AI – POWERED NUTRITION ANALYZER FOR FITNESS ENTHUSIASTS

TEAM LEADER : KARTHIKA R

TEAM MEMBER 1: BHARANI H

TEAM MEMBER 2: BHAVADARANI D

TEAM MEMBER 3: DHIVYA A

LITERATURE SURVEY

1. INTRODUCTION

AI is a branch of computer science concerned with replicating human intelligence in machines. Implementing AI means asking yourself a question: how does a computer system might do things that people can do, such as think and make decisions? When applied to fitness software development, this might mean whether an app can “decide” on the workload, amount of reps, offer a suitable set of exercises, etc.

2. ARTIFICIAL INTELLIGENCE OFFERS PERSONALIZED NUTRITIONAL GUIDANCE: ARTIFIACIAL INTELLIGENCE APPROACH

Food is essential for human life and has been the concern of many healthcare conventions. Nowadays new dietary assessment and nutrition analysis tools enable more opportunities to help people understand their daily eating habits, exploring nutrition patterns and maintain a healthy diet. Nutritional analysis is the process of determining the nutritional content of food. It is a vital part of analytical chemistry that provides information about the chemical composition, processing, quality control and contamination of food.

Food pattern is an important factor to prevent diseases and improve lifestyle. Studies show that changes in diet affect the evolution of chronic noncommunicable diseases (CNCD) like cardiovascular diseases, obesity, and depression. It is highly recommended to change eating habits to prevent noncommunicable diseases. Artificial Intelligence in nutrition is becoming popular for prevention and treatment. The main aim of the project is to building a model which is used for classifying the fruit depends on the different characteristics like colour, shape, texture etc. Here the user can capture the images of different fruits and then the image will be sent the trained model. The model analyses the image and detect the nutrition based on the fruits like (Sugar, Fibre, Protein, Calories, etc.). Nutrigenomics refers to the integration of genomic science with nutrition which is becoming increasingly popular in the field of nutrition-based AI.

3. AI FOR DETERMINING PEOPLE'S HEALTH METRICS: A REVIEW OF MULTITUDE OF FACTORS INFLUENCING DIETARY RECOMMENDATIONS

By understanding the multitude of factors influencing dietary recommendations, it becomes clear that the idea of a universal diet for everyone is flawed and biologically impossible. That is where artificial intelligence comes in. Randomized trials have become difficult to conduct in the field of nutrition +because they require subjects to stick to diets for years while these studies have high chances of human error involved. However, the advent of artificial intelligence has allowed researchers to analyze big data sets resulting in a complete portrait of an individual's health metrics including the factors that influence their respective nutritional needs.

Analysis of personal health metrics has become possible because of advances in Artificial Intelligence. Two scientists, Eran Segal and Eran Elinav, in an institute of Israel, recently conducted a study on the variability of glucose levels post-meal by using personal and microbiome features to predict glucose responses in patients lowering post-meal glucose levels as a result. The researchers, with the help of machine learning, gathered and analyzed a data set of 1.5 million glucose measurements with various external factors to see what drove the glucose response to specific foods for each individual. An algorithm was built that way. Several factors were found to be involved in the glycemic response, but the food wasn't the key determinant. Instead, it was the gut bacteria.

As the world is growing more fitness-conscious with time, there is an increasing demand for advanced technological solutions to cater to it. Lately, many applications worldwide are using predictive analytics artificial intelligence as well as natural language processing to help scores of fitness enthusiasts to monitor their nutrition and calorie intake. Artificial Intelligence and its subsets have been leveraged by these platforms to identify the calorie intake and then make food recommendations for a healthy diet.

4. FOOD ANALYSIS IS THE CORE COMPONENTS OF THE AI NUTRITION RECOMMENDED SYSTEM

Food analysis is a core component of AI nutrition recommender systems, as it provides the prerequisites for obtaining a high-level understanding of the type and the amount of food consumed by the user. This category can broadly be divided into methods related to food category recognition, food ingredient and cooking instructions recognition and food quantity estimation. In the next sections, each category is further analyzed and the most important relevant literature is presented.

5. FOOD RECOGNITION ALGORITHM:

In this section, we will introduce our proposed food recognition algorithms, which runs on the FC and BC. Essentially, our system is a multiple-stage food recognition system that distributes the analytics throughout the network.

7. IMPLEMENTATION OF BACK-END COMPONENT

Our back-end system is mainly used for classification when we receive the images from the mobile device. Before testing, we used pre-trained GoogLeNet model from ImageNet, and then fine-tuned on public food data set like Food-101 and UEC-100/UEC-256. After these steps, a fine grained model is generated which can be used for specifically food image classification. We use Caffe to train and tune the model.

8. FOOD CATEGORY RECOGNITION ACCORDING TO THE DIET PLAN

This category of food analysis is concerned with recognizing the class that an item of interest belongs to. The majority of the existing literature regarding automated food analysis belongs to this category, since the first data-sets that were made publicly available only contained information regarding the class of the items. Due to the same reason, the dominant focus area of existing methods is image analysis, but approaches based on audio , motion , colour and odour also exist. Technically, methods concerned with multiple tasks at the same time (e.g., food recognition and calorie estimation) could also be included in this category, but in order to avoid duplication, they will be described. Regarding food categories, they can range from very broad ones, like rice, to very specific, such as chicken feet with black bean sauce. Another distinguishing factor for the methods of this category is the setting under which the food categorization was performed. On one hand, there are methods that operate on a completely unconstrained setting (no information about the food source is known), while on the other hand, there are methods that have confined the recognition setting to menu items of specific restaurants. Regarding the image-based methods, there is a clear distinction between earlier methods, which used traditional image representations, and methods developed during the last few years, and are almost exclusively based on learned representations by convolutional neural networks (CNNs). For instance, Chen et al. used representations based on color histograms and SIFT features, which were then processed by a support vector machine (SVM) classifier. Yang et al. used an SVM classifier, trained on statistics of pairwise local features, such as the distance between 2 image pixels and the orientation of the line connecting 2 pixels. In a 2-layer convolutional neural network (CNN) was used for the tasks of food detection (food / non-food classification) and food recognition.

9. AI NUTRITION RECOMMENDER SYSTEMS

This section initially provides a description of the components that an idealized AI nutrition recommender system would have. Each component is then compared to state-of-the-art methods and an assessment of its feasibility with current technology is provided. Finally, recent literature and EU-funded projects relevant to this task are presented, including the approach followed by the PROTEIN project, in which the authors of this work participate. To begin with, an ideal AI nutrition recommender system would be able to identify the type of food consumed by the user, providing as detailed a description as possible. For example, identifying a dish as Chicken Salad with Wild Rice instead of Salad. As described previously, this field of study has received the most attention from the research community and is in a mature state, with standardized large-scale data-sets being available for evaluation purposes. Although recent approaches in food category recognition have reported results above the 90% mark in Food-101, good evaluation results on a data-set equivalent in scale to ImageNet , such as Recipe1M, would be needed in order to get closer in fulfilling this requirement.

Next, an ideal recommender system would have to provide an accurate estimation of the ingredients, calories and nutrients present in the food. These three attributes constitute the building blocks of the recommender system, as any attempt at creating personalized nutrition plans depends on at least one of them. This requirement is considerably harder to satisfy compared to the previous one, because of the inherent difficulties of the task at hand. For example, there is the issue of visually occluded ingredients. There are recipes where some of the ingredients are not visible in the final form of the dish, e.g., olive oil in Moussaka, or almost every ingredient in Soup. As discussed , an interesting approach towards this problem was presented by Min et al. , where visible and non-visible ingredients were modeled separately within their architecture, providing improved performance.

Another issue is calorie estimation based on predefined tables. As presented , most methods first identify the displayed food, then obtain a volume estimate and finally translate this information into calories using predefined tables. Although this may be a good strategy in the absence of any dish-specific information, such tables provide food densities and calories for a ’typical’ interpretation of the dish, which may be quite different from the one at hand. Another issue related to this requirement is nutrient estimation without knowledge of the cooking method. Since nutrients are affected by the way the food is cooked, estimations that disregard this information, and are based on raw ingredients instead, could still be far off the actual value. The method of Chen et al headed towards this direction by incorporating ingredient cooking method estimation into their architecture. Regarding the state of each aforementioned area, ingredient recognition is currently under active development, after the recent introduction of large-scale data-sets for this purpose . The methodologies presented show promising results, but further improvements are needed if such systems are to be deployed for everyday use. On the other hand, it seems that the area of calorie and nutrient estimation has not reached a mature state yet, as literature approaches are often reporting evaluation results on small-scale private data-sets. Although not advertised as such, the Yummly-28K and Recipe1M data-sets could also be used for this task , providing up to two orders of magnitude more samples than the traditional data-sets.