Forecasting and Alerting Web App for Burned Calories using Random Forest Algorithm

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Abstract—Because of the changes in their lifestyles and professional responsibilities, many today have incredibly busy schedules. But to be fit and healthy, you need to exercise frequently. Obesity results from people not paying attention to their eating behaviour's. Obesity is becoming a serious and widespread issue in today's society. In order to keep fit and healthy, it advises people to choose their food and exercise equally. People should be adequately informed about how many calories they consume and expend. Calorie intake tracking is simple because it's provided on product labels or the internet, but tracking calories burned is challenging because few gadgets are available. Based on MET charts and calculations, calories burnt by an individual calculated. The major goal of this study is to accurately forecast the number of calories burned using a random forest algorithm model as the machine learning method. The random forest method model has been fed with a lot of data. After predicting the how many calories have burned, system will send notification to the user's email.

Keywords: Calories, Machine Learning, Random Forest Algorithm, Notification, Email, SMTP.

I. INTRODUCTION

A calorie is a measure of energy that comes from food and liquids a person consumes and from the energy expended during physical activity. Different foods have different amounts of calories depending on the part of energy a food can offer. As a result, it's crucial to consume calories properly because doing otherwise may result in obesity, diabetes, and other related health issues.

In today's modern living, regular physical activity is essential to become fit and in good shape, maintaining a healthy body, or losing weight. Running, walking, bicycling, swimming, exercising, and performing daily tasks all burn calories. The calories burned to depend on many factors, such as weight, gender, age, height, metabolism, and the type of activity or exercise.

Measurement of exact calories burned can be difficult. The use of an activity tracker app can estimate the number of calories burned, but the accuracy varies by product. Heart rate is one of the best ways to measure calorie burn, but it differs significantly between individuals based on fitness, age, and genetics. The metabolic Equivalent of Task (MET) is another way to estimate calories burned developed by researchers and used by the medical community. MET is the active metabolic rate to resting metabolic rate ratio. Metabolic rate is the energy consumed per unit of time based on the intensity of the activity or exercise.

The study aims to propose a solution for predicting the calories burned using machine learning algorithms. The learning algorithms considered are Linear Regression, Ridge Regression and Random Forest Regression. The goal of this the study is to evaluate which algorithms would be the best in predicting calories burned by an individual based on weight, gender, age, height, duration of the activity, heart rate, and body temperature. The model produced by the study can be integrated or used with the existing technologies to have a better estimate of calories burned by individuals after some physical activities.

II. LITERATURE REVIEW

[1] Marte Nipas ET.AN," Burned Calories Prediction using Supervised Machine Learning: regression Algorithm", 2022.

Physical activity on a regular basis is essential for staying healthy and fit. Individuals' calories burned are estimated using a formula and MET charts. In order to provide more accurate results, this study intends to predict calories burned using a regression model as one of the machine learning algorithms. Before data can be fed into regression models, it must first be prepared, cleaned, and analysed. To find the best model for the study, model training and testing with K-fold validation were performed. The performance and prediction accuracy of regression models were assessed based on model testing results after ten (10) iterations. The average accuracy was calculated, and the result shows that Random Forest regression is the best model for the study, with a 95.77% accuracy. It is critical to visualize and investigate the relationships between the variables in the data because they may affect the algorithm's performance in predicting the value of the target variable. The Random Forest regression model had a high accuracy rate in predicting calories burned.

[2] Sona P Vinoy ET.AN," Calorie Burn Prediction Analysis Using XGBoost Regressor and Linear Regression Algorithms", 2022

The main idea of this research project is to make a comparative study of machine learning algorithms to predict the calories burned during a workout. In this paper, they first build a machine learning system that can predict the number of calories burnt during exercise. In today's world, many people are curious about the workout they do, the weight loss plan they take, and how many calories they burn once they work out. We can use ML algorithms such as XGBoost regressor and Linear Regression to solve this problem. The analysis concluded that the XGB Regressor has more accurate results than the Linear regression model. Mean absolute error implies absolute error ought to be as low as viable. It is not anything but the difference between the actual and predicted values through the models. The mean absolute error value in XGB Regressor is 2.71, which is a good value. The error values are significantly less. Therefore, we can conclude that the best model for calorie burn prediction is XGBoost Regressor.

[3] Rachit Kumar Singh ET.AN" Prediction of Burned Calories Using Machine Learning", 2021.

The overarching goal of this research project is to compare machine learning algorithms for predicting calories burned during a workout. In this paper the author first builds a machine learning system that can predict the number of calories burnt during exercise. In today's world, many people are interested in the workout they do, their weight loss plan, and how many calories they burn once they work out. In this study, the author uses ML algorithms such as XGBoost regressor to solve this problem. Machine Learning is a category of algorithms that allows software applications to become more accurate in predicting outcomes without being explicitly programmed. The basic premise of machine learning is to build models and employ algorithms that can receive input data and use statistical analysis to predict an output while updating outputs as new data becomes available. These models can be applied in different areas and trained to match management's expectations so that proper steps can be taken to achieve the organization's target. The object of this research paper is to create a project that can be used to predict calories burnt using Machine Learning with Python.

[4] Shahriar Ahmed Ayon ET.AN," FoodieCal: A Convolutional Neural Network Based Food Detection and Calorie Estimation System", 2021.

Recent studies from around the world show that a healthy diet is essential for good health and body. People are more concerned about their diets than ever before. With scientific progress, it is now possible to build a unique food identification system to track daily calorie intake. However, creating and implementing this type of system introduces several complications. In our paper, we present a new neural network-based model that predicts food items from a given image and displays the estimated calorie content of the detected food items. To achieve our goal, they prepared a dataset of approximately 23000 images for 23 different food categories. We created a system that can detect multiple foods by training CNN with Inception V3 features. This model has an accuracy of 89.48%, and we have deployed our system on a webpage. The user must upload an image of a food item to the website, and our system will predict the food item as well as the estimated calories in real-time.

[5] G. Karthik Reddy ET.AN," A Non-Invasive Method for Calculating Calories Burned during Exercise using Heartbeat", 2015.

The novel design and development of a non-invasive new integrated device in an Arduino environment for measuring calories burned from heart rate. A calorie burnt relationship will be calculated using the heart rate. As obese people are most concerned about losing weight, they regularly need to check the weight they lose during exercise. This calorie estimator helps calculate calories burnt by using a rise in a heartbeat during a workout. This article measures heart rate using a Heartbeat sensor (IR sensor). However, most heart rate measuring tools and environments are expensive and need to follow ergonomics. Our proposed IR sensor is economical and user-friendly and uses optical technology to detect blood flow through the index finger. In this project, Arduino is used in which microcontroller. A Tmega328 is embedded into it, relevant codes have been written to detect and count the heartbeat and calculate the calories burnt microcontroller. A Tmega328 is embedded into it, relevant codes have been written to detect and count the heartbeat and calculate the calories burnt.

III. SYSTEM ANALYSIS
Proposed System

In this proposed system, the model was trained with ML algorithms such as random forest regressor to predict how many calories are burned. Random Forest Regression algorithms are a type of Machine Learning algorithm that employs the use of multiple random decision trees, each of which has been trained on a subset of data. In machine learning, the random forest algorithm performs well since it has robust handling of various data types, relationships, distributions, and the many hyperparameters you can fine-tune. Random forest algorithm can be used for regression, classification for both binary and multiclass, and ranking problems.

In this system, we trained the random forest algorithm with the dataset, which contains vast data considering age, gender, duration, weight, height, heartbeat, and calories. Before training the data, the we pre-processed the data set and analysed the data thoroughly.

After completing the data analysis and visualization we split the dataset into training data and test data. By using the random forest algorithm, we train the training data, and by using the test data we evaluate the prediction model.

After predicting the value of calories burned, through the usage of the SMTP email system we can send a report detailing that the number of calories that users have burnt.

IV. ALGORITHM
Random Forest algorithm

Random Forest is a powerful machine learning algorithm that is widely used for classification and regression tasks. It is an ensemble learning method that combines multiple decision trees to make predictions. Random Forest works by creating multiple decision trees on random subsets of the training data, using a subset of the features at each split. This process helps to reduce overfitting and improves the generalization ability of the model. Once the trees are built, the algorithm aggregates the predictions of all trees to make a final prediction.
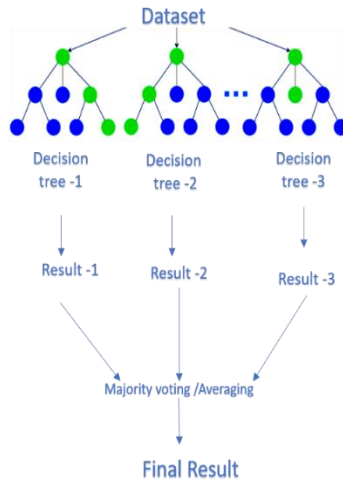
Random Forest is a popular ensemble learning algorithm that combines multiple decision trees to produce a more accurate and stable model. The algorithm randomly samples the data and features for each tree and aggregates the predictions of the individual trees to produce the final prediction.
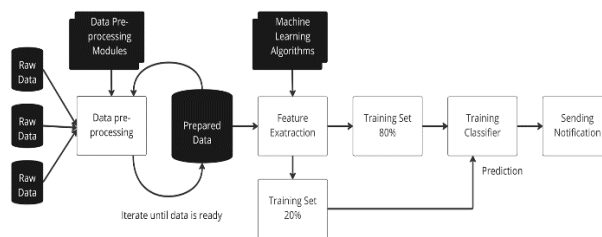
V. SYSTEM DESIGN
SYSTEM ARCHITECTURE

Fig. Forecasting and alerting web app for burned calories

VI. METHODOLOGY
Exploratory Data Analysis
- We need collect the data.
- We need to convert the raw data into structured tabular data using the pandas module.
- We must analyze the data to remove duplicates and check for null values.
- After the data analysis, we need to visualize the complete data.

The variables in the dataset must first be examined to determine their relationship to the target variable, which is the number of calories burned. Heart rate, exercise duration, and body temperature are all highly correlated with the dependent variable calorie, followed by height and weight.
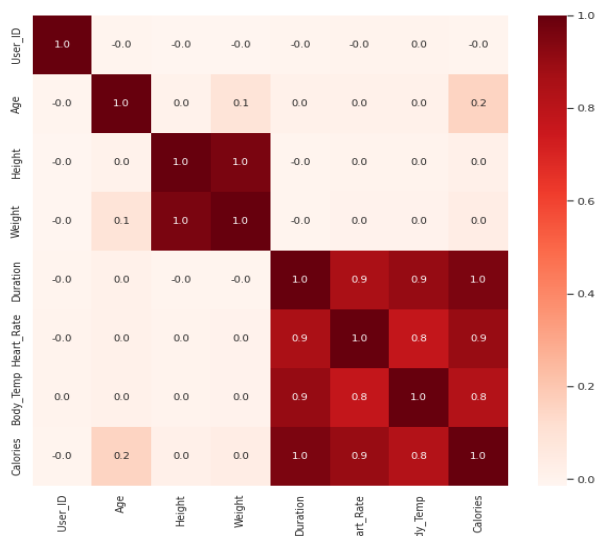
Fig. Pearson's Correlation between Variables

Splitting Data

- In this module we need to split our data set into two different data sets which are used for training data and testing data.
- After splitting the data set, we need to train and test our two data sets with a test size of 0.2, which means training data gets 80% of data and testing data gets remaining 20% of data.

Fig. Splitting data into training data set and testing data set

Forecasting the accuracy

- Now we are going to use Random Forest algorithm to train this model.
- We must train our training data set with the random forest algorithm.
- After training the model we need to evaluate this model with the testing data set.
- So that we can get how much number of calories we have burned.

Fig. Mean Absolute Error for Random Forest algorithm

Pop-up of burned calories

- After predicting the burned calories count, we need to send the detailed information to the user's email ID.
- We use the SMTP and data time modules to send notifications.
- To send the notification, we need to give the access to the system for sender's email id and password.

CONCLUSION

        As a result, we can conclude that our proposed system will be able to accurately predict the number of calories burned by the user. Here, accuracy is important in prediction-based systems, so we can make the calories prediction more innovative and successful by using multiple instance parameters and various factors. We also provide detailed information about calories burned if through an email client.

FUTURE SCOPE

The burnt calories estimate may be made more creative and effective by using several instance settings and different variables. Accuracy, a crucial component of prediction-based systems, may be greatly improved. One of the key benefits is that the regression results are more expressive and, to a certain extent, more intelligible.

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