which results in personalized yoga guidance along with understandable explanations. The system provides dual functionality which delivers both appropriate recommendations and transparent explanations about decision-making processes thus enhancing user safety and boosting their trust in the platform.

Despite the progress in AI-driven wellness tools, most existing yoga apps still lack genuine personalization features. Standard yoga sequences appear in several platforms even though these offerings fail to modify their content for health-specific conditions or safety restrictions [3]. These applications lack both real-time processing adjustments and precautionary safety rules that would react to changing user inputs during sessions. AI systems regarding explainability creates a substantial obstacle for individuals who need confirmation of recommendation suitability and safety.

Views about patient-customized solutions have appeared but their implementation depends on static classification approaches and straightforward matching methods which fail to account for the intricate developmental nature of health conditions. The current strategies do not deliver systems which achieve real-time analysis with explainable decision-making capabilities in truly conversational interfaces. AI-based yoga recommendation systems must address four essential capabilities: interactivity, contextual understanding, explainable operation and user-specific need awareness to fulfil the current research gap and practical usage needs. XAI Yoga Guru represents our solution to address this unmet need by becoming the standard for intelligent wellness systems with person-centered capabilities.

III. RANDOM FOREST AND EXPLAINABLE AI

A. Introduction to Machine Learning

Machine Learning serves as a field within artificial intelligence which allows computers to recognize patterns from data through unprogrammed processes to generate decisions or predictions [6]. The application of statistical methods within ML models enables them to uncover

intricate data connections while improving performance through the accumulation of additional data. The yoga recommendation systems gain necessary adaptability toward individual user health characteristics through Machine Learning techniques in personalized wellness domains.

B. Random Forest Algorithm

Random Forest (RF) represents a popular ensemble learning approach in machine learning which operates effectively for classification as well as regression operations [7]. During training the algorithm builds multiple decision trees while it delivers classification mode predictions or regression mean predictions obtained from individual trees. The training of each tree occurs using a different randomly selected subset of training data while node-split decision involves examining arbitrary random feature subsets. The random selection method in boosting decision trees helps minimize over fitting and produces better predictive generalization than standalone decision trees.

C. Training Phase

During the training process, the Random Forest algorithm builds n decision trees, each trained on a different random subset D_i of the full training set D . Each tree is grown by recursively splitting the nodes based on feature values that minimize a loss function such as Gini impurity or entropy [9]. For instance, in classification tasks, the Gini impurity at a node is computed as [7].

$$Gini = 1 - \sum_{i=1}^C (p_i)^2$$

Where p_i is the probability of class i at that node and C is the number of classes. The feature that results in the greatest decrease in impurity is selected for the split, promoting highly discriminative trees.

D. Testing and Prediction

Once the forest is trained, testing involves passing a new input sample through each of the trained trees. Each tree independently makes a prediction, and the final output is determined by either majority voting (for classification tasks) or averaging (for regression tasks). The ensemble prediction \hat{y} can be mathematically represented as [7].

$$\hat{y} = \frac{1}{n} \sum_{i=1}^n f_i(x)$$

Where $f_i(x)$ is the prediction generated by the i -th decision tree for the input x . This ensemble approach significantly improves prediction stability and accuracy over individual models.

E. Explainable Artificial Intelligence (XAI)

Random Forest models provide excellent accuracy and generalization capabilities while operating as untraceable algorithms which users find difficult to understand their output reasoning [4]. The inability to interpret these models creates problems in healthcare applications because users require full transparency alongside trust in every decision.

Explainable Artificial Intelligence (XAI) develops systems that enable AI decision-making processes to become both clear and understandable to users [8]. The interpretability of Random Forests can be achieved using methods that include feature importance analysis and partial dependence plots (PDP) as well as SHAP (SHapley Additive Explanations) and LIME (Local Interpretable Model-Agnostic Explanations). The techniques provide human-readable information about influential features that guide particular predictions so users can carefully evaluate the appropriateness of recommended poses and build confidence in AI systems. Our system contains XAI components that allow users to build trust and understand their customized yoga recommendations.

IV. XAI YOGA GURU

A. Dataset Description

The fundamental component of XAI Yoga Guru System operates through the Pose Safety Dataset. This database consists of comprehensive labels for multiple yoga postures which are classified per user profile safety standards. Yoga pose entries within the dataset specify information about required body flexibility aspects together with balance requirements and muscle engagement levels and body pressure points. The dataset uses links to specify exact contraindications for yoga poses by indicating age restrictions as well as injury and medical conditions.

The Pose Safety Dataset functions as basis for training the Random Forest classifier. Each pose obtains a binary classification (safe/unsafe) based on the health information of users accommodated in the dataset structure. The Random Forest algorithm processes multiple feature parameters which include pose intensity together with target muscles and risk factors to achieve accurate predictions for user-supplied inputs regarding safety levels. Through this functionality the system generates secure individualized yoga recommendations that safeguard both effectiveness and medical security of the users.

B. Project Architecture and Explanation

XAI Yoga Guru System functions as an adaptive personal yoga recommendation service that responds to user input and integrates transparency measures for safety assurance. The project architectural design uses modular techniques for sequential task execution while the block diagram represents this arrangement.

The system starts its operation by requesting user data including their age alongside their medical conditions and injury background. Processing this information together

with the Pose Safety Dataset leads to obtaining necessary features for creating personalized pose recommendations. The third module of the system uses the Random Forest algorithm to classify yoga poses in two groups based on their safety levels. User conditions receive assessment against pose risk factors to guarantee that the system recommends suitable poses.

After running classification operations the Explainable AI (XAI) system becomes active. The LIME (Local Interpretable Model-Agnostic Explanations) technique enables the system to create explanations people can understand regarding which poses the system regarded as safe or unsafe. The transparent system interface promotes user trust and offers explanatory explanations which demonstrate how to handle personal health needs effectively.

The system goes on to provide security advice that matches the precise requirements of each user. The system indicates safe poses which need special attention for proper execution when there are mild back restrictions.

The system has an RAG (Retrieval-Augmented Generation) Query Resolution module for dynamic handling of user inquiries. The system draws required data from its expanded information foundation while providing users with specific detailed recommendations. Users obtain detailed real-time guidance about yoga together with pose recommendations through this system.

The XAI Yoga Guru highlights itself as an advanced yoga recommendation system because of its explainable intelligent adaptive framework which incorporates state-of-the-art machine learning and retrieval approaches beyond static applications.

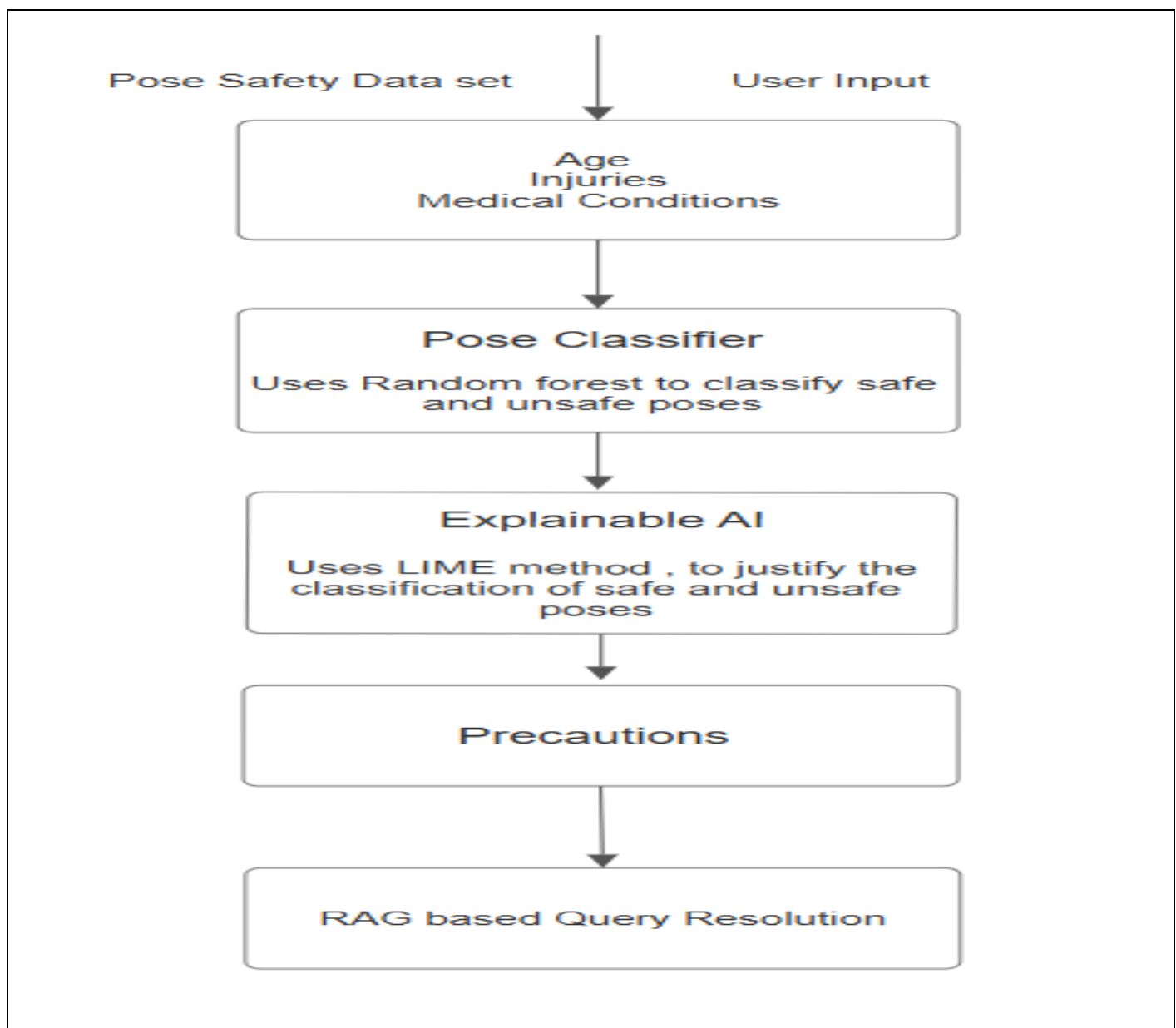


Fig 1: Block Diagram of XAI Yoga Guru.

V. RESULTS AND DISCUSSION

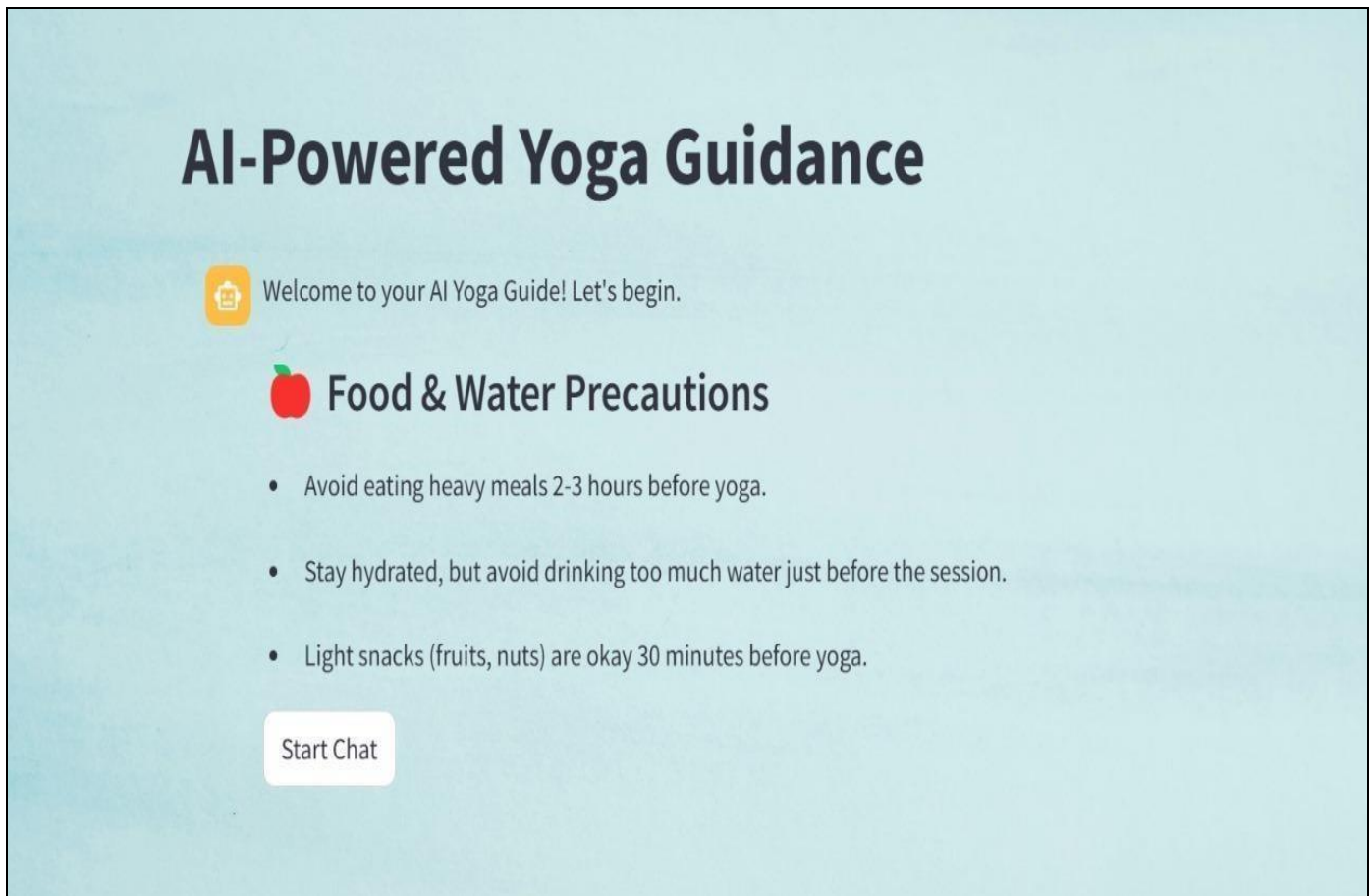


Fig 2: Precautions

The chat interface displays food and water precautions before starting yoga, so that the user has a comfortable experience while following along the yoga poses.

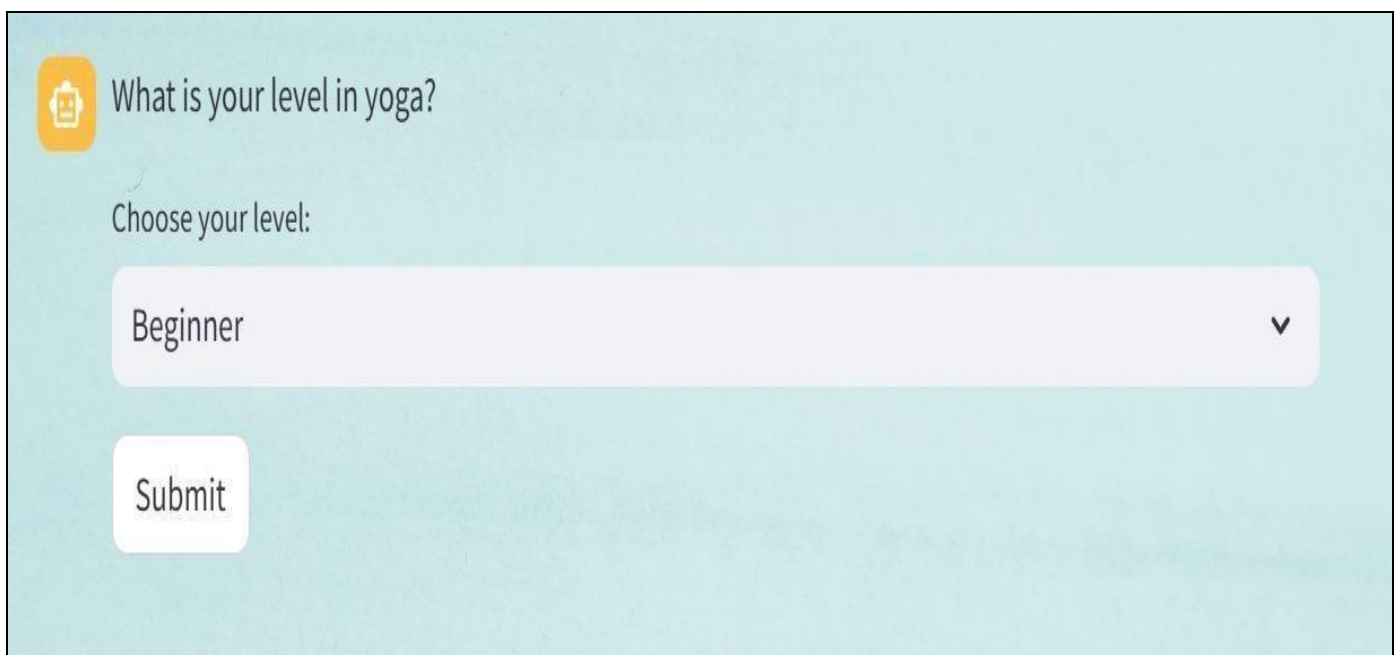
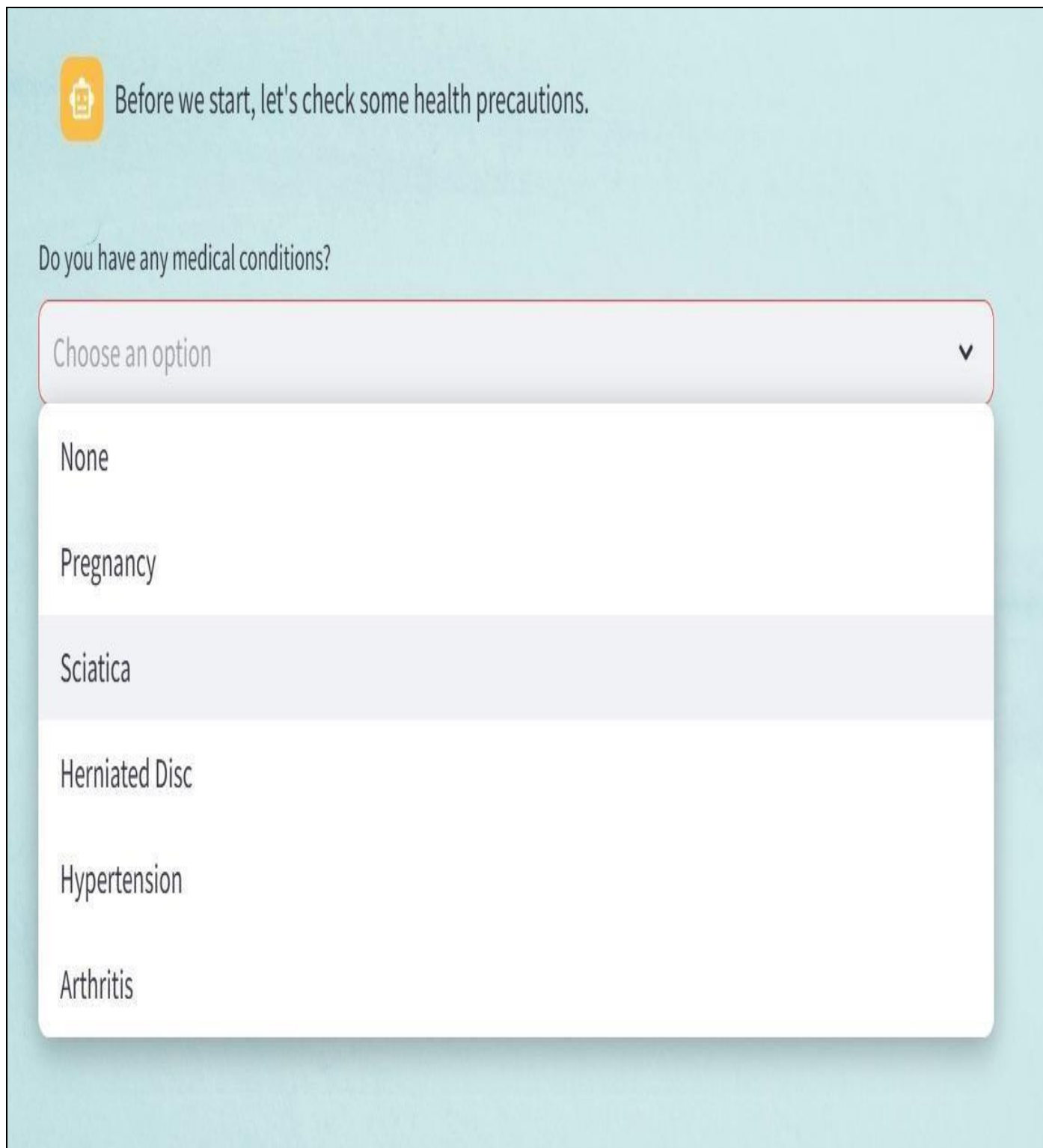


Fig 3: Checking Level in Yoga

User level is checked and used for safe and unsafe pose classification, and yoga pose suggestion.



Before we start, let's check some health precautions.

Do you have any medical conditions?

Choose an option ▼

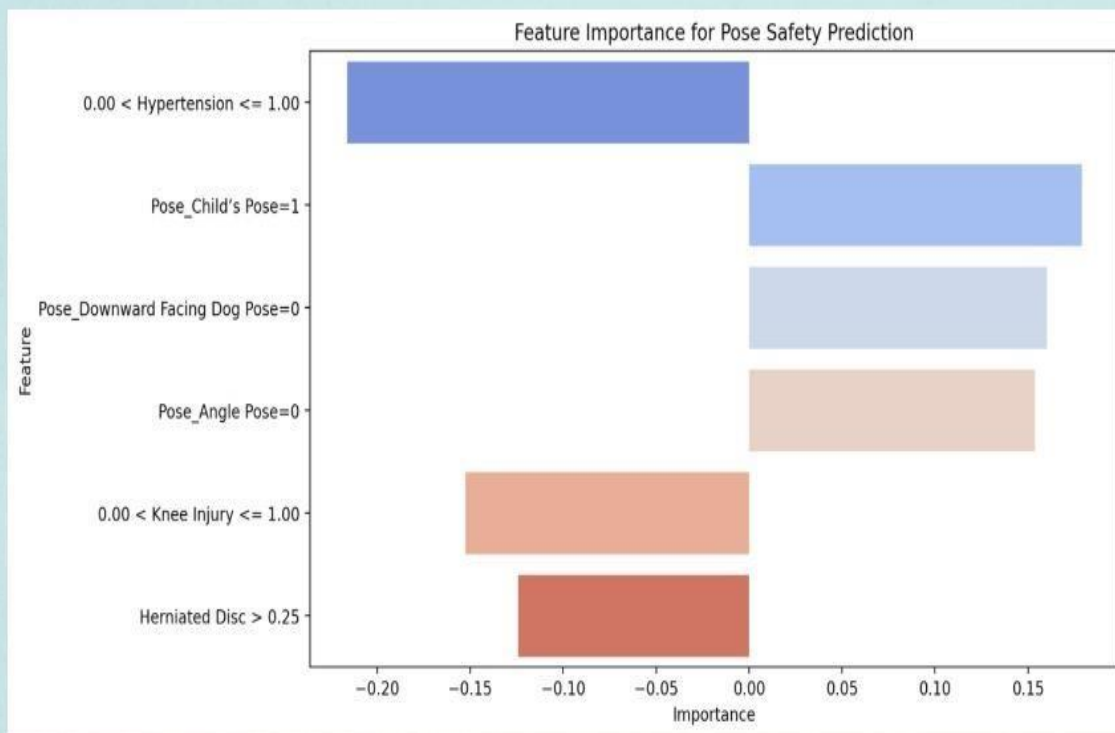
- None
- Pregnancy
- Sciatica
- Herniated Disc
- Hypertension
- Arthritis

Fig 4: Collecting user Health Information

Health information of user is collected that includes any medical conditions and also sub-medical conditions that follow.



AI-Powered Pose Safety & Explanation



Child's Pose

Prediction: SAFE

LIME Top Features:

- 0.00 < Hypertension ≤ 1.00: -0.22
- Pose_Child's Pose=1: 0.18
- Pose_Downward Facing Dog Pose=0: 0.16
- Pose_Angle Pose=0: 0.15
- 0.00 < Knee Injury ≤ 1.00: -0.15
- Herniated Disc > 0.25: -0.12

Explanation: This pose is considered safe based on your health and injury conditions. The most important factors contributing to this are your lack of hypertension and knee injuries.

Fig 5: Pose Safety Classification and Explainability using XAI

Based on user inputs the random forest classifies the pose as safe or unsafe and then explainability is added using LIME, depicted by the feature plots showing how much importance each feature has in the classification.



Ask Any Yoga Question



Type your question: ↩

Ask me anything related to yoga, poses, safety, breathing, benefits...

What are the benefits of doing yoga



Mixtral (Groq) Response

What a great question!

The benefits of doing yoga are numerous and multifaceted. Yoga is an ancient Indian practice that promotes physical, mental, and spiritual well-being. Here are some of the benefits you can expect from regular yoga practice:

Physical Benefits:

- Improves flexibility and balance
- Strengthens muscles and bones
- Enhances posture and alignment
- Improves circulation and reduces fatigue
- Lowers blood pressure and improves overall cardiovascular health
- Aids in digestion and relieves symptoms of anxiety and depression

Mental and Emotional Benefits:

- Reduces stress and anxiety
- Promotes deep relaxation and calms the mind
- Improves focus, concentration, and mental clarity
- Enhances self-awareness and emotional regulation
- Supports mental wellness and reduces symptoms of depression

Fig 6: Query Resolution using RAG

RAG helps the system deliver targeted yoga knowledge retrieval followed by customized context-relevant answers to the user's open-ended questions.

VI. CONCLUSION AND FUTURE WORK

The current work introduces XAI Yoga Guru as a smart recommendation platform which generates personified yoga poses from users' health specifications. A combination of Explainable AI techniques together with Random Forest classification produces personalized safe yoga routines that offer humans understandable explanations of each suggested routine. Through the implementation of Retrieval-Augmented Generation (RAG) the system becomes able to provide contextualized answers in response to user queries thus expanding its features beyond static yoga instruction. Through unifying machine learning with explainable features and user-centered controls the platform resolves the main weaknesses of current yoga applications in one solution.

Researchers have proved that combining contemporary retrieval systems with conventional machine learning techniques enables the development of health applications which users find both trustworthy and effective to use. XAI Yoga Guru builds user confidence through complete explanations of pose classification reasons and achieves dual educational benefits. Research findings prove that wellness systems can accept real-time explainable decision-support frameworks as they maintain user safety while delivering satisfaction.

The upcoming work direction includes developing the Pose Safety Dataset by increasing its coverage of different body types as well as adding medical history details and multiple yoga practice styles. The system will be updated by implementing computer vision techniques which will provide users with visual image- and video-based pose correction capabilities. The system development will place priority on building active user input systems and multiple language features to achieve worldwide accessibility. XAI Yoga Guru will reach new heights through wearable sensors that monitor posture in real time which would prevent injuries in the future.

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