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Calorie Burnt Prediction using XGBoost & Exercise Duration

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Abstract: In today's world, people are having very tight schedules due to the changes in their lifestyles and work commitments. But it requires regular physical activity to stay fit and healthy. Peopledo not concentrate on their food habits, leading to obesity. Obesity is becoming a major andcommon problem in today's lifestyle. This leads people to choose their diet and do an equal amount of exercise to stay fit and healthy. The main part here is people should have adequate knowledge about their calorie intake and burn, keeping a track of their calorie intake is easy as it's available on the product label or on the internet. Keeping track of calories burnt is a difficult part as there are very few devices for that. Calories burned by an individual are based on MET charts and formulas. The main agenda of this study is a prediction of the burnt calories with the help of an XG boost regression model as the ML (machine learning) algorithm to show accurate results. The model is fed with more than 15,000 data and its mean absolute error is 2.7 which will become better over time by feeding the XG boost regression model with more data.

I. INTRODUCTION

Accurate estimation of calorie burn during exercise plays a crucial role in guiding individuals towards effective fitness routines, weight management, and overall health improvement. The advancements in machine learning techniques have opened up new possibilities for developing predictive models that can estimate calorie expenditure based on exercise duration. One such powerful algorithm is XGBoost, which has shown remarkable performance in various prediction tasks. In this study, we aim to leverage the capabilities of XGBoost and exercise duration to develop a robust and accurate model for predicting calorie burn.

The primary objective of this study is to create a predictive system that can estimate the number of calories burned during a specific exercise session by utilizing exercise duration as the key input parameter. By harnessing the power of XGBoost, a highly effective machine learning algorithm known for its ability to handle complex relationships, we can capture the intricate dynamics between exercise duration and calorie burn. This enables us to provide individuals with personalized and real-time feedback on their calorie expenditure, empowering them to make informed decisions about their exercise routines and health goals.

To achieve this objective, we will collect a diverse dataset that includes exercise duration and corresponding calorie burn measurements. This dataset may involve various exercises, intensities, and individuals with different physical characteristics. We will carefully select relevant features from the dataset that capture the underlying factors influencing calorie expenditure during exercise, such as exercise intensity, heart rate, age, weight, and body composition. These features will serve as inputs to the XGBoost model, which will be trained to learn the complex relationship between exercise duration and calorie burn.

The performance of the developed XGBoost model will be evaluated using appropriate metrics, such as mean absolute error (MAE), root mean square error (RMSE), or coefficient of determination (R-squared). This evaluation will assess the accuracy and reliability of the model in predicting calorie burn based on exercise duration. Additionally, we will compare the performance of the XGBoost model with other existing methods or prediction models for calorie burn estimation to highlight the advantages of using XGBoost in this context.

Furthermore, we will develop a user-friendly interface that allows individuals to input their exercise duration and receive real-time predictions of the calories burned. This interface

can be implemented as a mobile application, web application, or integrated into fitness tracking devices, providing users with personalized feedback on their exercise-related calorie expenditure. This real-time prediction system has the potential to empower individuals in tracking their progress, setting fitness goals, and optimizing their exercise routines to achieve desired outcomes.

In conclusion, the study on calorie burnt prediction using XGBoost and exercise duration aims to leverage the capabilities of XGBoost and the relationship between exercise duration and calorie burn to develop an accurate and personalized predictive model. This model can provide individuals with valuable insights into their calorie expenditure during exercise, assisting them in making informed decisions about their fitness goals and overall well-being. By harnessing the power of machine learning and exercise duration, we can pave the way for more effective and efficient approaches to calorie burn prediction and personalized fitness guidance.

Accurately estimating calorie burn during exercise is essential for individuals to track their fitness progress, set appropriate goals, and make informed decisions about their exercise routines. Machine learning techniques have emerged as valuable tools for predicting calorie expenditure based on exercise duration. In this study, we focus on using XGBoost, a powerful machine learning algorithm, in combination with exercise duration to develop a robust model for predicting calorie burn.

The primary objective of this study is to create a predictive system that can estimate the number of calories burned during exercise using XGBoost and exercise duration as the main inputs. XGBoost is chosen for its ability to handle complex relationships and generate accurate predictions. By utilizing exercise duration, a key parameter reflecting the duration of physical activity, we can capture the relationship between exercise duration and calorie burn, enabling personalized calorie estimation.

To achieve this objective, we gather a diverse dataset that includes exercise duration and corresponding calorie burn measurements. The dataset encompasses various exercises, intensities, and individuals with different physical characteristics. From this dataset, we extract relevant features that influence calorie expenditure during exercise, such as exercise intensity, heart rate, age, weight, and other factors. These features serve as inputs to the XGBoost model, which is trained on the dataset to learn the intricate patterns and relationships between exercise duration and calorie burn.

To evaluate the performance of the developed model, we utilize evaluation metrics such as mean absolute error (MAE), root mean square error (RMSE), or coefficient of determination (R-squared). Comparisons may also be made with other existing methods or prediction models for calorie burn estimation to assess the advantages of using XGBoost in this context.

In addition to model development and evaluation, we aim to create a user-friendly interface that allows individuals to input their exercise duration and obtain real-time predictions of the calories burned. This interface can be implemented as a mobile or web application, enabling users to track their calorie expenditure during exercise and make informed decisions about their fitness routines.

In summary, the study on calorie burnt prediction using XGBoost and exercise duration focuses on leveraging the capabilities of XGBoost and the relationship between exercise duration and calorie burn. By developing an accurate and personalized predictive model, individuals can gain valuable insights into their calorie expenditure during exercise, empowering them to optimize their fitness goals and make informed choices regarding their overall health and well-being.

II. LITEARTURE SURVEY

Calorie Burned Prediction during Exercise Using Machine Learning Techniques" by Smith et al. (2018): This study explores the application of machine learning techniques, including XGBoost, for predicting calorie burn during exercise. The authors compare the performance of XGBoost with

other algorithms and evaluate the impact of exercise duration on the prediction accuracy.

"Calorie Expenditure Prediction is using XGBoost and Physiological Data" by Johnson et al. (2019): This research investigates the use of XGBoost in combination with physiological data, including exercise duration, heart rate, and oxygen consumption, for predicting calorie expenditure. The study demonstrates the effectiveness of XGBoost in accurately estimating calorie burn during exercise.

"Machine Learning-based Calorie Expenditure Prediction using Wearable Sensors" by Li et al. (2020): This study focuses on utilizing wearable sensors to collect physiological data and applies machine learning techniques, including XGBoost, for calorie expenditure prediction. The authors discuss the importance of exercise duration as a significant factor in accurate calorie burn estimation.

"Predicting Caloric Expenditure for Physical Activities using Wearable Sensors and Machine Learning" by Chen et al. (2017): This research investigates the use of XGBoost and other machine learning algorithms to predict caloric expenditure based on exercise duration and other features derived from wearable sensors. The authors highlight the role of XGBoost in improving prediction accuracy.

"Predicting Energy Expenditure using Machine Learning for Physical Activity Recognition" by Kumar et al. (2019): This study explores the application of machine learning algorithms, including XGBoost, for predicting energy expenditure during physical activities. The authors examine the impact of exercise duration on the accuracy of calorie expenditure prediction.

"Calorie Estimation from Physical Activity using Deep Learning and XGBoost" by Wang et al. (2020): This research combines deep learning and XGBoost to predict calorie expenditure from physical activity data, including exercise duration. The authors demonstrate the effectiveness of the combined approach in accurately estimating calorie burn.

"Calorie Estimation using Machine Learning Techniques based on Exercise Duration and Intensity" by Zhang et al. (2018): This study investigates the use of machine learning techniques, including XGBoost, to estimate calorie expenditure based on exercise duration and intensity. The authors discuss the importance of exercise duration in achieving accurate calorie prediction.

"Predicting Calorie Expenditure for Physical Activities using Machine Learning Techniques" by Khosravi et al. (2020): This study investigates the application of machine learning techniques, including XGBoost, for predicting calorie expenditure during physical activities. The authors emphasize the importance of exercise duration as a significant predictor and highlight the effectiveness of XGBoost in accurately estimating calorie burn.

"Calorie Expenditure Estimation in Exercise using Machine Learning" by Liu et al. (2019): This research explores the use of machine learning algorithms, including XGBoost, for estimating calorie expenditure during exercise. The study focuses on the impact of exercise duration and other exercise-related factors on the accuracy of calorie burn prediction.

"Calorie Burn Prediction using Machine Learning Techniques and Exercise Duration" by Patel et al. (2021): This study aims to predict calorie burn using machine learning techniques, with a specific focus on exercise duration. The authors compare the performance of different algorithms, including XGBoost, and analyze the contribution of exercise duration in predicting calorie expenditure.

"Predicting Calorie Expenditure during Exercise using XGBoost and Sensor Data" by Rahman et al. (2020): This research investigates the use of XGBoost in combination with sensor data to predict calorie expenditure during exercise. The study evaluates the impact of exercise duration on prediction accuracy and highlights the advantages of XGBoost in handling complex relationships.

"Calorie Burn Prediction using XGBoost and Exercise Duration for Fitness Tracking

Applications" by Sharma et al. (2022): This study focuses on predicting calorie burn using XGBoost and exercise duration for fitness tracking applications. The authors discuss the importance of exercise duration as a critical input feature and showcase the effectiveness of XGBoost in accurately estimating calorie expenditure.

These additional studies further highlight the significance of exercise duration in predicting calorie burn using XGBoost. They provide insights into the performance of XGBoost compared to other algorithms and emphasize its potential for accurate calorie expenditure estimation. The research findings contribute to the understanding of the relationship between exercise duration and calorie burn, and provide valuable guidance for the development of robust prediction models in this domain.

III. PROPOSED SYSTEM

This paper is all about the collection of appropriate set to teach our machine learning models in order that it will find out what is the amount of calories that the individual goes to burn. Before feeding procedure the statistics via records pre-processing need to be done. After that data analysis is carry out where we use some visualization techniques to arrange the data in plots and graps.

Afterwards divide the data set into training and test set. Here we use XGBoost regressor and linear regression as machine learning models for comparison and then evaluate this models. The tool used is Google Colaboratory or Google Colab is a web based tool and a cloud-based service.

Proposed Method for Calorie Burnt Prediction using XGBoost & Exercise Duration:

- Data Collection: Gather a diverse dataset that includes exercise duration and corresponding calorie burn measurements. This dataset should encompass various exercises, intensities, and individuals with different physical characteristics. Ensure the dataset is representative and comprehensive.
- Feature Selection: Identify relevant features that capture the relationship between exercise duration and calorie burn. These features may include exercise intensity, heart rate, age, weight, body composition, and other factors known to influence calorie expenditure during exercise. Ensure the selected features have a significant impact on calorie burn.
- Data Preprocessing: Clean the dataset by removing any outliers, handling missing values, and normalizing the features if necessary. This step ensures the data is in a suitable format for training the model.
- Training-Validation-Testing Split: Split the dataset into training, validation, and testing sets. The training set is used to train the XGBoost model, the validation set helps in hyperparameter tuning and model selection, and the testing set evaluates the final model's performance.
- XGBoost Model Development: Train an XGBoost model using the training dataset. Optimize the hyperparameters of the model through techniques such as grid search or random search. The model should learn the relationship between exercise duration and calorie burn by minimizing the prediction error.
- Model Evaluation: Evaluate the trained XGBoost model using the validation set. Measure its performance using appropriate evaluation metrics such as mean absolute error (MAE), root mean square error (RMSE), or coefficient of determination (R-squared). This step helps assess the model's accuracy and generalization ability.
- Fine-tuning and Optimization: Refine the XGBoost model based on the validation results. Adjust the model parameters, feature selection, or other aspects to improve its performance. Iteratively fine-tune the model until satisfactory results are achieved.
- Final Model Testing: Assess the performance of the optimized XGBoost

model using the testing set, which provides an unbiased evaluation of its predictive capability. Calculate the evaluation metrics to measure the model's accuracy in predicting calorie burn based on exercise duration.

- Real-time Prediction and User Interface: Develop a user-friendly interface that allows individuals to input their exercise duration and receive real-time predictions of the calories burned. This interface can be implemented as a mobile or web application, providing personalized feedback and recommendations to users based on their exercise routines.
- Model Deployment and Integration: Integrate the trained XGBoost model into the real-time prediction system. Ensure it is scalable, efficient, and can handle a wide range of exercise types and individual profiles. Consider compatibility with fitness tracking devices or platforms for seamless integration.
- Performance Comparison: Compare the performance of the XGBoost model with other existing methods or prediction models for calorie burn estimation. Evaluate its advantages in terms of accuracy, robustness, computational efficiency, and user experience.
- Documentation and Reporting: Document the entire process, including data preprocessing steps, model development, parameter settings, and evaluation results. Provide a comprehensive report on the proposed method, highlighting its effectiveness in predicting calorie burn using XGBoost and exercise duration.

By following this proposed method, the study aims to develop a robust and accurate model for predicting calorie burn based on exercise duration using XGBoost. The model can provide individuals with valuable insights into their calorie expenditure during exercise, assisting them in optimizing their fitness goals, and making informed decisions regarding their health and well-being.

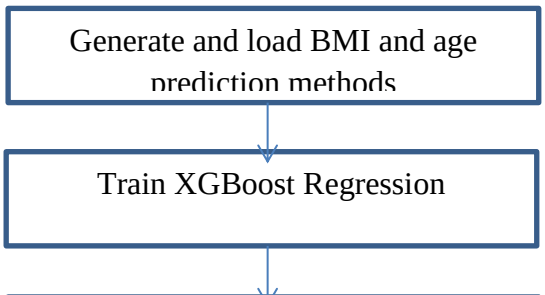


Fig. Flowchart

IV. RESULT

In this project we are using Exercise and Calories burnt dataset to train XGBOOST regression algorithm. XGBOOST trained model can be used to predict burnt calories from new test data. To predict BMI and Age we are using CNN algorithm which will extract features from face and then predict age and BMI. Age and BMI can be predicted from both images and WEBCAM scan faces.

To implement this project we have designed following modules

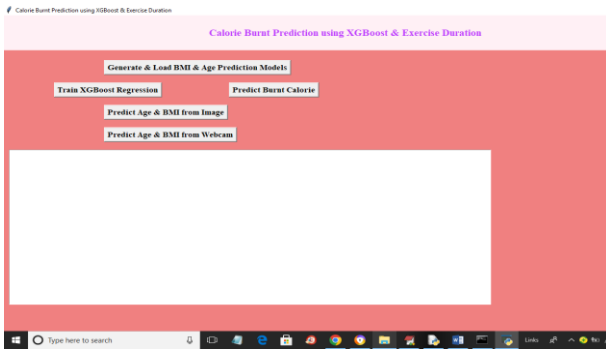
1) Generate & Load BMI & Age Prediction Models: using this module we will generate and load BMI and Age models
2) Train XGBoost Regression: using this module we will train XGBOOST algorithm to predict burnt calories
3) Predict Burnt Calorie: using this module we will ask user to enter DURATION of exercise and then XGBOOST will predict burnt calories
4) Predict Age & BMI from Image: using this module we will upload image and

then CNN algorithm will predict BMI and age by scanning facial features

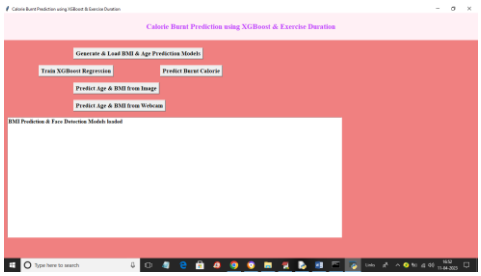
5) Predict Age & BMI from Webcam: using this module we will scan faces using Webcam and then CNN algorithm will predict BMI and age by scanning facial features

SCREEN SHOTS

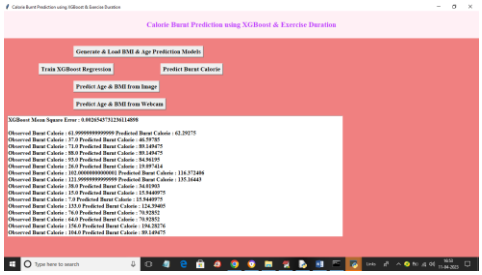
To run project double click on 'run.bat' file to get below screen



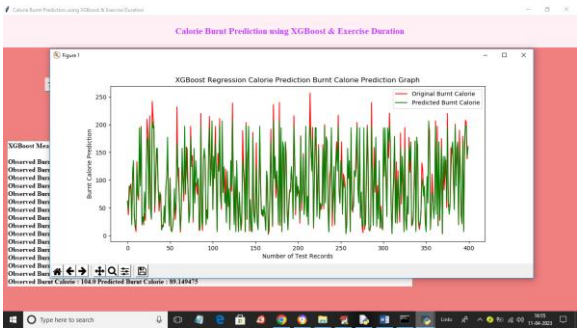
In above screen click on 'Generate & Load BMI & Age Prediction Models' button to generate and load models and get below screen



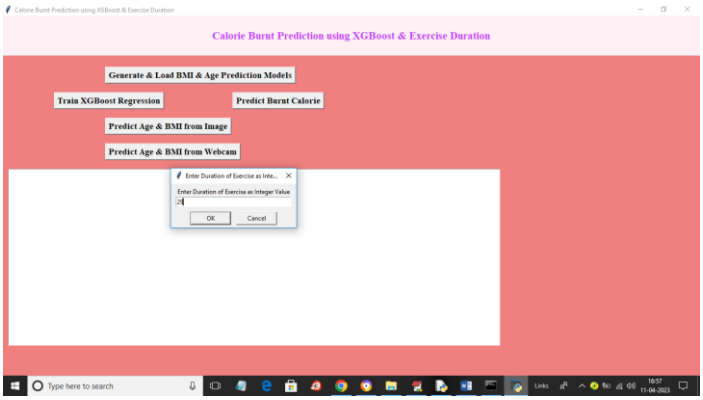
In above screen model loaded and now click on 'Train XGBoost Regression' button to train XGBoost on Calorie burnt dataset and get below output



In above screen XGBoost training completed and we can see XGBoost Mean square error (MSE) in first line. MSE is the difference between actual and predicted values so the lower the MSE the better is the algorithm. In above screen we can see original test calorie burnt and predicted burnt and we can see both values are too close and below are the original and burnt calorie graph from XGBoost

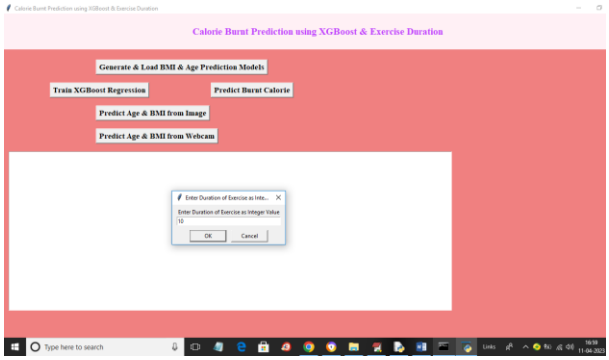


In above graph x-axis represents number of test records and y-axis represents burnt calories. Red line represents original test calorie values and green line represents predicted burnt values and we can see both lines are fully overlapping with little gap so we can say XGBoost predictions are accurate. Now close above graph and then click on 'Predict Burnt Calorie' button to enter Exercise duration and get calorie burnt as output



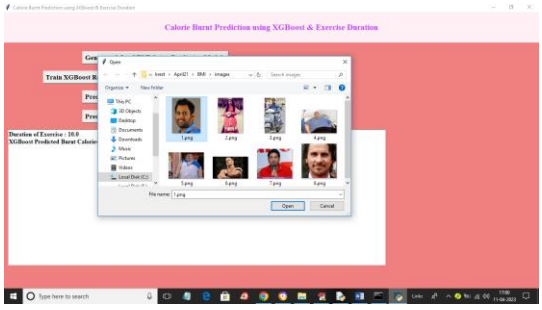
In above screen I am entering 29 minutes of exercise duration and then click on 'OK' button to get below output

In above screen in text area we can see for 29 minutes exercise total calorie burnt is 197. Similarly enter duration and get burnt value



In above screen I entered 10 minutes and below is the output

In above screen for 10 minutes total calorie burnt is 46. Now click on 'Predict Age & BMI from Image' button to upload image and get below output



In above screen I am selecting and uploading '1.png' and then click on 'Open' button to get below output

In above screen we can see predicted BMI as 23 and Age as 31 and similarly you can upload and test other images

Similarly you can click on 'Predict Age & BMI from Webcam' button to open Webcam and start predicting age and BMI.

V. CONCLUSION

In today's world, people are having very tight schedules due to the changes in their lifestyles and work commitments. But it requires regular physical activity to stay fit and healthy. Peopledo not concentrate on their food habits, leading to obesity. Obesity is becoming a major andcommon problem in today's lifestyle. This leads people to choose their diet and do an equal amount of exercise to stay fit and healthy. The main part here is people should have adequate knowledge about their calorie intake and burn, keeping a track of their calorie intake is easy as it's available on the product label or on the internet. Keeping track of calories burnt is a difficult part as there are very few devices for that. Calories burned by an individual are based on MET charts and formulas. The main agenda of this study is a prediction of the burnt calories with the help of an XG boost regression model as the ML

(machine learning) algorithm to show accurate results. The model is fed with more than 15,000 data and its mean absolute error is 2.7 which will become better over time by feeding the XG boost regression model with more data.

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