AI-Crafted Diet and Fitness for Diseases using Machine Learning

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Abstract: Fast food and sedentary lifestyles have increased the prevalence of chronic conditions such as obesity, diabetes, and PCOD, especially in people in their mid-30s. This is addressed by a web application based on Python and Flask, which uses AI and ML to deliver personalized diet and exercise plans. Some of the features include calorie trackers, BMI calculators, and nutritional value trackers. By gathering user data on calorie intake, activity, and health conditions, it uses advanced algorithms such as reinforcement learning, GNNs, and transformers to provide tailored recommendations. It has a curate's recipe database with meals designed for specific health needs, enabling informed dietary choices. The app integrates diet and exercise plans to help manage symptoms, prevent complications, and promote sustainable lifestyle habits. The comprehensive approach helps in managing chronic conditions and overall quality of life and hence makes it a very viable solution for health and wellness management.

Keywords:
Personalized nutrition, artificial intelligence (AI), machine learning (ML), recurrent neural networks, convolutional neural network.

1. INTRODUCTION

In recent decades, increased consumption of fast foods coupled with sedentary lifestyles has increased chronic health problems related to overweight and associated diseases such as obesity, diabetes, high blood pressure, ulcers, and polycystic ovarian disease. This is the case mainly for individuals in their mid-30 s because poor dietary choices and a lack of physical activity begin to take their toll on the body. This has created a need to develop effective long-term strategies for weight and health management. Consequently, while established solutions such as a low-fat diet cannot work, innovative methods have become preferable. Some innovative methods include very-low carbohydrate ketogenic diets and digital health technologies using artificial intelligence (AI) and machine learning (ML). Such technologies promise many applications, especially those related to personalized nutrition and fitness and the management of chronic diseases, to meet the differences in these needs.

Role of Diet and Exercise in the Management of Chronic Diseases:

Obesity has increased globally and has recently become an enormous epidemic caused by environmental exposure and lifestyle choices. Poor eating habits, complemented by a diet of calorie-rich yet nutritionally poor fast foods, which are associated with low levels of physical activity, have been major contributors to this crisis. Although low-fat diets have been widely prescribed for weight loss, their use has been questioned because obesity rates continue to rise. The most recent evidence suggests that ketogenic diets, that is, those with very low carbohydrate intake, are more effective in terms of short-term weight loss and improvements in markers of metabolic health, that is, blood sugar and cholesterol levels. However, concerns remain about sustainability and potential long-term health implications.

Physical activity is the element absolutely agreed to be part of healthy lifestyles, prudent for adequate maintenance of both weight and overall well-being. However, the best type, intensity, and duration that may enable maximum benefit realization are less clear. For example, although HIIT indeed allows fast results with respect to fat burning and cardiovascular benefits, it may not be suitable or practical for everyone. Thus, exercise plans need to be individualized and taken into consideration with respect to one's fitness level, preferences, and health condition.

The combination of diet and exercise plays a very important role in managing chronic conditions, such as diabetes and obesity. For example, regular physical activity improves insulin sensitivity and helps control blood glucose levels, whereas an appropriate diet affects body weight to prevent further metabolic disorders. However, long-term compliance with these lifestyle modifications continues to be challenging for the majority of patients. Short-term interventions often imply weight regain when individuals revert to their previous habits, which indicate a need for sustainable, patient-centered approaches.

The Emergence of Digital Health Technologies:

The use of digital health technologies opens new avenues for chronic disease management. AI and ML are two of the more prominent of these innovations and provide promising tools for diagnosis and monitoring and even for suggesting personalized treatment alternatives. AI-based Applications in the Management of Diabetes: AI-based applications can be applied in monitoring glucose continuously, forecasting fluctuations in blood sugar, and even early detection of diabetic retinopathy complications. It employs big data analysis that aids in building life trends and making possible predictions for more accurate and timely intervention than would otherwise be possible.

Similarly, the fitness industry has achieved more widespread use of AI and ML in making workout experiences engaging and effective. For example, AI can be engaged in developing individualized workout plans that relate to a user's performance data, preferences, and set goals via AI-based fitness applications. These usually apply data mining techniques and causal inference modeling to refine the suggestions, thereby providing a tailored, adaptive, or intelligent training experience that changes as time progresses. This not only enhances the user experience but also provides more opportunities for them to follow a fitness regimen in the long term.

Personalized Nutrition and Recommendation Systems:

One of the most promising applications of AI and ML in health management is personalized nutrition. Unlike traditional one-size-fits-all dietary advice, personalized nutrition considers not only an individual's unique characteristics, such as genetic makeup or metabolic profile but also his lifestyle and health conditions to make diet recommendations for individuals. This has been a rapidly increasing area of research that shows that many people react differently toward the same food, depending on various factors, such as the gut microbiota or insulin sensitivity. Recommendation systems play the most critical role in providing personalized nutrition advice. Such systems are constructed from AI, ML, and other computational technologies for the analysis of multidimensional data, making it possible to generate and provide meal plans every day or week according to a person's goals and specific desires about health. For example, nutrition recommendation systems may use the data collected by wearable devices through medical records and user inputs for recommendations on personalized meals to cover some nutrient needs. Recipe recommendation systems create recipes in which the system offers meal options to the users while considering user profiles, such as specific dietary wishes and restrictions, making the system less burdensome by making it easier for the user to maintain a healthy diet. Restaurant recommendation systems help users identify healthier options from restaurant menus that are appropriate for their dietary needs and preferences. These personal recommendation systems have been shown in several studies to increase user satisfaction, diet adherence, and overall health outcomes.

AI and Machine Learning in Fitness Apps:

The integration of AI and ML into fitness applications has dramatically altered the use of exercise and physical activity. Apps using these technologies are able to provide users with an exercise regimen custom-fit for their fitness levels, progressions, and goals. In this case, an AI-powered fitness app can quickly evaluate a user's exercising performance to better identify weaknesses and strengths; thereafter, it can make changes to the workout plan. This is referred to as a "human-augmented AI approach," a methodology that integrates the know-how of a personal fitness trainer with data-driven insights culled from user interactions to provide a dynamic, personalized experience in fitness. A perfect example is Freel tics, which is one of Europe's favorite fitness apps that use AI to automatically personalize workout routines. Its chief executive notes that the AI system continuously learns from millions of users' performance data compared against their particular goals and capabilities, refining suggestions on exercise.

The result of this comparison is then used by the AI to modify the exercise recommendations to help the users achieve their respective outcomes. These can be either building strength or cardiovascular fitness. By incorporating the techniques of data mining and causal inference modeling, Freel tics presents a rather highly customized fitness experience that adapts to each user's needs as well as performance metrics. In addition to personalizing workout plans, AI-driven fitness apps can be exploited for motivational support, tracking progress, and providing informative suggestions on aspects of physical fitness, such as sleep quality, hydration, and recovery.

2. LITERATURE REVIEW

The developed diet and workout recommendation system makes use of previous research in personalized health solutions by using machine learning to create custom plans for users on the basis of their specific details, such as their BMI and nutrient requirements. For example, research by Sadhasivam et al. (2023) [1] highlights caloric balance, nutrient profiling, and personal fitness goals as part of the recommendation framework. Previous work has analyzed the use of computational models for diet planning optimization in light of macronutrient composition and exercise regimens. This system essentially closes the gap between automated health intervention and personalized user experiences.

The most recent development in personalized health systems has been the integration of machine learning to propose diet and exercise plans according to individual needs. Moga Veera et al. (2021) [2] proposed an eHealth monitoring system based on decision tree algorithm C4.5, in which recommendations are based on diabetes-related complications, blood pressure, and thyroid conditions. The system includes health monitoring and personalized advice by integrating patients' medical reports and health parameters. This research, therefore, highlights the importance of combining data-driven insights with clinical applications for better healthcare management.

Obesity management research increasingly incorporates machine learning techniques that can be used to estimate potential weight loss from diet and exercise data. Pinto et al. (2021) [3] aimed to utilize techniques such as decision trees and k-nearest neighbor algorithms in classifying the potential of obese patients into high, medium, and low subclasses for potential weight loss. The present study used data collected via smart watches, which highlights the practical integration of wearable technology in health monitoring.

Advances in health monitoring systems are utilizing machine learning and deep learning methods to estimate caloric intake and provide dietary management. Muralidhar et al. (2020) [4] presented an Android-based food image classifier and detector application using CNNs and Faster R-CNN, where the system analyzes images to estimate caloric intake on the basis of the volume and type of food detected.

Recently, the use of social media in health and fitness has gained increased attention, and most of these media are rich in user-generated data resources. Park et al. (2020) [5] focused on more than 1.1 million tweets using hash tags related to health, fitness, diet, and weight loss to understand obesity-related image-sharing practices. Using the VGG16 deep learning model, the research was able to categorize 130,000 unique images from various themes, including informational, motivational, and physical activity content.

The application of machine learning in weight management is accelerating, as many of its studies concentrate on prognostic interventions for weight loss outcomes in patients. Pinto et al. (2021) [6] classified obesity risk profiles for weight loss into high, medium, and low by using diet and exercise data collected from smart watches. Using decision tree and k-nearest neighbor algorithms, the research indicated that decision trees performed better in terms of diet classification (71.54%) accuracy and exercise classification (63.63%). These results suggest that data-driven approaches can help healthcare professionals tailor interventions for obese patients. Ultimately, the study reveals how predictive analytics and machine learning can significantly improve weight management techniques.

More research on personalized health solutions integrates ontology-based systems for tailoring fitness and dietary recommendations. Basnayake et al. (2021) [7] proposed a recommender system with food and exercise ontologies for designing fitness plans that cater to healthy BMI among overweight individuals. The system, with the integration of user-specific data such as age, medical history, and exercise preferences, exploits SPARQL queries in data retrieval and Python-based tools in the interface development and reasoning process.

A paper titled "Mobile application for personalized food recommendation" by Jalali et al. [8] discussed the use of machine learning in the development of personalized food recommendation systems. Having utilized the data from the users, the system combines content-based filtering and collaborative filtering to recommend food items on the basis of users' preferences, dietary requirements, and context-based situations such as weather and time of day The study further shows how ML is integrated into common application use, consequently improving satisfaction and interaction with users.

The "Machine Learning Model for Awareness of Diet Recommendation" by Rout et al. [9] addresses the global increase in the prevalence of non communicable diseases by using machine learning to create personalized diet recommendation systems. Given that unhealthy diets are key drivers of diseases, this research emphasizes the application of RSs (recommendation systems) to help prevent information overload and to make better health decisions. This study highlights the potential of RSsin health domains and offers personalized advice to enhance well-being. This approach aligns with the broader trend of employing ML to address real-world health challenges effectively.

The paper titled "Application of e-Healthcare Based on Machine Learning in an Internet of Things Ecosystem" by Pattnayak et al. [10], which integrates ML and IoT technologies, enhances healthcare services. With advancements in devices such as fitness bands and healthcare applications, extensive unstructured data can now be used to provide precise health monitoring and early disease diagnosis. This study performs an analysis of an ischemic stroke dataset, showing the potential application of ML for fast and accurate clinical evaluation.

3. METHODOLOGY AND RESULTS

It integrates diet, exercise, and chronic disease management into a single interface, simplifying the user experience while promoting holistic health management.

Personalized Recommendations: Leveraging advanced AI technologies, including reinforcement learning, graph neural networks (GNNs), and transformers, the app provides personalized diet and exercise plans. Additionally, it takes into account user metrics, such as calorie intake, physical activity, health goals, and chronic conditions applicable to users. The monitoring of BMI and caloric and nutrient intake will be useful for making the right choice. It includes the inculcation of recipes along with calorie burn estimation for short-term and long-term health goals.

Continuous Tracking and Feedback: The application feeds users back real-time data on their activity and dietary choices, thereby encouraging them not to fall off the track and eventually foster permanent lifestyle adjustments.

Systemic health management: The integrated approach balances diet, exercise, and chronic disease management all in one place without the necessity of having a number of apps.

The behavior of habits, long-term lifestyle change: Continuous tracking and feedback foster sustainable behavior by providing insight to the users, empowering them to understand their health progress. **Appreciation of informed choice-making:** Nutritional values, caloric counts, and BMI tracking make the user more informed of his or her health choices and the end-result effects of those choices on his or her overall wellness.

The user-friendly design: A centralized scheme minimizes user confusion and information overload altogether by centralizing health information into an easier scheme.

Improved Adherence and Health Outcomes: Guidelines should be individualized, user friendly, and easy to follow so that users are likely to adhere to their health goals, thus improving adherence and long-term health outcomes. The system is holistic, with reference to each point of disease management and overall health.

a. **Data Gathering and Preprocessing:**
Diverse datasets are derived from where the needs for training deep learning models were sourced to provide a broad base for formulating personalized fitness and nutrition programs. Additionally, knowledge of medical history, fitness monitoring, eating habits, and demographic information, among other information, provides a comprehensive perspective on patients' health, allowing them to make recommendations

b. **Feature Selection and Engineering:**
After preprocessing, the most relevant step involved feature selection and then the engineering of those selected features for use in developing a model. This was an important phase because not all the data collected had the same potential to classify personalized health recommendations. Feature selection techniques were used to identify which variables are the most significant when exercising an influence on diet and exercise recommendations for disease control. Some biomarkers or clinical measurements (such as blood pressure or glucose) are more relevant for disease control and are not as relevant as others. Moreover, feature engineering was used in the creation of new variables or assemblages of existing variables in some form, which might better explain more of the deep learning models. For example, physical activity has been segmented into some bands of intensity,that is, low, moderate, and high, to make it easier for the model to predict what kind of exercise would be apt and at what intensity to be used for any individual.

c. **Model Selection and Architecture Design:**
The methodological core, therefore, relies on the creation of a deep learning model to digest the heterogeneity of features and predict individualized recommendations. The appropriate model architectures for evaluation are as follows:
Artificial Neural Networks (ANNs): ANNs were first considered for their ability to learn complex relationships between the inputs and the outputs. **Recurrent Neural Networks (RNNs):** Because health data are frequently viewed in terms of time sequences, for example, the trend of weight or change in blood pressure over a period of time, RNNs were considered. This is mainly because RNNs perform very well with sequential data. **Convolution neural network (CNN):** Since the model was originally developed to address images, CNNs tend to find those patterns that other models would not immediately capture.
Long short-term memory (LSTM): This is a specific type of RNN. The application of LSTM networks to access long-term dependencies in health data would be very helpful in the management of chronic diseases, for which long-term trends and history will come into play. For this purpose, the models are trained on the dataset, where the input features that include age, sex, exercise frequency, and medical history and the output variables indicate personalized dietary and exercise recommendations. The multilayered neural networks learn the relationships among inputs and outputs through many layers of abstraction, thereby learning more complex abstract representations of the data.

d. **Model training and hyper parameter tuning:**
This research work concentrate to split the dataset into training, validation, and test sets to train these deep learning models. The training set was used to instruct the model, whereas the validation set helped in hyper parameter tuning and appropriate selection of the learning rate for regularization, with multiple choices of batch size and hidden layers. All that would be achieved through this iterative process of training and validation is that it could generalize well to new, unseen data. Grid search or random search was conducted to tune the hyper parameters with optimal values for major parameters. The performance of the models was continuously monitored via metrics such as accuracy, precision, recall, and F1 score, depending on the task needed.

e. **Model Evaluation and Optimization:**
The model was tested against its behavior on the test set after training. The evaluation approach involved comparing the predicted results, such as workout regimens and diet plans, with real results or the recommendations of experts to validate and examine the applicability of the model's prediction. The test set consisted of real-to-life data, which were different from the training of the model and helped provide unbiased evaluation. To address any inadequacies in performance, this model was optimized with dropout to prevent over fitting, stopped early to prevent training when over fitting occurred, and the architecture of the neural network was fine-tuned. The outcome from the optimized model was recommendations for exercise and diet that were not only customized but also physiologically based and functional for disease management.

f. **Deployment and real-world application:**
Once optimized and evaluated, the model was implemented to support decision making for health care professionals as well as patients. A state-of-the-art interface was designed that allowed users to input current health data; the model would then provide personalized exercise routines and diet recommendations. The system could adapt recommendations in real time by inputting new data so that advice would always be well-timed with changing health conditions and personal goals. The system was tested in real-world scenarios; consequently, it gathered all the feedback from patients and healthcare providers to validate this system. This feedback loop ensures that the recommendations produced are practical, achievable, and conducive to improving disease management.

ALGORITHM IS PSEUDO CODE:

```
# Main Algorithm Components
1. Data Representation and Preprocessing
   Function PreprocessData(patient_data, disease_data, nutrition_data, exercise_data):
# Create knowledge graph structure
      G = InitializeGraph()
# Node types:
# - Patient nodes (features: age, weight, height, disease severity, etc.)
# - Disease nodes (features: type, constraints, risk factors)
# - Food nodes (features: nutrients, calories, restrictions)
# - Exercise nodes (features: intensity, type, muscle groups, contraindications)
# Add edges with relationships:
# - Patient-Disease edges (has_condition)
# - Disease–Food edges (recommended/restricted)
#-Disease-exerciseedges (recommended/contraindicated)
      Return preprocessed_data, G
2. GNN Model for Relationship Learning
   Function BuildGNNModel():
# Define GNN layers
      class DietFitnessGNN:
# Message passing layers
layer1 = GraphConv(in_channels, hidden_channels)
layer2 = GraphConv(hidden_channels, hidden_channels)
layer3=GraphConv(hidden_channels, out_channels)
# Node-type specific transformations
patient_transform=Linear (patient_features, hidden_dim)
disease_transform=Linear(disease_features, hidden_dim)
food_transform = Linear (food_features, hidden_dim)
exercise_transform=Linear(exercise_features, hidden_dim)
         Function forward(G):
   # Perform message passing
            x = self.layer1(G)
            x = ReLU(x)
            x = Dropout(x)
            x = self.layer2(x)
   x = self.layer3(x)
```

```
            return x
```

3. RNN Model for Temporal Pattern Learning

```
        Function BuildRNNModel():
          class ProgressionRNN:
# LSTM layers for temporal modeling
lstm = LSTM (input_size, hidden_size, num_layers)
# Prediction layers
            fc1 = Linear (hidden_size, hidden_size)
            fc2 = Linear (hidden_size, output_size)
            Function forward(temporal_sequence):
# Process temporal sequence of patient metrics
            lstm_out = self.lstm(temporal_sequence)
          predictions = self.fc2(ReLU(self.fc1(lstm_out)))
            return predictions
```

4. Combined recommendation system

```
    Function GenerateRecommendations(patient_id, G, gnn_model, rnn_model):
# Patient subgraph
patient_subgraph=ExtractPatientSubgraph(G, patient_id)
# Obtain temporal data
temporal_data = GetPatientTemporalData(patient_id)
# Generate embeddings via the GNN
graph_embeddings = gnn_model(patient_subgraph)
# Generate temporal predictions via RNN
progression_prediction = rnn_model(temporal_data)
# Combine both insights
recommendations=CombineInsights(graph_embeddings, progression_prediction)
# Generate personalized recommendations
 diet_plan = GenerateDietPlan(recommendations)
fitness_plan = GenerateFitnessPlan(recommendations)
            return diet_plan, fitness_plan
```

5. Recommendation Refinement

```
    Function RefineRecommendations(recommendations, patient_feedback):
# Update knowledge graph on the basis of feedback
        UpdateGraph(G, patient_feedback)
# Adjust recommendations on the basis of:
# - Patient adherence
# - Progress metrics
# - Side effects reported
# - Preference patterns
        return refined_recommendations
```

User Information: The system gathers information regarding the user, such as his health metrics and preferences shown in the figure1.

Figure1 Flow diagram for an automatic diet recommendation

Health Problem/Disease: The system observes whether the user suffers from a specific disease or health issue, such as diabetes or blood pressure, to implement appropriate advice.
Calorie Measurement: The system measures the calorie needs of the user by considering his profile and health information for a proper schedule for diet planning. On the basis of caloric and health information, the system recommends the diets of individuals on the basis of their requirements, shows in the figure2.

Figure2 BMI and Calories Measurement

Recipe Suggestions: The system, which is based on the dietary recommendations and caloric needs of the user, suggests specific recipes. The figure 3 shows, an options for custom food, where the user can add extra food items or meals that are not included in the list of the recommended recipe.

Figure3 Recipe and Diet Recommendation System

Nutrition Value: The system tests the nutritional value of personalized food to ensure that the nutritional value of the food is within their dietary guidelines. The figure 4(a) is describes the nutritional values for the prescribed diet recommendation system with an individual measurements.

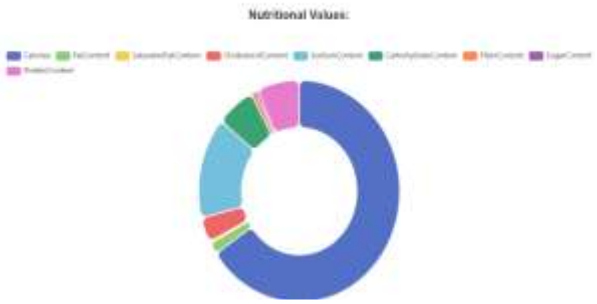

Figure4(a) Nutritional Values for the personalized food

Figure4(b) Composition Meal for Diet

On the basis of the health profile and the user's health goals, the system also provides personal recommendations of workouts as per the diet plan designed for that user. The figure 4(b), show the composition of the personalized food with nutritional values. The system tracks the kcal burned during workouts, thus enabling the user to be on the right track in working toward their health and fitness goals.

4. DISCUSSION

This system can be improved with AI learning adjustments in diet plans and exercise plans by taking feedback and progress from the users in the near future. Connection with wearable devices would offer monitoring in real time of such aspects as heart rate, sleep, and activity, which will lead to better understanding of one's own health.

Additional expansion may be about other health-related conditions such as heart disease and arthritis for a more holistic approach to care. Inclusion of mental wellness might be a holistic approach to it by suggesting the management of stress and mood tracking. Community features add social interaction which may boost the motivational level. Gamification adds more fun to the experience, ensuring that users achieve their goals and receive a prize for so doing. Food recognition can make food logging less cumbersome, and the advanced analytics will be able to track trends in light of progress. User ability to connect directly to telemedicine health professionals enables them to consult with health professionals directly through the application thus supports enhancement of chronic disease management. The last one is that predictive analytics can help find early warning signs of potential health issues so that the users can take preventive action.

This is a personalized health management system combining diet, exercise, and condition-specific recommendations that integrate most of the major needs for sustainable health improvement. Considering further improvements in the aspects of personalization, accuracy, and engagement, the system can be an extremely effective tool in managing immediate health needs but also proactively managing health that can make people transition to healthy lifestyles and potentially better long-term health outcomes.

5. CONCLUSION

The development of AI-powered web applications for diet and fitness management will be the first steps to combating chronic health issues like obesity, diabetes, and metabolic syndrome. Thus, the app combines personalized meal planning, a fitness guide, and real-time tracking in order to guide its users in the right direction with informed decisions that have a changed lifestyle forever. This study clearly reflects how digital health tools can act as a platform between scientific clinical studies and every day, applied health management. The system includes user health data with tailored diet and exercise recommendations for a personalized approach to health management. It begins with basic user information and specific health conditions to create a profile for giving diet and workout suggestions that match individual needs. This allows users with chronic conditions such as diabetes or hypertension to address their special health requirements. Calculating calorie requirements allows the system to create diets that help individuals meet their weight goals without nutritional imbalances. Recipe suggestions are available, although users can also have their custom foods added, which offers more flexibility but maintains nutritional covers. In addition to diet recommendations, the integration of calorie tracking with workout suggestions supports the concept of reaching a balanced regimen for users to be in better control of managing their weight and fitness. It should be used for continuous tracking and feedback, which lead them to develop healthier, permanent habits, wherein there is a major challenge in lifestyle changes over time.

6. REFERENCES

[1] S. Sadhasivam, M. S. Sarvesvaran, P. Prasanth and L. Latha, "Diet and Workout Recommendation Using ML," *2023 2nd International Conference on Advancements in Electrical, Electronics, Communication, Computing and Automation (ICAECA)*, Coimbatore, India, 2023, pp. 1-4, doi: 10.1109/ICAECA56562.2023.10199540.

[2] D. Mogaveera, V. Mathur and S. Waghela, "e-Health Monitoring System with Diet and Fitness Recommendation using Machine Learning," *2021 6th International Conference on Inventive Computation Technologies (ICICT)*, Coimbatore, India, 2021, pp. 694-700, doi: 10.1109/ICICT50816.2021.9358605.

[3] K. A. Pinto, N. L. Abdullah and P. Keikhosrokiani, "Diet & Exercise Classification using Machine Learning to Predict Obese Patient's Weight Loss," *2021 International Congress of Advanced Technology and Engineering (ICOTEN)*, Taiz, Yemen, 2021, pp. 1-5, doi: 10.1109/ICOTEN52080.2021.9493560.

[4] E. S. Muralidhar, T. S. Gowtham, A. Jain and K. Padmaveni, "Development of Health Monitoring Application using Machine Learning on Android Platform," 2020 5th International Conference on Communication and Electronics Systems (ICCES), Coimbatore, India, 2020, pp. 1076-1085, doi: 10.1109/ICCES48766.2020.9137969.

[5] A. Park, C. Li, J. Bowling, Y. Ge and M. Dulin, "Diet, Weight loss, Fitness, and Health related Image Sharing using Twitter: an Observation Study," *2020 IEEE International Conference on Bioinformatics and Biomedicine (BIBM)*, Seoul, Korea (South), 2020, pp. 2049-2053, doi: 10.1109/BIBM49941.2020.9313194.

[6] K. A. Pinto, N. L. Abdullah and P. Keikhosrokiani, "Diet & Exercise Classification using Machine Learning to Predict Obese Patient's Weight Loss," *2021 International Congress of Advanced Technology and Engineering (ICOTEN)*, Taiz, Yemen, 2021, pp. 1-5, doi: 10.1109/ICOTEN52080.2021.9493560.

[7] C. Basnayake, C. Peiris, H. Wickramarathna and P. Jayathunga, "Recommender System based on Food and Exercise Ontologies to Find the Suitable Fitness Exercise Plan with the Aid of Python," *2021 5th SLAAI International Conference on Artificial Intelligence (SLAAI-ICAI)*, Colombo, Sri Lanka, 2021, pp. 1-6, doi: 10.1109/SLAAI-ICAI54477.2021.9664742.

[8] A. Jalali, K. P. Arjun Manoj, N. Amulya, A. Siddiqua, A. K. Singh and S. M. Hari Krishna, "Mobile Application for Personalized Food Recommendation," 2022 IEEE 7th International conference for Convergence in Technology (I2CT), Mumbai, India, 2022, pp. 1-6, doi: 10.1109/I2CT54291.2022.9824896.

[9] A. K. Rout, A. Sethy and N. S. Mouli, "Machine Learning Model for Awareness of Diet Recommendation," *2023 International Conference on Inventive Computation Technologies (ICICT)*, Lalitpur, Nepal, 2023, pp. 96-101, doi: 10.1109/ICICT57646.2023.10133998.

[10] P. Pattnayak, S. Patnaik, A. Mohanty and T. Das, "Application of E-Healthcare Based on Machine Learning in an Internet of Things Ecosystem," *2023 3rd International Conference on Innovative Sustainable Computational Technologies (CISCT)*, Dehradun, India, 2023, pp. 1-5, doi: 10.1109/CISCT57197.2023.10351420.