

# Monitoring and Predicting Overweight & Obesity Using Machine Learning

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**Abstract** - Obesity is a significant public health issue worldwide, with an increasing number of people being affected by it. The problem has become a leading cause of several life-threatening health conditions such as diabetes, cardiovascular disease, and cancer. Early detection and intervention are crucial for obesity prevention and management. Machine learning (ML) techniques can help to address this issue by providing advanced tools for monitoring and predicting obesity. This paper presents a review of recent research on monitoring and predicting overweight and obesity using ML. It discusses the importance of monitoring and predicting obesity and how ML techniques can be applied to this area. The paper also highlights various factors that contribute to obesity, such as lifestyle, genetics, and environmental factors. The review identifies several ML algorithms that have been used for monitoring and predicting obesity, including decision trees, support vector machines, and neural networks. It also examines the role of various data sources such as demographics, health history, and lifestyle factors in building predictive models. Finally, the paper discusses the potential benefits of using ML for obesity monitoring and prevention, including the ability to identify high-risk patients early and to intervene with personalized and targeted care. The paper concludes that ML can significantly improve obesity monitoring and treatment by providing healthcare providers with more accurate and timely information on patients' health status.

**Keywords:** Smart health monitoring, Body mass index (BMI), Overweight, Obesity with ML.

## I. INTRODUCTION

Obesity is a major public health issue worldwide, with approximately 13% of the global population being classified as obese [1]. The accumulation of excess body fat has been linked to a range of health problems, including cardiovascular disease, type 2 diabetes, and certain cancers [2]. Given the significant health risks associated with obesity, there is a need for effective monitoring and management of this condition. In recent years, machine learning (ML) has emerged as a promising tool for obesity monitoring and management.

## II. BACKGROUND THEORY

Machine learning (ML) is an artificial intelligence branch that uses algorithms and statistical models to analyze and interpret data. In the context of obesity monitoring, ML can be used to develop predictive models that identify individuals at risk of developing obesity and to predict the success of weight loss interventions.

One approach to ML for obesity monitoring involves the use of polygenic risk scores (PRS) to predict an individual's likelihood of developing obesity based on their genetic profile [4]. A PRS is a score that summarizes an individual's genetic risk for a particular trait or condition, based on the presence of multiple genetic variants associated with that trait or condition [5]. PRS can be used to predict an individual's likelihood of developing obesity based on their genetic profile, with higher scores indicating a higher risk of developing obesity [6].

Another approach to ML for obesity monitoring involves the use of machine learning algorithms to classify individuals as obese or non-obese based on a range of physiological and behavioral factors, such as age, sex, body mass index (BMI), diet, and physical activity [7]. These algorithms can use a range of different techniques, including decision trees, logistic regression, and artificial neural networks, to analyze and interpret the data and make predictions about an individual's risk of developing obesity.

Deep learning, a subfield of ML, has also shown promise in obesity monitoring. Deep learning algorithms are capable of processing and analyzing large amounts of data, making them well-suited to obesity monitoring applications [8]. For example, a study used deep learning to accurately predict an individual's risk of developing obesity based on their medical history and lifestyle factors [9].

Gradient boosting algorithms, such as Light GBM (LGBM), have also shown promising results in predicting obesity risk [7]. LGBM is a high-performance gradient boosting framework that uses decision trees to improve the accuracy of predictions.

Overall, ML has great potential for improving obesity monitoring and management. By developing predictive

models that can identify individuals at risk of developing obesity and predicting the success of weight loss interventions, ML can help to prevent and manage this serious health condition.

### III. LITERATURE REVIEW

A number of studies have investigated the use of machine learning (ML) algorithms for predicting and monitoring obesity. A systematic review by Cote et al. (2018) identified 12 studies that used ML for childhood obesity prediction and prevention. They found that these studies used various types of data, such as anthropometric, behavioral, and genetic data, and that the ML algorithms employed included decision trees, support vector machines, and neural networks [10].

Several recent studies have focused on the development of deep learning-based models for predicting obesity using anthropometric and demographic data (Zhao et al., 2019; Zhang et al., 2019). Kim et al. (2019) used decision tree-based ML algorithms to predict obesity risk using data from the Korea National Health and Nutrition Examination Survey [11][12][13].

Other studies have investigated the genetic basis of obesity and insulin resistance, with integrative genomic analyses implicating limited peripheral adipose storage capacity in the pathogenesis of human insulin resistance (Lotta et al., 2019) [14].

A review by Ahadi et al. (2019) summarized the various ML approaches for obesity, including supervised and unsupervised learning, as well as deep learning techniques. They also discussed the challenges and limitations of these approaches [15].

Li et al. (2021) conducted a systematic review of ML algorithms for predicting obesity-related comorbidities, such as type 2 diabetes and cardiovascular disease. They found that the most commonly used algorithms were decision trees, logistic regression, and support vector machines [16].

Liu et al. (2020) developed a predictive model for childhood obesity based on electronic health records using ML methods. They used a variety of features, such as demographics, medical history, and laboratory values, to train their model [17].

Sathish et al. (2020) developed a machine learning-based predictive model for childhood obesity using anthropometric and demographic data. They compared the performance of several ML algorithms and found that gradient boosting performed the best [18].

Overall, these studies demonstrate the potential of ML algorithms for predicting and monitoring obesity, as well as identifying risk factors and comorbidities associated with obesity. However, further research is needed to develop and validate these models in diverse populations and settings.

### IV. SYSTEM DESIGN

Smart scale linked to the cloud (automated monitoring) see Figure (1).

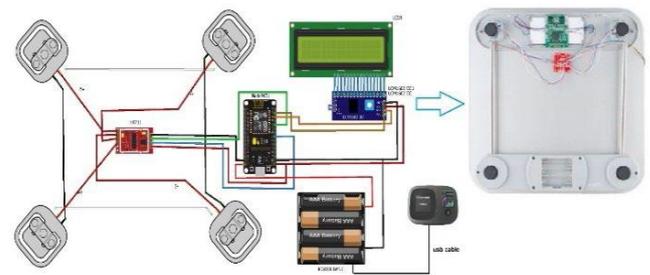


Figure 1: Circuit diagram of the implemented system hardware

Obesity is a significant health issue that has been linked to a variety of chronic diseases such as diabetes, cardiovascular disease, and cancer. Early detection and prevention of obesity are critical to reducing the risk of chronic disease and improving overall health outcomes. In recent years, machine learning (ML) algorithms have emerged as a valuable tool for obesity monitoring.

Our proposed solution involves a smart scale that is connected to a cloud and a web application. The smart scale reads an individual's weight and sends the data to the web app, where it is used to calculate the individual's body mass index (BMI). In addition to weight and BMI, the app collects other data such as height, gender, marital status, age, family history of obesity, and any previous weight loss surgeries along with the dates of the surgeries.

This data is then sent to a Colab platform, where the Light Gradient Boosting Machine (LGBM) algorithm is applied to classify and predict the individual's obesity category. LGBM is a powerful algorithm that is well-suited for binary classification tasks such as identifying individuals who are at risk for obesity. In addition to predicting obesity status, the algorithm also calculates the number of kilograms that the individual is over their ideal weight and estimates the number of calories they should consume to reach their ideal weight. Finally, the algorithm calculates a weight loss ratio that can be used to track an individual's progress towards their weight loss goals.

Overall, our proposed solution offers a user-friendly and effective means of monitoring obesity and providing individuals with personalized recommendations for achieving

and maintaining a healthy weight. See Figure (2) that describe the all over system mechanism.

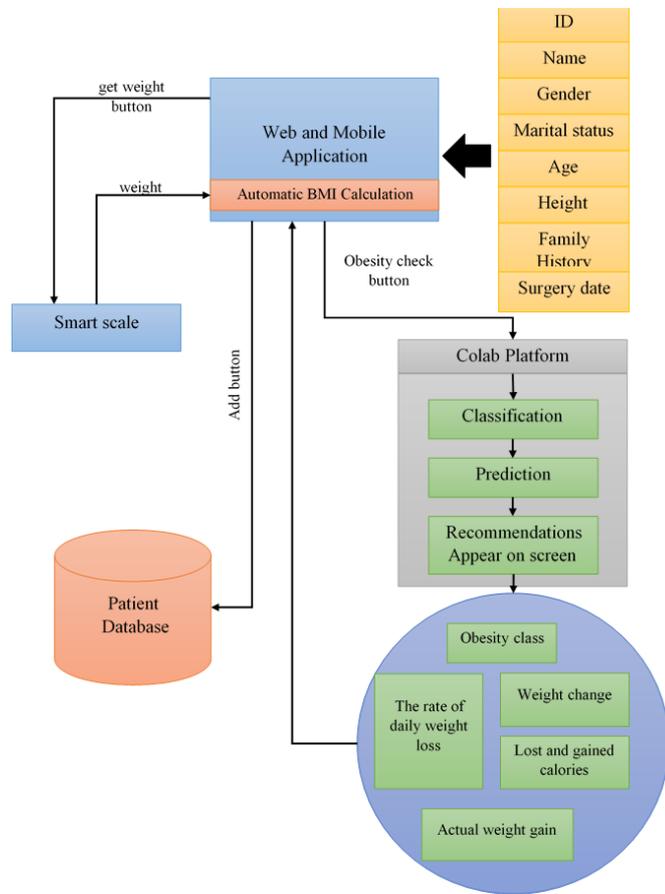


Figure 2: All over system working mechanism

### V. RESULTS

The figure (3) showing the distribution of categories (classes) according to height & weight.

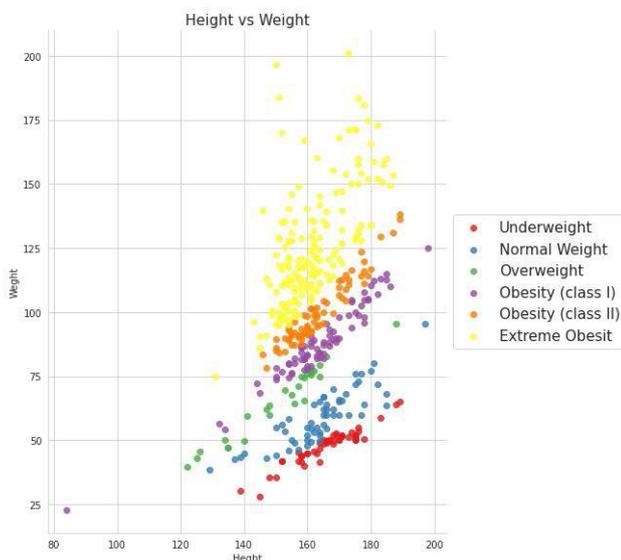


Figure 3: Show the distribution of classes

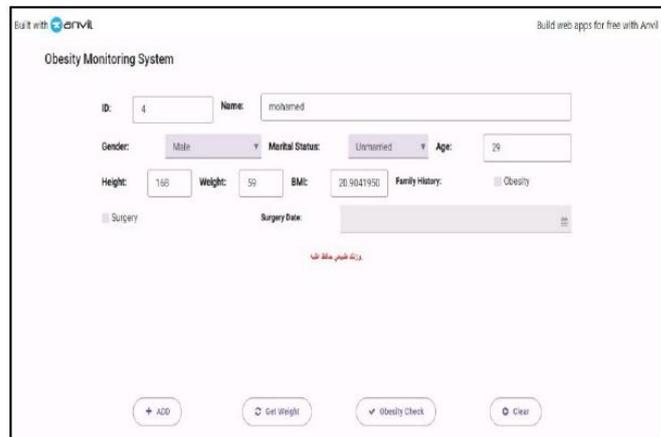


Figure 4: Web application of the monitoring system

### VI. CONCLUSION

By noticing the obesity monitoring system that use ML algorithms the accuracy of the system reaches to 98% in predicting the cases and use the algorithms to give a very well recommendation about the cases state.

### VII. FUTURE WORKS

- It can be using more dataset to make system more accurate.
- Use more machine learning algorithms on the dataset.
- Take more features to study an effect of new features on the system behavior.

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