# ANNAPURNA: Diet Recommender System

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## ABSTRACT
Grains, non-veg protein sources, vegetables, and fruits are key parts of a good varied diet. They are emphasized in this guideline because they provide vitamins, minerals, complex carbohydrates, proteins, fats, and other substances that are important for good health. They are also generally low in fat (good fats), depending on how they are prepared and what is added to them at the table [2]. Thus a recommender system that recommends a good and balanced diet for achieving fitness goals like weight gain or muscle gaining, say fat burning and weight maintenance

## General Terms
Diet recommendation, Data mining, Customized meals, Ketogenic diet, Target caloric intake, Current caloric intake.

## Keywords
Diet recommendation, Data mining, Artificial Intelligence basic methodologies, Machine Learning, Decision Tree, Customized meals, Keto diet, BMI.

## 1. INTRODUCTION
A clean balanced diet plays an important role when considered an individual's life. A balanced meal plan is beneficial for having good health as well as the prevention of various diseases [1]. A person who takes a balanced diet seems to be fit all the time. Nonetheless, what actually is a balanced diet? A balanced diet includes an appropriate amount of all nutritional groups, such as carbohydrates, minerals, proteins, fats, and sugar (through natural sources) for maintaining health. All the issues related to the health of a person are related to the diet [1]. The tripod stand consists of three major pillars namely diet, exercise, and proper sleep.

So the whole fitness goal revolves around these three factors which are mainly weight maintenance, fat loss programs, and weight gain. People being aware of the importance of diet still can't manage due to their hectic schedules to get their dietary system on point. Thus a diet recommendation application which is portable, user-friendly, easily accessible provides individual plan considering the goals. The key point to be mentioned diet may vary as per the goals and basic aspects considered like weight, height, work ethic, age, gender and history of diseases.

Thus considering the goals, we display the calorie count to be maintained for routine life. Also, a meal plan consisting of five to six precise meals that can be customized and will be targeting the calorie count required using machine learning.

Considering the daily corporate life, it becomes difficult for people to have a clean diet plan and that to follow it precisely. The bad eating habits lead to a variety of diseases [1].

To help a person for scheduling a daily plan, BMI stands for Body Mass Index which indicates whether the person is obese or under-fit or ideal. BMI helps for maintaining healthy structure day to day life. The scope of this system can be cost-effective. It consists of an application recommending people meal plans according to the veg, & non-veg or both. A budget-friendly diet plan that is accessible from anywhere. No appointment system as readily available for all age groups so we can provide a meal plan as per their dietician choice. BMI or Calories will be calculated daily.

The traditional diet system consists of appointment booking then sharing personal details varies from person to person and then suggesting a diet, which is time-consuming. The "Dietician Application" reduces the time span and skips the appointment procedure. The product is cost-effective, optimizes the time factor and readily available.

## 2. RELATED WORK
There are a variety of different applications with work related to dietary foods and supplements.

An application like My Fitness Pal contains a huge database with covering over variety of foods and their key parameters like calories, proteins, carbohydrates, fats, potassium, and sodium, which gives a general idea about the daily intake of these parameters considering feasible goals [1].

There are other applications that track our calories and give us an oriented approach to the calories burned, My fitness pal is one of the widely used applications [6]. There are different approaches like the fuzzy approach which is been used for diet prediction. Suggestion applications based on ontology and fuzzy approach.

Special cases like users with a medical history, considering their health condition providing a customized diet plan according to the goals. Ketogenic diets which have been a trend in a fitness industry that involves more caloric intake from proteins, fats and less preferred from carbohydrates, here there are few applications which are best for a ketogenic diet like "Carb-Manager", it is an application which involves all

the steps required for a perfect ketogenic diet for losing fat like caloric intake calculation, insulin and many more [4]. Thus there is another application which focuses on customizing meals and providing a better insight into the macros being consumed throughout the day like PlateJoy, It focuses on customized meals thus giving detailed information about the nutrients being consumed [5].

## 3. DATASET

Dataset is prepared by taking all the aspects of various people who have successfully transformed themself into their desired goal. Nutritionists have played a major role in helping creating datasets. Dataset is made by surveying local gyms. Trainers of these gyms have shared information including the diet plan of all the clients. The dataset consists of a variety of nutritious food which is extremely healthy for humans. Food which is taken into consideration is easily available in the market. They are extremely cheap as well. For example, seasonal fruit that is grown on motherland is healthier than the fruits which are imported. Once the BMI is calculated, the next step is to select a goal. Users can select their goal as weight gain, weight maintenance or weight loss. Once the current calories are known, target calories can be calculated. Target calories is given by,

Target calories= (Height (cm)-100)*33

Once the target calories are known, next step determines the diet plan.

**Table 1: Dataset**

| Total number of Records | Attributes | Diet Plans |
|---|---|---|
| 163 | BMI, Current Calorie, Target Calorie, Diet Plan | 12 |

## 4. PROPOSED FRAMEWORK

The system uses a MYSQL database for containing all the information of the user. The database contains all the structured data about user profiles, goals, and parameter like calorie count [3]. The basics of an individual like weight, height, work schedule, age, and gender are considered. BMI calculation indicates a person's body mass index which identifies the current fitness state. According to the BMI results like under-fit, over fit and fit; the goals are selected and then calorie count is displayed. Considering the target calories with the help of machine learning, a customized diet plan is generated. The main aspect of the application is providing an option for veg or non-veg combined with veg sources. A generic diet plan will be displayed to the user.

**Table 2: Diet plan for calories ranging from 1000-1200**

| Meals | Food Items | Calories |
|---|---|---|
| 1 | One whole egg one egg Omelette, One Chapati | 200 |
| 2 | One apple | 100 |
| 3 | Rice(1/2 cup),Dal(1/2cup), Ghee(1 tspn) Oil(15ml) | 478 |
| 4 | Oats(40gm),Almonds(3),Honey( 2tspn) | Total calories=1110 |

### 4.1 BMI

BMI stands for body mass index. BMI is determined by weight in kilograms divided by square of height in meters. BMI is used to measure the leanness of a person based on height and weight. It determines whether the person has appropriate body weight with respect to their height. BMI is used to calculate tissue mass. The value of BMI determines whether the person is normal weight, underweight, or overweight.

BMI is given by,

BMI= Mass (kg)/Height^2 (m)

**Table3: Different Range of BMI for adults**

| BMI range | Category |
|---|---|
| Below 18.5 | Under weight |
| 18.5-24.9 | Normal Weight |
| 25.0-29.9 | Over weight |
| 30.0 -35.0 | Obese class 1 |
| 35.0-40.0 | Obese class 2 |
| >40.0 | Obese class 3 |

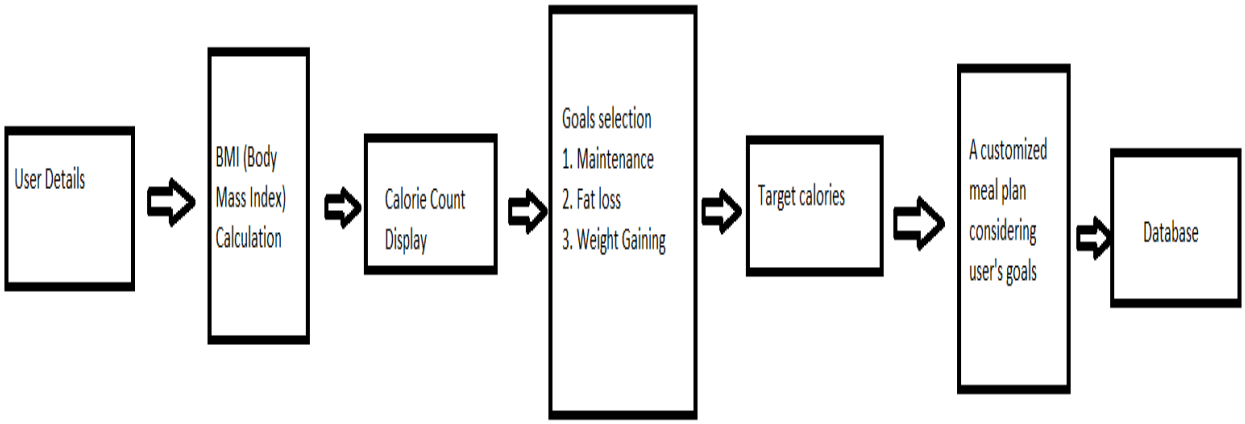


**Fig 1: System Flow Diagram**

## 4.2 Algorithm

Regression Tree is used in order to measure how effective the 'target caloric intake' of a person has to be to maintain one's 'weight' and as such provide a suitable diet plan. The attribute such as 'height' and 'weight' are used to calculate BMI (Body Mass Index), suggests in which range (Under-weight, Ideal, Over-weight) a person belongs to.

Regression Trees are a type of Decision Tree and follow an upside-down schema. In a Regression Tree, each leaf represents a numeric value. It is used to determine how to divide the observations by trying different 'thresholds' and calculating the Sum of Squared Residuals (SSR) at each step. The step with the smallest sum of squared residuals becomes a candidate for the root of the tree. If there is more than one predictor, first find the optimal threshold for each one and pick the candidate with the smallest sum of squared residuals to be the root. When there are fewer than some minimum number of observations in a node, then that node becomes a leaf node otherwise repeat the process to split the remaining observations until no observations can further be split into smaller groups.

**Mathematical Model**

Set Theory S= {s, e, X, Y, φ}

Where, s = Start of the program.

1.Log in with username and passcode.

2.Submitting personal details like height and weight.

3.Calculation of BMI.

4.Select a goal.

5.Calculation of current caloric intake and target caloric intake.

6. Displaying the diet plan.

e = End of the program.

X = {BMI, goal, current calorie, target calorie}

X = Input of the program.

Goals= weight loss, weight gain, weight maintenance.

Y = Output of the program (diet plan**).**

Basic steps include the calculation of BMI, current caloric intake and target caloric intake. The features are provided as an input to the Decision tree Regression Model and then the resultant output is a diet plan.

X, Y ∈ U

Let U be the Set of System. S= {A, U},

Where,

Admin and User are the elements of the set.

A = Admin U = User

# 5. RESULT

## 5.1 Comparison Report

The initial task in research was to compare different machine learning models. The figure below represents comparison in terms of accuracy metrics when trained and tested on datasets. Random splitting was performed on the datasets thus training and testing of the algorithm leads to enhancement of model performance. It was observed that machine learning algorithms/models such as Naive Bayes and KNN performed fairly well but Decision Tree outperformed all the other models. Decision Tree provides better results in comparison to other models as it divides the dataset into subsets so as to provide better results.

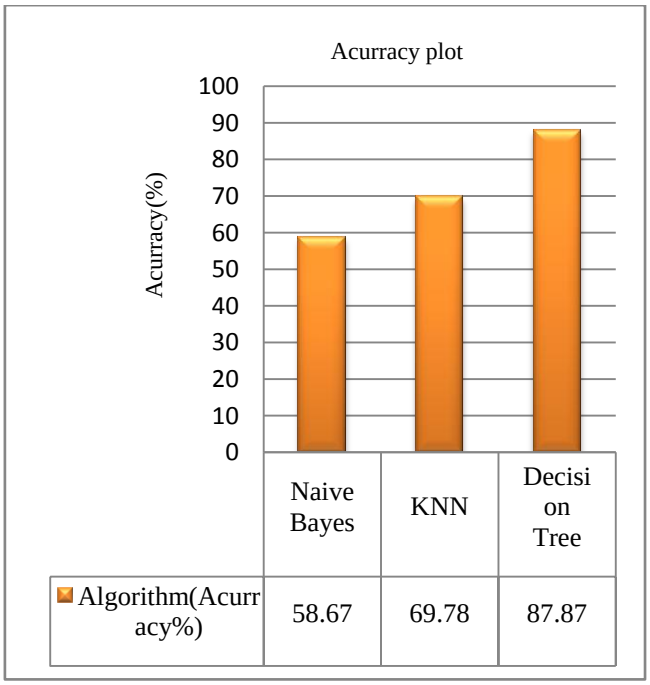


**Fig2. Comparison of Algorithms**

# 6. CONCLUSION

The proposed framework performs accurately and gives a diet plan which is user convenient. The Regression Decision tree provides an accuracy of 87.87%. The system consists of an application recommending people, meal plans according to veg, non-veg, or both included and provides a budget-friendly diet plan that is accessible from anywhere. No appointment system as it is readily available for all age groups so we can provide a meal plan.

# 7. REFERENCES

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