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An Online Diet Recommendation System Based On Artificial Intelligence

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***Abstract*—** This research paper aims to present the study and implementation of artificial intelligence dietician which can simulate the experience of a human dietician. The main aim is to recommend to the users a perfectly planned diet according to their body parameters and their day to day activities using artificial intelligence. The online artificial dietician is a bot with artificial intelligence about human nourishments. It acts as a diet specialist similar to an actual dietician. We have also taken under consideration the health status of the user. We have used artificial intelligence as the driving technology. To select the diet of user it has to check various parameters and there can be various food items that pass the criteria. So to select the best among all, we take the help of Genetic Algorithm. Genetic Algorithm is our key algorithm, besides the Naïve Bayes algorithm. Genetic algorithm keeps on finding the best option from the pool of options while Naïve Bayes is used for the purpose of classification.

***Keywords*—**Genetic algorithm, Naïve Bayes Classifier, Artificial Intelligence

I. INTRODUCTION

Now a days, people are suffering from various health problems such as fitness problems, the issue of maintaining proper diet, etc. Therefore, we are developing this website for providing special diet information for normal people and for medical patients as well. The effective personal dietary guidelines are very essential for managing our health, preventing chronic diseases and the interactive diet planning helps the users to adjust the plan in an easier way. Based on the individual requirements of the customers as regards to reasonable diet, medication and so on, this application simulates the nutritionist's experience by artificial intelligence, and uses internet as the technical platform, so as to introduce customers to a scientifically and perfectly structured menu or diet medication plan based on their preference and health status. There will be two classes of users, the admin and general users. The users fill the registering form and then log onto the website. After logging in, users will have to fill their individual data including age, weight, height, gender, medical conditions and exercise level. On the basis of calculated BMI (Body Mass Index) and medical conditions Artificial Dietician will display the proper diet for the user. The system will be trained to provide safe, evidence-based dietary advice and interventions by counting calories, checking the number of vitamins, carbohydrates and fat in different kinds of ingredients exposed to various preparation methods. This application can keep a track of the user's previously suggested diets.

The purpose of the article is to suggest a system which provides the user with a clear and concise diet chart by taking into consideration user's parameters and making use of artificial intelligence. The statement also:

1. clearly articulates the use of artificial intelligence to suggest user friendly diet chart which is customized to suit each and every user's needs;

2. the article suggests the use of genetic algorithm and naive bayes classification to advance the current research methods; and

3. makes use of artificial intelligence instead of conditional algorithms and suggests customized diet charts to each user.

This paper is organized as follows. In section II, we state the related work. The architecture and the methodology of the system has been shown in section III. In section IV we have discussed the algorithms to be used to implement the proposed system . Finally, in section V we provide our conclusions and the future scope of the proposed system .

II. RELATED WORK

To accomplish diet management and healthy lifestyle, a number of non-commercial and commercial solutions are proposed in the form of personal computer based and/or smart phone based applications to assist users. The most

frequently seen free resources on the internet are questionnaires, calculators, tracking tools and food nutrient information system. Questionnaires test a user's diet preference, exercise habits, and social connection to give a risk evaluation for various diseases and improvement recommendation methods [4]. Calculators can help estimate user's current status according to some metric (e.g., BMI calculator), and also evaluate the daily nutrition and energy requirement based on age, gender, metabolism rate and physical activity. Nutrient information system and tracking tools have an aim to enable users to track their progress in dietary and physical exercise habits over a period of time. Many applications are also developed on the iPhone AppStore and Android Markets, such as Calorie Tracker, Eat This, Not That, and Nutrition Menu, Daily burn [4]. These apps can be summarized as storing and tracking what you eat and graph for reviewing your goals. However, none of the aforementioned tools or apps can give a user a personal guidance about diet management.

As to academic researches and patents, most previous works focus on developing a system that can help store user's intake or query nutrition facts of a food in a manual fashion. Shaobo Kuang and other authors proposed a portable electronic device, which allows the user input a nutrition facts data about the food he or she takes into the device [4]. The device then stores the nutrition facts a user takes, and possibly gives a warning message when the user takes more nutrition facts than the predefined thresholds. A cellular phone-based nutrition that can provide nutrition information to an end-user corresponding to the menu of a specified food service provider was developed [4]. However, these methods cannot give any customized diet suggestions to users.

Angell and other authors proposed to build a meal database indicating which foods are known to be helpful for certain diseases according to the latest medical studies [4]. A meal plan is then identified for the set of prospective guests based on the collecting historical attendance data and a calendaring application. Unfortunately, Angell's system can only provide user the meals stored in the database, but not a customized diet, which considers user's personal requirements, for each individual.

Mault et al. proposed an image-based diet logging system, which assists a person create an image record of food items consumed by the person [4]. However, all the user can do on the system is simply viewing the food images on the display of the electronic device and identifying food items consumed. In the arrangement of a food menu in a restaurant, clinic or at home is done by the counselling system which is being designed and developed by the authors of this system [2].

The Food-Oriented Ontology-Driven System (FOODS) is comprised of (a) an expert system, (b) a food ontology and

(c) a user interface [2]. A major health concern is obesity which is caused by unhealthy eating habits [6]. In order to support self-monitoring mobile technology has been primarily adopted by digital weight loss interventions. As a part of dietetic practice, many available apps are not designed; therefore, a significant gap in the research exists between technologies that support the practitioner-patient relationship.

The paper my Pace, an application which helps in complete weight loss and management system that is deployed via a smartphone and/or a PC [6]. It helps to connect dietitians and patients between face-to-face consultations and further extends the relationship through patient's regular and consistent progress updates and dietitian's tailored and timely advice, for sustained behaviour change. Depending on the specific requirements of the users based on rational and proper diet, medication, etc., the application in this paper makes you feel the nutritionist's experience using AI, and makes use of internet as the platform, so as to bring to the users, a scientifically and perfectly structured diet medication plan based on their preferences and health status by using actual and real time recognition, collocation and integration

[3]. The system adopts GA as the key algorithm in accordance with the complexion of the process of intelligent diet organization. This paper improves GA [3]. For increasing the efficiency of process, the system makes the adaptability perfect. The intelligent diet management system based on Multi-agent is preliminarily achieved. Nowadays people have become extremely conscious about watching their weight, their eating habits and avoiding junk food [5]. A system that can measure calories and food properties can be very useful for maintaining a person's health. A food management system will be highly beneficial to both dietitians as well as patients. The information about the fitness of a person is stored by a receptive website. The developers have also referred data required to develop the website, from gym exercise book which makes the website a unique one. This website consists of the user interface which will be displayed on the website i.e. the basic information regarding the fitness such as how to maintain good health by doing some workouts, exercising and by eating food products which include calories, proteins and carbohydrates etc. The project also contains user login such as Admin and User. The online artificial dietician is a bot with artificial intelligence about human diets. Artificial Intelligence and Dietician paper abstract will give overview on modules developed in this website. The

bot acts as a diet consultant similar to a real human dietician. Dieticians are educated with nutrient value and different properties of foods. A dietician takes into consideration a person's exercise schedule, body type, height and weight. All this data is taken from the user and processed by the system. Data like the user's height, weight, age, etc. are taken into consideration by the system. The user's needs are met by calculating this value along with the nutrient values.

III. METHODOLOGY

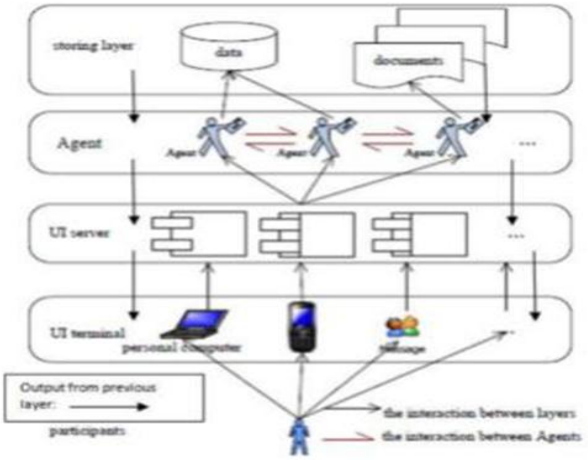

Figure 1. Architectural Diagram of the system.

The figure depicts the architecture of our system. The entire system has been broken down into 4 layers: storage layer, agent layer, UI server layer and UI terminal layer. Users can interact with the system via various ways, like PC, tablet or cell phones. These devices form the UI terminal layer. The UI server provides communication services between the event console and the event server. In simple words, it provides interface services to the users. Agent is responsible for the exchange of information between the storage layer and the UI server. The storage layer will consist of all the required data, such as the various nutritious elements contained in each food item, user's diet history, etc.

IV. ALGORITHMS

The algorithms that are used for the implementation of the system are:

(i) Naive Bayes Classification Algorithm

(ii) Genetic Algorithm

Naive Bayes is a probabilistic classification method based on Bayes' theorem. It considers that the existence or non-existence of a specific feature of a class is not related to the existence or non-existence of other features.
According to Bayes' theorem,

$$P(A|B) = \frac{P(B|A)\,P(A)}{P(B)}$$

The conditional probability regarding the event A happening, provided that the event B has previously occurred, is represented as P(A|B), which can be calculated with the help of the above cited formula. Now, with a few simplifications, it can be extended to a Naive Bayes classifier.

$$P(y|x1,\ldots,xn)\ \alpha P(y)\prod_{i=1}^{n} P(xi|y)$$

Using this formula, we can obtain the class, given the predictors.

In our system, this algorithm will be used for the purpose of classification of users into various classes. For example, the health status and BMI of a user can be used as predictors to assign him/her to the class of users who have Type-I diabetes, and then provide the user of that class with proper diet by making use of genetic algorithm.

A genetic algorithm is a search heuristic that is inspired by Charles Darwin's theory of natural evolution. This algorithm reflects the process of natural selection where the fittest individuals are selected for reproduction in order to produce offspring of the next generation. GA is carried out in 5 phases:

(i) Initial population
(ii) Fitness function
(iii) Selection
(iv) Crossover
(v) Mutation

The process begins with a set of entities which is called a population. Each individual is a solution to the problem that we want to solve. An individual is characterized by a set of constraints (variables) known as genes. Genes are joined into a string to form a chromosome (solution).

The fitness function determines how fit an individual is. It gives a fitness score to each individual. The probability that an individual will be selected for reproduction is based on its fitness score.

The idea of selection phase is to select the fittest individuals and let them pass their genes to the next

generation. Crossover is the most significant phase in a genetic algorithm. For each pair of parents to be mated, a crossover point is chosen at random from within the genes. Offspring are created by exchanging the genes of parents among themselves until the crossover point is reached. The new offspring are added to the population.

Mutation occurs to maintain diversity within the population. We have chosen the fitness function as

$$Fit(x_i) = \sum_{i=1} \left(p_{yi} \times \frac{1}{|y_i - \bar{y}_i| + 1} \right)$$

x_i represents the various food items.

y_i represents the various nutritious elements contained in the food.

p_{yi} is the element y's optimum weight in the i^{th} group people's diet, taking values [0,1].

$\bar{y}$ is the optimum intake amount of nutrients.

elements.

Using this fitness function, the fitness of various food items can be calculated and it can be decided whether a particular food item is to be recommended to the given user or not. The parameter for conciliation has been eliminated as it would introduce noise in the final genetic choice. The food items that will possess a satisfactory fitness value for the given user will be added to the diet of that user.

V. CONCLUSION AND FUTURE SCOPE

Our system successfully recommends a perfectly organized diet to the users based on their body constraints and health history. This system will reduce the time and cost of consulting a real dietician. Even the dietitians can use this system for recommending diets to people.

Further research will attempt to improve the structure of genetic algorithm and the fitness function which we have used in our system to increase its efficiency. In addition to this, more use of artificial intelligence algorithms rather than database is preferred.

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