

# SMART - Machine Learning Based Fitness Mobile Application

Santhiramohan Madhushika<sup>1</sup>, Mohomed Zowrie Mohomed Akil<sup>2</sup>, Nifthas A.R.M<sup>3</sup>, Pirtheep GT<sup>4</sup>, Ravi Supunya Swarnakantha N.H.P<sup>5</sup>, Suriyaa Kumari<sup>6</sup>

<sup>1</sup> Sri Lanka Institute of Information Technology, Faculty of Computing  
Mount Vernon M.D Patana, Sri Lanka, PH-+94 77 895 9014  
*Madhushika014@gmail.com*

<sup>2</sup> Sri Lanka Institute of Information Technology, Faculty of Computing  
72/4C, Library Road, Maharagama, Sri Lanka, PH- +94 75 329 3186  
*mohomedakil123@gmail.com*

<sup>3</sup> Sri Lanka Institute of Information Technology, Faculty of Computing  
239/2, muhaideen mp maawarthay block j east 2, Sammanthurai Sri Lanka, PH- +94 77 694 6266  
*abduhrasoolnifthas1998@gmail.com*

<sup>4</sup> Sri Lanka Institute of Information Technology, Faculty of Computing  
New Kandy Road, Malabe, Sri Lanka, PH- +94 77 492 6126  
*bpiratheep@gmail.com*

<sup>5</sup> Department of Information Technology, Sri Lanka Institute of Information  
Technology, Matara, Sri Lanka  
*ravi.s@slit.lk*

<sup>6</sup> Department of Information Technology, Sri Lanka Institute of Information  
Technology, Malabe, Sri Lanka  
*suriyaa.k@slit.lk*

**Abstract:** Many people don't pay attention to their health and fitness with their busy life styles. This situation vastly increased in Sri Lanka with the economy crisis of the country. People spending a stressful life bad economy and shortage of products and services. Most people spend time in the Fuel queues, and due to the shortage of fuel, they have trouble visiting fitness centers, etc. Meantime they miss fitness guidance, motivations, and diet plans and face physical and mental troubles because of the lack of time. SMART mobile application is very helpful for fitness users who really need to improve their health. SMART includes various aspects like workout, food schedule, and gym equipment suggestion, and trainer help are covered. In today's world, mobile applications have become an indispensable tool for many people. This is especially true in countries where other forms of technology may not be as readily available. For fitness enthusiasts looking to save time and maintain their fitness goals, the SMART mobile app provides a secure and reliable solution. While the app is designed for users with basic fitness knowledge, it also provides advanced features that cater to the needs of professional fitness coaches. The SMART app leverages the power of machine learning, image processing, and the Python module to deliver a seamless user experience. With its innovative technology and user-friendly interface, the SMART app is poised to revolutionize the way people approach fitness.

**Keywords:** Fitness, Mobile application, Workouts, Machine learning, Image processing.

## 1. Introduction

Amidst the ongoing situation prevailing in the country, individuals are making a concerted effort to achieve their goals. Simultaneously, with the growing emphasis on "maintaining good health" and "regular exercise" among people, the fitness culture is gaining momentum, and an increasing number of individuals are focusing on their physique and even monitoring numerical aspects such as body fat percentage [1]. Fitness apps are designed to enable individuals to compare their fitness performance with others, providing motivation to improve their behavior [4]. This feature allows users to view statistical graphs of physical activity among their friends or communities who also use the app, encouraging them to strive for better results [4].

By benchmarking their progress against others, users can build stronger habits and enjoy the benefits of a healthier lifestyle. Furthermore, these applications serve as a medium for people to interact with like-minded individuals who have common fitness objectives, fostering a feeling of camaraderie and encouragement throughout their physical

wellness endeavors. A new fitness app has been designed for self-trained individuals who have experience in exercising [1]. The proposed mobile application utilizes image recognition technology to accurately identify the user's fitness level, and provides personalized recommendations on food and workout plans through the use of machine learning algorithms and a recommendation system [1].

The SMART app offers a comprehensive solution for fitness enthusiasts who are looking for timely workout routines, nutritional guidance, and access to virtual trainers. With a wide range of gym equipment and workout plans, this mobile app is a must-have for anyone looking to maintain a healthy and active lifestyle.

The proposed system is designed to be user-friendly and highly accessible. Upon accessing the system, the user will be prompted to answer a set of questions, and they will be able to upload or take an image using their own device. The system will then analyze the image using image processing techniques and provide the user with valuable information

regarding workouts, gym equipment, and meal planning. The system aims to provide comprehensive guidance to the user, including instructions on how to use the equipment correctly, how to plan meals effectively, and how to perform workouts correctly. Additionally, the system provides a list of the top exercise machines and gym equipment recommended by fitness coaches to help users select the best equipment for their needs.

Overall, the system is an excellent tool for anyone looking to maintain a healthy lifestyle and improve their fitness levels. The framework's user-friendly interface and comprehensive guidance make it an indispensable tool for beginners and experienced fitness enthusiasts alike. By leveraging the latest advancements in image processing and fitness coaching, the system provides valuable insights and suggestions to help users achieve their fitness goals.

The process for using the fitness-enhancing application is relatively straightforward. The user needs to upload an image of the body part that they wish to improve. The system will then compare the image values with the available datasets using conventional neural network (CNN) to determine the appropriate type of meal that the user needs to consume based on the provided instructions. Afterward, the system will calculate the Body Mass Index (BMI) value for that specific body part image.

This study aims to implement a supporting application that can significantly improve fitness by utilizing various machine learning algorithms and classification techniques to provide the most accurate and effective solutions for users. By analyzing the user's body part images and providing customized recommendations, the application can help users achieve their fitness goals more efficiently. The use of machine learning algorithms and classification techniques allows the system to make personalized recommendations for each user.

This enables the system to provide accurate and efficient results, which can greatly enhance the user's fitness journey. Moreover, the system can adapt to the user's changing needs and preferences, ensuring that the recommendations remain relevant and effective over time. In conclusion, the fitness-enhancing application provides a user-friendly solution for individuals seeking to improve their fitness. By using machine learning algorithms and classification techniques, the system can provide customized recommendations to users, which are tailored to their specific needs and preferences. The fitness industry could be transformed with this application, as it offers a highly effective and efficient means for people to attain their fitness objectives.

## 2. Background

If you're new to fitness, you can begin your journey by enrolling in a group fitness class or hiring a personal trainer. As they become more acquainted with the equipment and their own body, they may choose to work out on their own as the cost of a personal trainer can be prohibitive [1]. The responsibility of trainers includes keeping track of exercises, such as what movements to perform and how much weight to use. When working out solo at a gym, many individuals choose to keep track of their workouts using a notebook or mobile application [1].

In 2020, a study was conducted to address security concerns related to the protection of personal data in mobile fitness applications. The researchers analyzed 110 health-related applications and found that only 51 of them were deemed trustworthy. To gather evidence, they examined the Wi-Fi communication utilized by these applications [6].

In 2010, an application was developed that focuses on the physical and mental health of undergraduate students at the university. This application underwent comprehensive analysis in this area [7]. An Android application was developed in 2018 to track fitness and provide advice based on fitness criteria. This application allows individuals to monitor their fitness progress [8].

The increasing reliance on mobile devices and apps in our daily lives has the potential to revolutionize the way we approach our health. However, existing solutions that leverage sensor technologies to encourage healthier habits often struggle to motivate user participation. To address this challenge, we propose a novel approach in which fitness challenges are integrated into users' daily routines to increase engagement. To bring this concept to life, we introduce GeoFit, a mobile app that allows users to discover and add fitness challenges within their vicinity. GeoFit has the potential to inspire and encourage users to make their health a priority by offering a fun and competitive way to stay active. This innovative fitness solution has the ability to help individuals seamlessly incorporate exercise into their daily routines [4]

## 3. Methodology

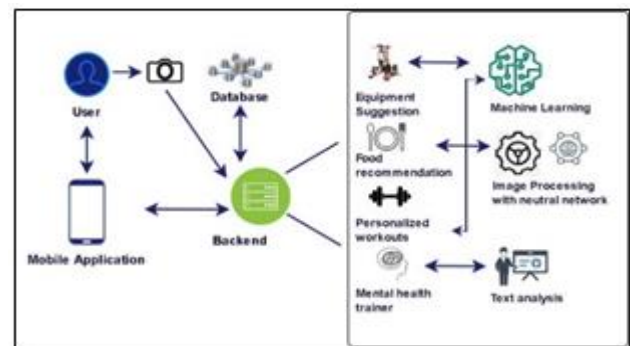


Figure 1: Overall System Diagram

The Proposed System, a supporting application for enhancing fitness workouts, is depicted in Figure 1. The mobile application aims to provide assistance and support for fitness enthusiasts in improving their physical health. The primary objectives of the application include helping users with their workout routines, providing a product analyzer for health supplements, and offering guidance on healthy fitness practices. The app is designed to be user-friendly and accessible, catering to fitness users who are struggling to navigate the complexities of maintaining a healthy lifestyle.

The proposed framework comprises of four main components that will be completed to achieve the desired outcome. A range of CNN algorithms and models will be employed. Once the model is trained, the binary classifier results will be sorted, and the frontend part implementation will be carried out using Visual Studio. Python has been

selected as the programming language, and several libraries will be used, including Image Processing and Machine Learning frameworks. Additionally, a K-means clustering model will be implemented in the development of the mobile application. Image processing will be utilized to analyze the body part, which is an essential step in the disease detection and severity assessment process.

- 1) Recommendation of Gym equipment.
- 2) Getting information from users, and according to the information suggest some meals for users.
- 3) Personalized workout plan recommendation.
- 4) Provide solutions, recommendations and ideas for fitness and health related issues. Provide solutions using machine learning

Different types of CNN algorithms and models will be used to examine the data analyzing. After the machine learning model has been prepared, the binary classifier results are will be sorted. Visual studio used for frontend part implementation. Python was picked as the programming language., alongside the libraries, Machine Learning, Image Processing, Machine Learning framework, K-means clustering model to implementation of the mobile application. Image processing for used to analyze the body part.

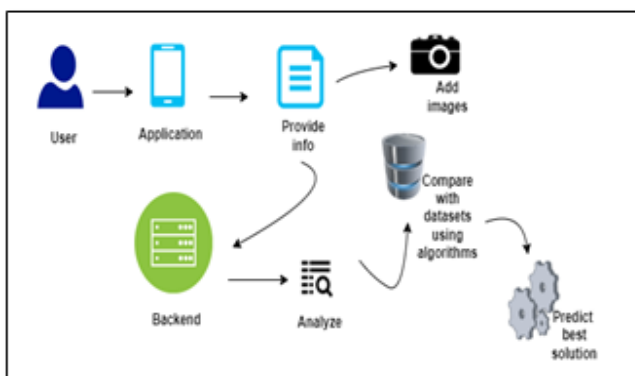


Figure 2: Gym Equipment suggestion

### 1.2 Recommendation of Gym Equipment

Systems recommends user requirements based on various criteria like given user information, user preferences, search history, demographic information, user purchase history etc. These kinds of recommendations are more important and beneficial when a person has no idea about a particular selection / decision etc. A recommendation system is mostly an Artificial intelligence or algorithm, usually combined with machine learning.

These recommendation systems are built to recognize user characteristics, user preferences, user past decisions, by the interaction data gathered. They are impressions, likes, clicks, searches, and purchases etc. Recommendation systems are capable of providing highly personal predictions.

Individuals that enjoy working out will use a variety of gym equipment on their own. not just at home, but also in gym facilities. It's advisable to be knowledgeable about the advantages of different gym equipment. Sometimes people become too attached to only one or two pieces of equipment and stop there. They can significantly improve if they have the right equipment expertise. Below figure shows the

individual system diagram for the recommendation of gym equipment.

### 1.2 Getting information from users, and according to the information system suggest meals for users

#### 1.2.1 Getting information from users

This system is more dependable, secure, and user-friendly. In this component, the system will ask some important and basic questions from users. What is your age? What is your height? What is your weight? Based on those values, the system should analyze those things with existing data sets. Following that, the system will allow fitness users to scan and upload their body image into the system using their own device's camera to analyze the body part and give the value of that particular body part based on an image processing component. The system will compare the entered values to the uploaded image based on those values.

The program will allow users to provide appropriate food items according to existing information, recommending food for precise result. The primary goals of this application system are to provide food items with accurate information and quality at the appropriate time, when user really need it, to keep them from taking the incorrect food items to keep their bodies and body part healthier. First, we should import the data set, If the user needs to lose weight, the system uses datasets to calculate their BMI values. The system will then train those values before creating some array layers. This array layer will be used to train the model using the calculated BMI values. The system then recommends the right and precise food to users in hopes of enhancing their body part.

The system diagram in Figure 3 presents a typical representation of the research component that includes machine learning. The system works by first scanning the image of a body part and processing it using image processing techniques to separate the object. The K-means clustering algorithm is then used to identify the body part type and analyze the image details with existing data and user input. This system can be particularly useful for individuals looking to improve their body fitness level by utilizing a mobile application. With the ability to accurately identify body parts and analyze details, the system can provide valuable insights and recommendations to help users achieve their fitness goals.

#### 1.2.2 K-Mean clustering algorithms.

The K-means algorithm in data mining involves a series of steps to analyze the learning data. Initially, a set of randomly chosen centroids is selected as the starting points for each cluster. Then, the algorithm performs iterative calculations to improve the position of the centroids by minimizing the sum of squared distances between data points Figure 2: Gym equipment suggestion Figure 2: Gym equipment suggestion Figure 3: Food suggestion part and their respective centroids. Through this process, K-means clustering helps to identify distinct groups or clusters within the data, which can aid in making predictions or uncovering patterns. By continuously refining the centroid positions, the algorithm seeks to find the optimal clustering solution for the given data set.

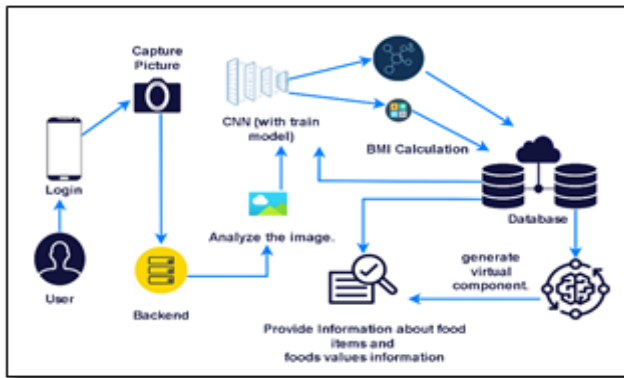


Figure 3: Food Suggestion

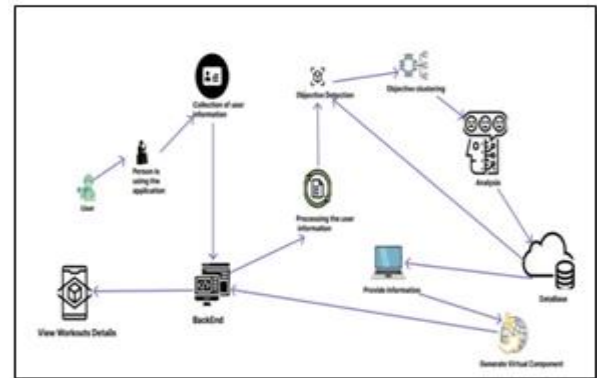


Figure 5: Personalized workout plan recommendation

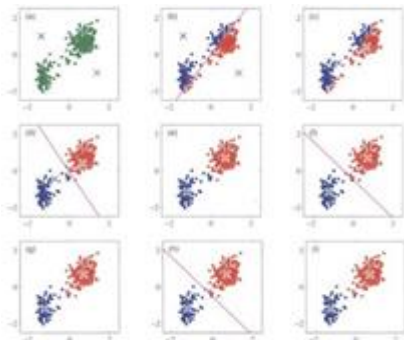


Figure 4: Sample K-Mean clustering Algorithm

### 1.2.3 Data mining method

Data mining is a powerful tool that involves the application of statistical and computer methods to uncover valuable insights from large databases. By analyzing data from various perspectives, patterns, correlations, and linkages that were previously unnoticed can be discovered. By leveraging the power of data mining, companies can extract meaningful information from vast amounts of data, allowing them to better understand customer behavior, identify market trends, and make data-driven decisions that lead to improved performance. As the volume of available data continues to grow, data mining has become an indispensable tool for organizations across a wide range of industries.

### 1.3 Personalized workout plan recommendation

The proposed methodology involves collecting and preprocessing data, developing and training a machine learning model, evaluating the model's performance, deploying the model, and monitoring and updating the model. The dataset used for training the model includes BMI, age, gender, and workout routines of individuals collected from various sources such as health apps, and medical records. The proposed methodology is expected to provide personalized workout recommendations to individuals based on their BMI, age, and gender.

This methodology basically involves five steps: first one is data collection and preprocessing, model development and training, model evaluation, model deployment, and model monitoring and updating. The first step involves collecting data from various sources such as fitness trackers and health apps. The dataset includes BMI, age, gender, and workout routines of individuals. The data is then preprocessed to remove missing or incomplete data, check for outliers, and normalize the data.

The second step involves developing and training a machine learning model using various algorithms such as regression or neural networks. The model is trained using a combination of supervised and unsupervised learning techniques to predict the best workout routines for individuals based on their BMI, age, and gender. The third step involves evaluating the model's performance by comparing the predicted workout routines with those that individuals are currently doing or have done in the past. The model's accuracy and effectiveness are assessed based on various metrics such as precision, recall, and F1 score.

The fourth step involves deploying the model to suggest workout routines to individuals based on their BMI, age, and gender. The model can be deployed through a fitness app or website, and individuals can input their personal details to receive personalized workout recommendations. The fifth step involves monitoring and updating the model regularly to ensure that it remains accurate and effective. Any updates or improvements to the model are made based on new data or feedback from users. The proposed methodology is expected to provide personalized workout recommendations to individuals based on their BMI, age, and gender. This approach is expected to lead to improved fitness outcomes and reduce the risk of injuries or health issues. The model's accuracy and effectiveness are evaluated using various metrics, and any updates or improvements to the model are made based on new data or user feedback.

And the proposed system takes in a video of an individual performing a set of exercises and analyzes it using computer vision techniques. The system first identifies the individual's body parts and joints using a pose estimation model, such as Open Pose. The system then calculates the angle and movement range of each joint during the exercise and compares it to ideal movement patterns for that exercise. Based on this analysis, the system recommends a set of exercises that are safe and effective for the individual's specific needs. and Personalized workout recommendations based on BMI calculation, age, and gender using machine learning algorithms are expected to lead to improved fitness outcomes and reduce the risk of injuries or health issues.

#### 1.3.1 Deep Convolution Neural Network Design:

The proposed deep convolutional neural network (DCNN) design takes in input images or videos of individuals performing exercises and outputs a set of recommended workouts based on the individual's BMI, gender, and age. The network architecture consists of multiple convolutional

layers. To prevent overfitting, the network includes dropout layers that randomly drop out a fraction of the neurons during training. The output of the dropout layer is then passed through a fully connected layer, which combines all the extracted features and outputs a set of recommended workouts based on the individual's BMI, gender, and age.

#### 1.4 Provide solutions, recommendations and ideas for fitness and health related issues. Provide solutions using machine learning.

In recent times there are several developments in the fitness and health fields using machine learning process. There are many notable success developments in the various topics such as Customized workout plans can be made using machine learning algorithms that consider a person's physical attributes, fitness objectives, and past workout behavior. Real-time feedback: Machine learning algorithms can evaluate data from fitness trackers and other wearables to give feedback on an individual's form, performance, and efficiency while exercising.

##### 1.4.1 Injury prevention

By analyzing a person's movement patterns and identifying potential injury risks, machine learning algorithms enable early intervention and injury prevention. Nutritional advice: Based on a person's fitness objectives and an analysis of their eating patterns, machine learning algorithms can provide individualized recommendations for healthy eating.

##### 1.4.2 Virtual coaching

Overall, implementing machine learning into fitness alternatives has the possibility of significantly enhancing the efficacy and customization of training programs, resulting in better results for people. But most of the proposed systems and systems already available in the market for public usage are mostly designed to work in a common way. Like only few common factors are considered and people do not have the option to get specifically personalized services. Sometimes they might not get what they are looking for. Most of the available systems are giving limited amount of information. They might not get solutions which including all the aspects of health and fitness.

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This proposed system consists of five main steps are including collection and preprocessing data, develop and train the model, verification and evaluation of the model and consistently monitoring and updating the model. In the first step data will be collected from various sources to ensure accuracy of the recommendations, data will be collected from activity tracking apps, fitness apps and wide range of both mental and physical health related apps available on the

market. Dataset will consist of Age, gender, both mental and physical health related issues, sleeping patterns, life style patterns, workstyle and etc. Once the collection of data is done then data will be preprocessing the get specific and accurate results so the data will be cleaned which involves removing duplicates, correcting errors and filling missing data points. Then in the second step, the model will be developed and trained in order to produce correct results.

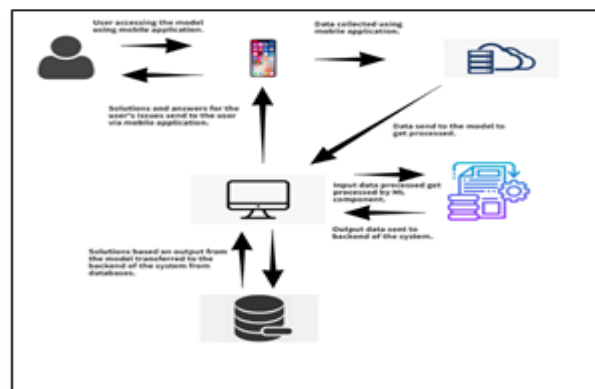


Figure 6: System Diagram

During this process the model will learn to make predictions by analyzing patterns in input and output data. Then the third step is evaluation of the model. In the fourth step the model will be deployed. The deployment will be done in the form of mobile application so it will be easy for users to access it. In the mobile application, the user can interact with the model to give inputs like age, gender, weight, height, health related issues, lifestyle, workstyle & etc. Once the model gets essential data, it will process the data and provide information and solution like what might be possible health related issues the user might face in the future, how to reduce the chances of getting affected by those issues, how to reduce the effects and symptoms of already existing issues, what are the changes they have to make in their lifestyle, what are the lifestyle changes they have to follow. In the fifth step, performance of the model will be monitored continuously and based on feedbacks from users, mandatory updates and correction will be made to model and incase on Figure 6: Individual System Diagram any updates the new data set also will be fed to the model to keep it updated.

## 4. Results and Discussion

The mobile applications described in the above sections were developed using Android mobile application software. If you would like a modified version of the sentence, please let me know. One of the primary objectives of the solution that has been suggested is to enhance the level of fitness and workouts, gym equipment, food regimentation and mental health, provide solutions, recommendations and ideas for fitness and health related issues for fitness users. In conclusion, our study makes an important contribution to the area of fitness by using this mobile application. The promises of machine learning and image processing to improve fitness related issues and give proper suggestions to users. We think our suggested method may be expanded upon to solve other issues in the area of online fitness and has important implementations for its long-term usability.

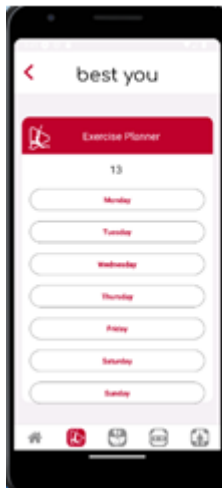


Figure 7: Home Page



Figure 8: Workout recommendation



Figure 9: Food Suggestion



Figure 10: Image uploading part

## 5. Conclusion

The development of a mobile application for fitness enthusiasts is a significant breakthrough in the world of health and fitness. This app utilizes the mobile camera, image processing, and machine learning modules to accurately identify the user's fitness level and recommend customized workout plans. The primary focus of this study is to improve the accuracy of fitness systems by gathering image data through image processing. Utilizing this approach would guarantee that users achieve more efficient outcomes and advantages from their workout routines. Additionally, integrating machine learning technology can significantly improve the accuracy of activity tracking, yield valuable insights into user behaviors, and produce custom-tailored workout plans. As this technology continues to evolve, the potential for fitness apps to assist individuals in leading healthier lifestyles is truly exciting. Overall, the development of a mobile application for fitness enthusiasts that utilizes image processing and machine learning technologies has the potential to revolutionize the fitness industry. By providing accurate data and personalized recommendations, this app can help individuals achieve their fitness goals more efficiently and effectively.

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