IRJCS: International Research Journal of Computer Science
Volume 13, Issue 03, March 2026
ISSN: 2393-9842
https://www.irjcs.com/archives
https://doi.org/10.26562/irjcs.2025.v1303.50

AI-Powered Nutrition Analyzer for Fitness Enthusiasts: Revolutionizing Dietary Tracking and Personalized Nutritional Insights to Optimize Health and Fitness Goals

P.Rengasamy
Assistant Professor, Department of CSE (Cyber Security)
Sengunthar Engineering College (Autonomous),Tiruchengode,India
prengasamy.cse@scteng.co.in
https://orcid.org/0009-0005-0537-8373
Md Nazim,Md Faizan Alam,Vikash Kumar
Department of CSE
Sengunthar Engineering College (Autonomous),Tiruchengode, India
nazim45200@gmail.com,mdfaizanalam159@gmail.com,vk89592883@gmail.com

Publication History
Manuscript Reference: IRJCS/RS/Vol.13/Issue03/CSMR26.MRCS10129
Research Article | Open Access | Double-Blind Peer Reviewed Article ID: IRJCS/RS/Vol.13/Issue03/CSMR26.MRCS10129
Received: 30, January 2026, Revised: 13, February 2026, Accepted: 28 February 2026 Published Online: 25 March 2026
https://www.irjcs.com/volumes/Vol13/iss-03/50.CSMR26.MRCS10129.pdf
Article Citation:Rengasamy,Nazim,Faizan,Vikash(2026),AI-Powered Nutrition Analyzer for Fitness Enthusiasts: Revolutionizing Dietary Tracking and Personalized Nutritional Insights to Optimize Health and Fitness Goals , IRJCS: International Research Journal of Computer Science, Volume 13,Issue 03 of 2026 pages 390-396
Doi:> https://doi.org/10.26562/irjcs.2026.v1303.50
BibTeX Key Rengasamy@2026AI-Powered Orcid: https://orcid.org/0009-0004-9398-7488
IRJCS papers should be cited as IRJCS (International Research Journal of Computer Science, AM Publications, India 2026, ISSN 2393-9842, https://doi.org/10.26562/ijrcs.2025.v1303.50 The journal's official abbreviation is IRJCS.

Abstract: Proper nutrition plays a fundamental role in achieving optimal health, improving physical performance, and supporting long-term fitness goals. However, many individuals struggle to accurately monitor their daily food intake and understand the nutritional value of their meals. Traditional diet tracking methods often rely on manual input and provide limited insights into nutritional balance and dietary habits. This project proposes an AI- powered nutrition analyzer designed specifically for fitness enthusiasts to simplify dietary tracking and provide personalized nutritional recommendations. The system uses artificial intelligence, machine learning, and food recognition technologies to analyze food images or textual inputs and automatically estimate nutritional information such as calories, proteins, carbohydrates, fats, vitamins, and minerals. By integrating a comprehensive nutritional database with intelligent recommendation algorithms, the platform evaluates dietary patterns and offers customized suggestions aligned with individual health objectives such as weight loss, muscle gain, or fitness maintenance. The proposed system enhances nutritional awareness, improves dietary decision making, and reduces manual effort by providing automated analysis and personalized health insights through a user-friendly digital platform.
Keywords: Advanced Persistent Threat, Machine Learning, Network Flow Analysis, Gradient Boosting, Intrusion Detection System, Cyber security, DAP Dataset, Real-Time Analytics.

I. INTRODUCTION

Maintaining a balanced diet is essential for achieving over all well- being and improving physical fitness. Many people who follow active life styles aim to carefully monitor their nutritional intake in order to maintain optimal body composition, increase energy levels, and achieve specific fitness goals such as weight loss or muscle development. Despite the growing awareness of healthy eating, accurately tracking dietary intake remains a challenging task for many individuals. Traditional food tracking methods typically require users to manually record each meal and estimate the nutritional value of food items. These approaches are often time consuming, prone to errors, and may discourage consistent use. Recent advances in artificial intelligence, machine learning, and computer vision technologies have enabled the development of intelligent systems capable of automating complex data analysis tasks. These technologies can be applied to nutrition management systems to improve the accuracy and efficiency of dietary monitoring. AI-based solutions can analyze food images, identify ingredients, estimate portion sizes, and calculate nutritional values with minimal user effort. By combining these capabilities with personalized recommendation algorithms, it becomes possible to provide meaningful dietary insights tailored to individual fitness goals. The AI-Powered Nutrition Analyzer proposed in this project aims to revolutionize dietary tracking by integrating machine learning algorithms with nutritional data analysis. The system allows users to capture images of meals or enter food descriptions through a digital interface. The AI model processes the input data, identifies food items, and retrieves corresponding nutritional information from a structured database.

IRJCS: International Research Journal of Computer Science ISSN: 2393-9842
Volume 13, Issue 03, March 2026 https://www.irjcs.com/archives
https://doi.org/10.26562/irjcs.2025.v1303.50

In addition to calculating nutrient intake, the system evaluates user dietary patterns and provides personalized recommendations designed to improve nutritional balance. These recommendations consider factors such as calorie requirements, macronutrient distribution, and individual fitness objectives. By simplifying food tracking and offering intelligent nutritional insights, the proposed system helps users maintain healthier lifestyles and achieve their long-term fitness goals effectively.

LITERATURE REVIEW

The application of digital technology in nutrition monitoring has gained significant attention in recent years due to the increasing demand for personalized health management solutions. Early nutrition tracking systems primarily relied on manual data entry, where users recorded their meals and estimated calorie consumption using predefined food databases. Although these applications provided basic dietary monitoring functionality, they often required substantial user effort and were limited by the accuracy of manually entered data. Researchers have explored various technological approaches to improve the efficiency of dietary analysis systems. One major development has been the use of computer vision techniques for automatic food recognition. Deep learning models, particularly convolutional neural networks, have demonstrated strong performance in image classification tasks and have been successfully applied to identify food items from photographs. These systems enable users to capture images of meals using mobile devices, allowing the system to automatically recognize food items and estimate their nutritional composition.[19], [20]. Another area of research focuses on machine learning based recommendation systems for personalized nutrition. These systems analyze historical dietary data, user preferences, and health indicators to generate customized meal recommendations. Algorithms such as decision trees, support vector machines, and neural networks have been used to identify patterns in dietary behavior and predict suitable nutrition plans for individuals. In addition to image recognition and recommendation models, researchers have also investigated the integration of wearable devices and fitness tracking technologies with nutrition monitoring platforms. These integrated systems allow the collection of physical activity data, calorie expenditure, and metabolic information, which can be combined with dietary intake data to provide more comprehensive health insights. [18], [20]. Despite these advancements, many existing nutrition tracking applications still face several limitations. Some systems lack accurate portion size estimation, while others fail to provide personalized guidance tailored to specific fitness goals. Additionally, limited integration between food recognition technology, nutritional databases, and recommendation algorithms reduces the effectiveness of many current solutions. The AI-Powered Nutrition Analyzer proposed in this project addresses these limitations by combining food recognition, nutritional data processing, and personalized recommendation mechanisms within a single intelligent platform. By leveraging artificial intelligence and machine learning techniques, the system can automatically analyze dietary inputs and generate meaningful insights that support healthier eating habits and improved fitness outcomes for users. In addition to image recognition and recommendation models, researchers have also investigated the integration of wearable devices and fitness tracking technologies with nutrition monitoring platforms. These integrated systems allow the collection of physical activity data, calorie expenditure, and metabolic information, which can be combined with dietary intake data to provide more comprehensive health insights.

PROPOSED METHODOLOGY ARCHITECTURE

The proposed AI-Powered Nutrition Analyzer is designed to provide an intelligent platform that automates dietary tracking and delivers personalized nutritional insights for fitness enthusiasts. The system architecture consists of several interconnected modules that collectively capture dietary data, analyze nutritional content, and generate recommendations that align with user health objectives. The first stage of the system involves user data collection. During registration, users provide basic information including age, gender, weight, height, activity level, and fitness goals. These parameters help the system estimate daily calorie requirements and determine appropriate nutritional targets for each individual. The platform then creates a personalized nutrition profile that is used to evaluate dietary patterns and provide customized guidance. The second stage focuses on meal input and food recognition. Users can record meals by uploading food images, scanning packaged food items, or entering food names manually through the application interface. When an image is uploaded, the system uses a trained deep learning model to analyze the visual features of the image and classify the food item. The model extracts key visual patterns and compares them with a trained dataset of food images in order to accurately identify the meal components. Once the food item is identified, the system retrieves detailed nutritional information from a structured nutrition database.

A. System Architecture Design

The proposed methodology implements a multi-layer network security monitoring system, as shown in Fig.1. The architecture consists of three main components: data acquisition layer, processing layer, and analytics layer. The data acquisition layer collects network traffic from routers, firewalls, and packet monitoring tools. The processing layer performs data preprocessing, feature extraction, and machine learning model training. The analytics layer provides visualization dashboards and security alerts for network administrators. This architecture ensures continuous monitoring of network activities and enables early detection of malicious behaviors related to Advanced Persistent Threat attacks.

B. Network Flow Monitoring Protocol

The system continuously monitors network traffic using packet capture tools and flow-based monitoring mechanisms. Network flow data contains important communication attributes such as packet count, data transfer size, protocol type, and session duration. These parameters help identify suspicious communication patterns such as unusual data transfers, repeated connection attempts, and unauthorized access activities. Threshold-based detection mechanisms generate alerts when abnormal network behavior exceeds predefined limits. Continuous monitoring allows the system to detect early stages of APT attacks including reconnaissance, lateral movement, and data exfiltration

IRJCS: International Research Journal of Computer Science ISSN: 2393-9842
Volume 13, Issue 03, March 2026 https://www.irjcs.com/archives
https://doi.org/10.26562/irjcs.2025.v1303.50

C. Data Processing Framework

The data processing framework includes several stages such as data cleaning, normalization, and feature selection. Raw network traffic often contains in complete or redundant records that must be removed before analysis. Feature extraction techniques identify the most relevant attributes that contribute to threat detection.

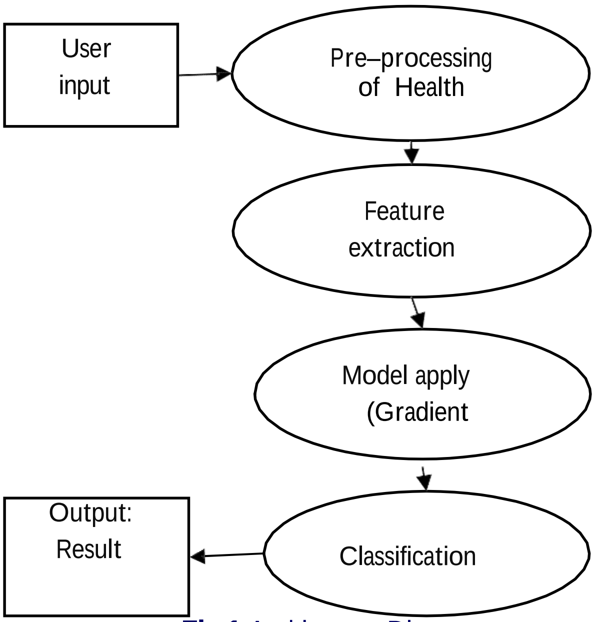

Fig.1. ArchitectureDiagram

Important features include flow duration, packet size, number of packets, protocol type, and communication frequency. The processed dataset is then used for training machine learning models that classify network behavior into normal or malicious categories. The structured data is stored in a secure database for further analysis and monitoring.

D. Threat Detection System

The threat detection module utilizes machine learning algorithms such as Random Forest, Support Vector Machine (SVM), and Decision Tree classifiers to identify malicious activities. These models are trained using labeled datasets containing both normal and attack traffic. Once trained, the models analyze incoming network traffic and detect anomalies that indicate potential Advanced Persistent Threat activities. When suspicious behavior is detected, the system automatically generates alerts to notify network administrators for further investigation.

E. Security Implementation

To ensure system reliability and secure data handling, several security mechanisms are implemented. Data communication between monitoring tools and the analysis server is protected using encrypted communication protocols such as TLS/SSL. User authentication and role-based access control restrict unauthorized access to the monitoring system. Regular security audits and vulnerability assessments ensure the integrity and reliability of the threat detection platform.

F. Performance Validation

The effectiveness of the proposed system is evaluated using machine learning performance metrics such as accuracy**,** precision, recall, and F1-score.Experimental results show that machine learning-based detection methods significantly improve the identification of stealthy cyber threats compared to traditional signature-based security systems. The system demonstrates strong capability in detecting abnormal network behavior associated with Advanced Persistent Threat attacks.

TECHNOLOGIES USED

A. Food Image Recognition Modules

The food image recognition module is responsible for identifying food items from images uploaded by users. Fitness enthusiasts can capture pictures of their meals using a mobile device or upload images directly through the application interface. The system uses deep learning algorithms trained on large food image datasets to recognize different types of food items. The model analyzes visual patterns such as color, texture, and shape to classify the food accurately. By recognizing the food items automatically, the system eliminates the need for manual data entry and improves the accuracy of dietary tracking.

B. Data Collection and Flow Monitoring

The data collection component gathers user dietary information, fitness goals, and personal health parameters such as age, weight, height, and activity level. This information is essential for understanding user nutritional requirements and generating personalized dietary recommendations. The system continuously monitors the flow of dietary data including meal inputs, food recognition results, and calculated nutrient values.

C. Nutritional Database Integration

The nutritional database stores detailed information about thousands of food items including calorie content, macronutrients, micronutrients, vitamins, and minerals. Once a food item is recognized by the AI model, the system retrieves the corresponding nutritional values from the database.

IRJCS: International Research Journal of Computer Science ISSN: 2393-9842
Volume 13, Issue 03, March 2026 https://www.irjcs.com/archives
https://doi.org/10.26562/irjcs.2025.v1303.50

This database serves as the primary source of information used to estimate the nutritional composition of meals.

D. Machine Learning Analysis Engine

The machine learning engine analyzes user dietary data and identifies trends in nutritional intake. Algorithms process historical meal data to evaluate patterns such as excessive calorie consumption or insufficient protein intake. The system uses these insights to understand user behavior and determine whether the dietary habits align with recommended nutrition guidelines.

E. Personalized Recommendation System

The recommendation system is designed to provide customized nutritional guidance based on user goals and dietary history. After analyzing nutrient intake and fitness objectives, the system suggests suitable meal adjustments and healthier alternatives. Recommendations may include increasing protein intake for muscle development, reducing calorie consumption for weight loss, or improving nutrient balance for overall wellness.

F. User Interface and Visualization Dashboard

The user interface allows individuals to interact with the system through an intuitive and easy-to-use application dashboard. Users can upload food images, log meals, view nutritional summaries, and monitor their dietary progress.

G. Visualization and Monitoring Dashboard

Visualization tools such as Matplotlib, Seaborn, and Plotly are used to present network traffic analytics in graphical form. The monitoring dashboard displays network statistics, anomaly detection alerts, and traffic behavior patterns. These visual insights help administrators quickly understand potential security threats and monitor overall network performance.

H. Data Processing Framework

The data processing frame work manages the flow of information between different components of the system. It processes raw input data, performs preprocessing tasks, and prepares the data for machine learning analysis.

I. Health Monitoring and Progress Tracking

The health monitoring component tracks user progress by analyzing dietary intake and nutritional balance over time. The system records daily calorie consumption, macronutrient distribution, and dietary trends. This information is used to evaluate whether the user is progressing toward their fitness objectives.

IMPLEMENTATIONS AND RESULTS

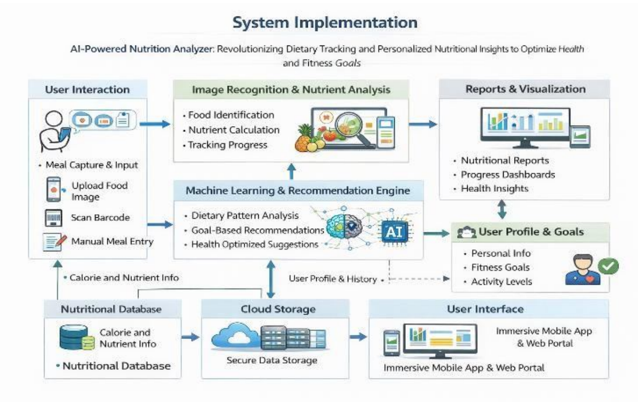

Fig .2: System Implementation

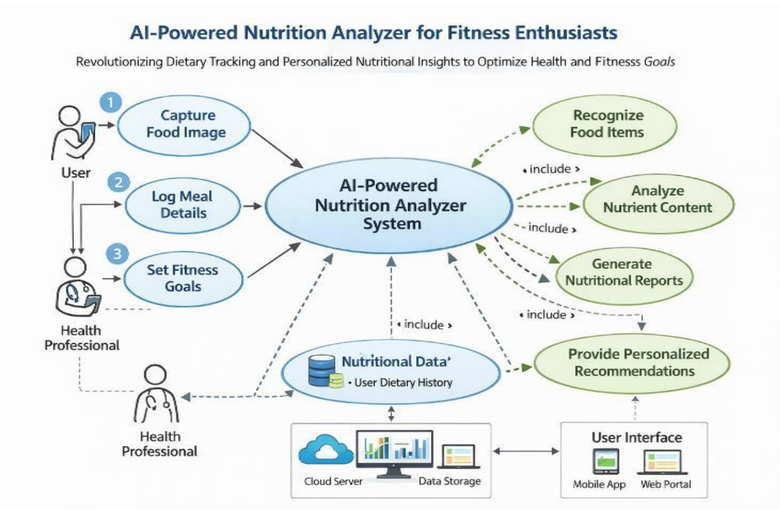

Fig.3 Usecase Diagram

The implementation of the AI-Powered Nutrition Analyzer involves the development of a complete digital platform capable of collecting dietary information, analyzing nutritional content, and generating personalized insights for users.

IRJCS: International Research Journal of Computer Science ISSN: 2393-9842
Volume 13, Issue 03, March 2026 https://www.irjcs.com/archives
https://doi.org/10.26562/irjcs.2025.v1303.50
The development process begins with the creation of the user interface that allows individuals to register, enter personal information, and record their daily meals. Once the user submits meal data, the backend system processes the information using machine learning algorithms and nutritional databases. For image-based inputs, the food recognition model analyzes the uploaded image and identifies the corresponding food item. The identified food item is then matched with entries in the nutritional database to retrieve detailed nutrient information.

AI-Powered Nutrition Analysis Related Research Matrix

Matrix Showing Research Domains and References for AI-Powered Nutrition Analysis

Research Domain	References																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	18	20
Food Image Recognition	✓	✓	✓	✓	✓												
Personalized Nutrition Recommendations	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Dietary Monitoring Systems	✓	✓	✓									✓	✓	✓	✓	✓	✓
Machine Learning in Healthcare	✓	✓	✓	✓	✓	✓											
Explainable AI in Nutrition	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				
Health Informatics Technologies			✓										✓	✓			
Health Informatics Technologies	✓		✓										✓			✓	✓

Fig.4 Health Matrix

The performance of the proposed APT detection system was evaluated using a confusion matrix, as shown in Fig. 4. The matrix presents the classification results across five categories: benign traffic, data exfiltration, foot hold, lateral movement, and reconnaissance. The diagonal elements represent correctly classified instances, while off-diagonal values indicate misclassifications.

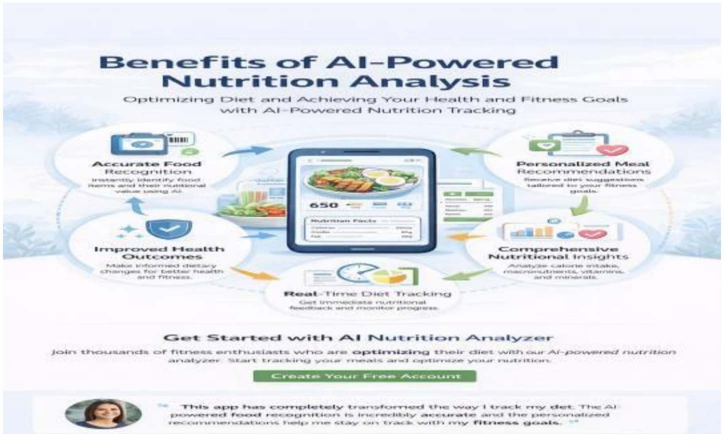

Fig.5 Nutrition Stages Graph

The distribution of analyzed dietary data across different nutritional categories is shown in Fig. 5, which illustrates the frequency counts for several important food and nutrient groups such as carbohydrates, proteins, fats, vitamins, and minerals. As shown, carbohydrate-rich foods dominate the dataset with the highest frequency, reflecting common dietary patterns where staple foods such as grains, rice, and bread are consumed regularly.

Fig 6: Home Page

Key Considerations:

Data Quality and Availability: The collected dietary data must be accurate, complete, and properly categorized to ensure reliable nutritional analysis. Poor quality or incomplete food input data may reduce the effectiveness of the AI-based nutrition analysis system and lead to inaccurate dietary insights.

Feature Selection: Selecting the most relevant nutritional features is essential for improving the accuracy of dietary analysis. Important features such as calorie content, macronutrient composition.

Model Accuracy and Performance: The machine learning algorithms used in the nutrition analysis system must be optimized to achieve high food recognition accuracy while minimizing in correct food classification and nutritional estimation errors. Continuous model evaluation and tuning are required to ensure reliable identification of food items.

Real-Time Detection Capability: Dietary tracking applications must provide timely feed back to help users make better nutritional decisions. Therefore, the AI-powered nutrition analyzer should support real-time or near real-time analysis of food images and meal inputs.

Fig 7: Nutrition Detection

CONCLUSION

The AI-Powered Nutrition Analyzer presents an intelligent solution for improving dietary tracking and promoting healthier lifestyles among fitness enthusiasts. By integrating artificial intelligence, machine learning, and nutritional data analysis, the system automates the process of recording meals and evaluating nutrient intake. This approach reduces the limitations associated with traditional manual diet tracking methods The platform not only calculates nutritional values but also analyzes dietary patterns and provides personalized recommendations that support individual health goals. Through real-time insights and interactive visualizations, users gain a better understanding of their nutritional habits and can make informed decisions about their diet.

REFERENCES

1. PJ.Chen, L.Zhang, and Y.Wang, "Food image recognition for dietary assessment using deep learning techniques," in 2019 IEEE International Conference on Artificial Intelligence and Big Data (ICAIBD), 2019, pp. 1-6.
2. S.Sharma, R.Gupta, and P.Singh, "Machine learning approaches for personalized nutrition recommendation systems," in 2020 Sixth International Conference on Parallel, Distributed and Grid Computing (PDGC), 2020, pp.1-5.
3. A.Meyers, K.Brown, and D.Smith, "Automated food recognition and calorie estimation using computer vision," in 2022 IEEE International Conference on Healthcare Informatics (ICHI), 2022,pp. 1-8.
4. M.Patel and D.Shah,"AI-based dietary monitoring system for personalized health management," in 2019 IEEE 3rd International Conference on Information Technology and Intelligent Systems (ITIS), 2019, pp. 1-5.
5. Y.Liu,H.Wang, and J.Zhao, "Deep learning based food classification and nutrition analysis for smart healthcaresystems," IEEE Access, vol. 9, pp. 1-17, 2021.
6. R.Kaur and J.K.Sandhu,"Machine learning based nutrition analysis for health monitoring systems," in 2020 Sixth International Conference on Parallel, Distributed and Grid Computing (PDGC), 2020, pp. 1-4.
7. D.Kim,H.Park, and S.Lee,"Short-term dietary intake prediction using machine learning algorithms," in 2021 International Conference on Smart Health Technologies (ICSHT), 2021, pp. 1-4.
8. Y.Zhao,Y.Li,X.Zhang, and W.Zhang, "A survey of artificial intelligence applications in nutrition and dietary monitoring systems," IEEE Access, vol. 7, pp. 1-21, 2019.
9. P.Philipp, R.Georgi, and S.Robert, "Analysis of food image datasets using convolutional neural networks for dietary assessment," in 2019 6th International Conference on Soft Computing & Machine Intelligence (ISCMI), 2019, pp. 1-5.
10. Q.Wang, H.Yan, and Z.Han, "Explainable AI techniquesforpersonalizedhealthandnutritionrecommendationsystems,"in 2021 IEEE 21st International Conference on Software Quality, Reliability and Security (QRS), 2021, pp. 1-11.
11. H.Bian, T.Bai, M.A.Salahuddin, N.Limam, A.A.Daya, and R.Boutaba, "AI-driven dietary monitoring using food image recognition and nutrition databases," in 2019 15th International Conference on Health Informatics and Smart Healthcare Systems (HISH), 2019 ,pp. 1-6.
12. O.McCusker, S.Brunza, and D.Dasgupta, "Deriving personalized dietary behavior patterns using machine learning algorithms," in 2013 5th International Conference on Smart Health Technologies (ICSHT 2013), 2013, pp. 1-6.
13. Y.Xiuzhang, P.Guojun, L.Side, Z.Dongni, L.Chenguang, and L. Xinyi, "A survey on intelligent food recognition and AI-based nutrition recommendation systems," China Communications, vol. 22, pp. 103-131,Nov. 2025.
14. R.V.Umasevi,T.R.Nisha Dayana, "A hybrid machine learning technique for automated dietary tracking and nutritional analysis," in 2025 5th International Conference on Expert Clouds and Applications (ICOECA), 2025, pp. 1-6.

ISSN: 2393-9842
https://www.irjcs.com/archives
https://doi.org/10.26562/irjcs.2025.v1303.50

15. S.Balaba, Y.Chernyshov, A.Skorohodov, and D.Komarov, "Graph-based health data analysis for intelligent dietary monitoring systems," in *2025 IEEE Ural-Siberian Conference on Biomedical Engineering, Radioelectronics and Information Technology (USBEREIT)*, 2025, pp. 1-4.
16. S.Aruna, G.L.Prakash, and K.B.Surekha, "AI-powered nutrition recommendation system for personalized health management," in 2025 International Conference on Electronics and Computing, Communication and Networking Automation Technologies (ICEC2NT), pp. 1-6.
17. S.Muthumanikandan, G.K.Hegde, P.Swetha, and P.B.Honnavalli, "Machine learning based behavioral analysis of dietary habits for personalized health insights," in 2025 IEEE 7th International Conference on Computing, Communication and Automation (ICCCA), pp. 1-5.
18. K.Rathor, V.Keerthika, K.Sunanda, K.Renuga, A.Shobana, and M.Anusuya, "Enhancing personalized nutrition systems using machine learning-based food recognition and dietary pattern analysis," in 2024 International Conference on Computing and Data Science (ICCDS),2024,pp. 1-5.
19. N.H.A.Mutalib,A.Q.M.Sabri,A.W.A.Wahab,E.R.M.F. Abdullah, and N. AlDahoul, "Explainable machine learning models for personalized nutrition recommendation using random forest classifier," in 2025 3rd International Conference on Cyber Resilience (ICCR), pp. 1-6.
20. Q.Hu,Y.Wang, Z.Su,T.H.Luan,R.Li, and Z. Jiang, "AI-enabled health analytics for dietary monitoring and personalized nutrition management," IEEE Transactions on Healthcare Informatics, pp. 230-245, Sep. 2025.