Abstract

Good nutrition is an important part of leading a healthy lifestyle. Combined with physical activity, the diet can help an individual reach and maintain a healthy weight, reduce risk of chronic diseases and promote overall health. The food that is eaten is directly reflected on the body. For fulfilling certain goals for one's body whether it be being fit, losing or gaining some weight what is eaten has to be precisely considered. So, as a tracker and planner of food is artificial intelligence bot "AI Dietician" acting as a perfect guide on one's daily meals to achieve certain body goal on the particular body type. The application gives an overview on food and the nutrients into the consideration of the user. The program is made mostly feasible for Nepalese consumers where firstly basic information of the user like their age, height, weight and their personal goal is collected, these data are analyzed and interpreted to the best food plan for a user. In this way, the construction of this program has provided us the interface to learn about machine learning and AI bot development and the audience a convenient platform to enhance healthy lifestyle.

Introduction

Background

"AI Dietician" is a program with artificial intelligence about human diets. It acts as a dietician helping users to plan their diet regularly. It is a diet consultant similar to that of a real dietician. Dieticians are the people who are expert in nutrition or dietetics and give advice on food and eating. A dietician consults a person based on their age, their schedule, body type, height and weight. Similarly, this system too asks all these kinds of information from the user and processes it. The app asks user several questions like their height, weight, age, their normal diet plans and if they exercise or conduct physical activities on daily basis. The system stores and processes all these data and then calculates the nutrient value needed to compensate user's needs. The system then shows an appropriate diet to the users and asks if user is with fine it, else it shows other alternate diets to fill up user's needs.

This application is an easier way to learn about food and how human body works and together how required result is obtained in one's body overtime with proper meal plans. This system provides full details of the nutrient constitution in body and if required more or not along with the plan by just answering to some queries.

Objectives

1. To give user a proper diet plan based on their individual requirement.
2. To provide user diet counseling without having to visit a dietitian.
3. To provide user friendly platform to keep track about individual's fitness.

Motivation and Significance

With the increase in number of fitness enthusiast, the need to consult a dietitian for diet plan has been very common these days. Dieticians basically help us to change our lifestyle to improve our health. The amount of time and energy wasted to visit dietitian on regular basis is quite hectic and money they charge is high. The alternative to these monotonous processes is to download a diet based application and follow the instruction provided by the application. Our app includes diet plan for this purpose. This app solves the problem of figuring out which food user should be having and in what amount to maintain their fitness. This can be a very useful source for diet conscious people in the context of Nepal to keep up with their diet routine. The basic application of this project is to keep record of user's daily diet and nutrients details of their food, keep track of healthy regimen process and make necessary changes, if required.

System Specifications

System Requirements

Compatibility: Compatible with all OS platforms

Hardware Specification: Minimum requirements PC supporting Python.

Development Tool: A supporting IDE such as Jupiter Notebook.

Tools Used

Python: Python is an interpreter, high-level, general-purpose programming language. Python has a design philosophy that emphasizes code readability, notably using significant whitespace. It provides constructs that enable clear programming on both small and large scales.

Sci-kit Learn: Scikit-learn (formerly scikits.learn) is a free software machine learning library for the Python programming language. It features various classification, regression and clustering algorithms including support vector machines, random forests, gradient boosting, k-means and DBSCAN, and is designed to interoperate with the Python numerical and scientific libraries NumPy and SciPy.

NumPy: NumPy is a library for the Python programming language, adding support for large, multi-dimensional arrays and matrices, along with a large collection of high-level mathematical functions to operate on these arrays.

Pandas: In computer programming, pandas is a software library written for the Python programming language for data manipulation and analysis. In particular, it offers data structures and operations for manipulating numerical tables and time series.

Matplotlib: Matplotlib is a Python 2D plotting library which produces publication quality figures in a variety of hard copy formats and interactive environments across platforms. Matplotlib can be used in Python scripts, the Python and IPython shells, the Jupyter notebook, web application servers, and four graphical user interface toolkits.

Methodology

Calorie: The calories in the foods and the beverages play a key role in weight and health status. The calories consumption helps the body to produce energy.

BMI(Body Mass Index): Body Mass Index is a simple calculation using a person's height and weight. The formula is BMI = kg/m^2 where kg is a person's weight in kilograms and m^2 is their height in metres squared.

Conditions:

If the BMI is below 18.5: BMI is considered underweight.

If the BMI is between 18.5-24.9: BMI is considered normal.

If the BMI is between 25-29.9: BMI is considered overweight.

If the BMI is above 30: BMI is considered obese.

Regression analysis

Regression analysis is a statistical technique for determining the relationship between a single dependent (criterion) variable and one or more independent (predictor) variables. The analysis yields a predicted value for the criterion resulting from a linear combination of the predictors. The first step in regression analysis is to determine the criterion variable. The criterion have acceptable measurement qualities (i.e. reliability and validity). Once the criterion has been selected, predictor variables should be identified (model selection). The aim of model selection is to minimize the number of predictors which account for the maximum variance in the criterion. R^2 is dependent on the multiple correlation coefficient (R), which describes the relationship between the observed and predicted criterion scores. If there is no difference between the predicted and observed scores, R equals 1.00. This represents a perfect prediction with no error and no unexplained variance (R^2 = 1.00). When R equals 0.00, there is no relationship between the predictor(s) and the criterion and no variance in scores has been explained (R^2 = 0.00). The chosen variables cannot predict the criterion. The goal of model selection is, as stated previously, to develop a model that results in the highest estimated value for R^2.

Our Application uses the polynomial regression model:

In this regression, the relationship between **dependent** and the **independent variable** is modeled such that the dependent variable Y is an nth degree function of independent variable Y. The polynomial regression fits into a non-linear relationship between the value of X and the value of Y. The Polynomial regression is also called as multiple linear regression models.

The formula, in this case, is modeled as –

$$y = \beta_0 + \beta_1 x + \beta_2 x^2 + \beta_3 x^3 + \cdots + \beta_n x^n + \varepsilon.$$

Where y is the dependent variable and the betas are the coefficient for different nth powers of the independent variable x starting from 0 to n.

For Our Graph:

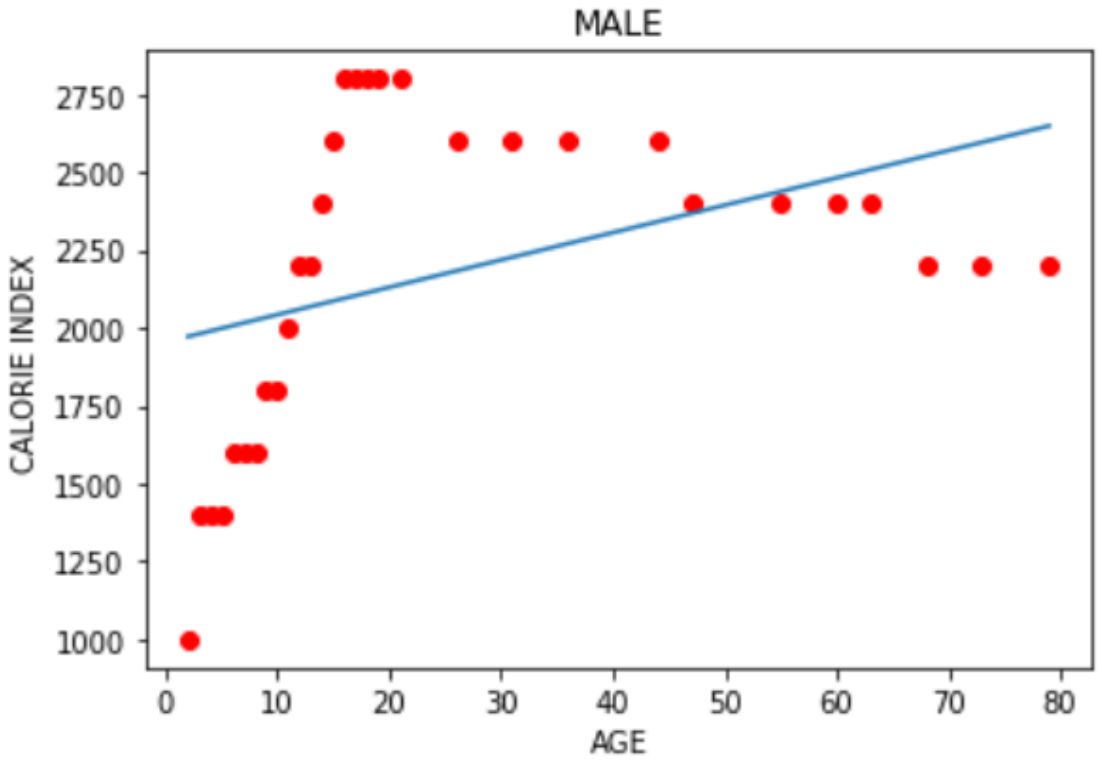

Figure: Linear Regression between age and calorie

When we used linear regression for the prediction of calorie requirement, the data points were scattered unevenly across the graph such that the linear line couldn't include the necessary points for the evaluation of the calories. Underfitting occurs in this case as the necessary data for the prediction aren't captured within the graph.

Hence, we used polynomial regression to overcome that.

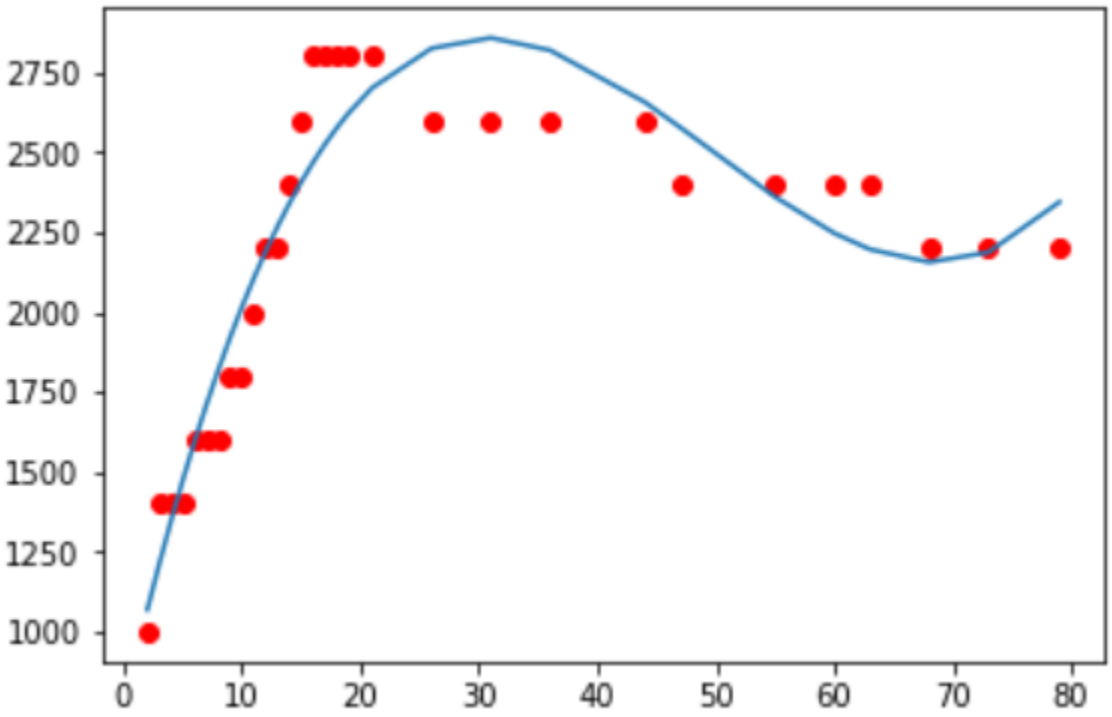

Figure: Polynomial Regression

The figure obtained after using polynomial regression is shown. It is able to include most of the approximations needed for the predictions of the calorie requirement. Hence, we predicted the values with better accuracy after using polynomial regression.

Logic for Predicting the Calorie Requirement:

1) We use a dataset containing input and gender to evaluate the calorie intake using regression model.

2) After that we calculate BMI using the standard BMI formula as indicated in the above methodology.

3) When a user enters height and weight, we use the data to calculate the total calorie intake needed.

Logic for choosing the food:

1) Food is divided into 4 parts- Breakfast-30%, Lunch-40%, Snack-10%, Dinner-30%.

2)There is an associated table of information about food and required information associated with each category.

3)Randomly draft foods from the list until the calorie needed matches the required calorie count for each of the category.

4)Also while choosing the food we chose balanced food with only one carbohydrate , one protein and fiber or fruits of one meal.

Functions Used:

where: Print a stack trace, with the most recent frame at the bottom. An arrow indicates the current frame, which determines the context of most commands.

append: The method append() appends a passed obj into the existing list.

read_csv: Read a comma-separated values (csv) file into DataFrame. Also supports optionally iterating or breaking of the file into chunks.

type(variable): Determines the type of variable used.

scatter(var x, var y): Plot the points of x and y in a graph.

LinearRegression(): Calculates linear Regression for the given dataset.

Iloc(x,y): Purely integer-location based indexing for selection by position.

Fit: Fit module is designed fto fit data frequently and quickly.

Plot: It is used to plot the required set over a graph.

XLabel: It is used to label the X axis of a graph.

YLabel: It is used to label the Y axis of a graph.

Title: It is used to give a title to the graph.

Fit_Transform: Apply Dimension reduction of a variable.

Predict(x,y): We can predict quantities with the finalized regression model by calling the predict()function on the finalized model.\

Screenshots:

	age	gender	calorie
0	2	M	1000
1	3	M	1400
2	4	M	1400
3	5	M	1400
4	6	M	1600
5	7	M	1600
6	8	M	1600
7	9	M	1800
8	10	M	1800
9	11	M	2000
10	12	M	2200
11	13	M	2200
12	14	M	2400
13	15	M	2600
14	16	M	2800
15	17	M	2800
16	18	M	2800
17	19	M	2800
18	21	M	2800
19	26	M	2600
20	31	M	2600
21	36	M	2600
22	44	M	2600
23	47	M	2400
24	55	M	2400
25	60	M	2400
26	63	M	2400
27	68	M	2200
28	73	M	2200
29	79	M	2200

	age	gender	calorie
30	2	F	1000
31	3	F	1200
32	4	F	1400
33	5	F	1400
34	6	F	1400
35	7	F	1600
36	8	F	1600
37	9	F	1600
38	10	F	1800
39	11	F	1800
40	12	F	2000
41	13	F	2000
42	14	F	2000
43	15	F	2000
44	16	F	2000
45	17	F	2000
46	18	F	2000
47	20	F	2200
48	21	F	2200
49	27	F	2000
50	33	F	2000
51	38	F	2000
52	45	F	2000
53	50	F	2000
54	51	F	1800
55	57	F	1800
56	62	F	1800
57	67	F	1800
58	74	F	1800
59	89	F	1800

Fig: age and gender table for male and female

	food	quantity	calorie	type
0	Strawberry	1	53	Fruit
1	Broccoli	1	45	Vegetable
2	Broccoli	1	45	Vegetable
3	Carrots	1	50	Vegetable
4	Cucumber	1	17	Vegetable
5	Eggplant	1	35	Vegetable
6	Beef	1	142	Protein
7	Chicken	1	136	Protein
8	Tofu	1	86	Protein
9	Egg	1	78	Protein
10	Fish	2	136	Protein
11	Pork	2	137	Protein
12	Shrimp	2	56	Protein
13	Cheeseburger	1	250	Carbohydrate
14	Hamburger	1	260	Carbohydrate
15	Potato	1	40	Carbohydrate
16	Rice	1	280	Carbohydrate
17	Sandwich	1	240	Carbohydrate
18	Milk (Whole)	1	146	Drink
19	Orange Juice	1 cup	111	Drink
20	Apple cider	1 cup	117	Drink
21	Dal	1	120	Drink
22	Roti	1	80	Carbohydrate
23	Rice Fried	1 cup	418	Carbohydrate
24	Corn	1 cup	120	Vegetable

Fig: Sample Table for a single category of food

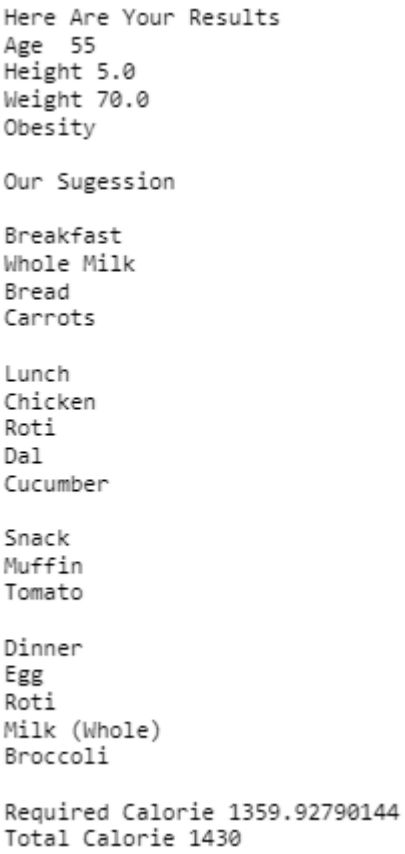

Fig: Prediction output by using the given algorithm

Conclusion

The project “AI Dietician” is used for calculating the calorie intake needed for each individual. The application takes care of all the requirements of calories and is capable of providing easy and effective information related to leading towards a healthier life. Hence, this project was a very fruitful project.

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