**AI based Nutrition Analyzer for Fitness Enthusiasts**

People can follow a healthy lifestyle through eating healthy food. The food we eat must contain nutrients which are essential for proper nourishment, growth and immunity for the human body. In today’s world, most of the people are living under uncertainty to decide on which foods are healthy and if healthy how much of it can be consumed. The nutritional facts label is printed on food products all over the world and they are represented using a similar structure but these labelling of nutritional information is difficult to understand by the common people. Another issue is that these labels are only for processed and manufactured foods which can be bought in the stores. . To make this information accessible in an easier way by classifying these food products into five levels of healthiness ranging from very healthy to very dangerous is the aim of this project work. This is done by a sequential process of data retrieval, data cleaning, data labeling and supervised learning.

**REQUIREMENTS**

There are four forms of nutritional assessment: surveys, surveillance, screening, and interventions.

**Nutrition surveys** – cross-sectional evaluations of selected population groups; conducted to generate baseline nutritional data, to learn overall nutrition status, and to identify subgroups at nutritional risk

**Nutrition surveillance** – continuous monitoring of the nutritional status of selected population groups (e.g., at-risk groups) for an extended period of time; conducted to identify possible causes of malnutrition

**Nutrition screening** – comparison of individuals’ parameters of nutritional status with predetermined standards; conducted to identify malnourished individuals requiring nutritional intervention.

**Methods of Nutritional Assessment**

**Dietary assessment** – estimation of nutrient intakes from evaluations of diets, food availability, and food habits (using such instruments as food frequency questionnaires, food recall procedures, diet histories, food records)

**Anthropometric assessment** – estimation of nutritional status on the basis of measurements of the physical dimensions and gross composition of an individual’s body

**Clinical assessment** – estimation of nutritional status on the basis of recording a medical history and conducting a physical examination to detect signs (observations made by a qualified observer) and symptoms (manifestations reported by the patient) associated with malnutrition

**Biochemical assessment** – estimation of nutritional status on the basis of measurements of nutrient stores, functional forms, excreted forms, and/or metabolic functions

**Sociologic assessment** – collection of information on non-nutrient-related variables known to affect or be related to nutritional status (e.g., socioeconomic status, food habits and beliefs, food prices and availability, food storage and cooking practices, drinking water quality, immunization records, incidence of low birth-weight infants, breastfeeding and weaning practices, age- and cause-specific mortality rates, birth order, family structure).

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**Due to the modern lifestyle, carefree attitude and being materialistic, people are taking their health and diet otherwise. Therefore, to facilitate them with a proper diet chart according to their lifestyle and cope up with their busy schedule, a need for an app emerges that can provide diet consultancies to the people at their preferred time and mobile phones without having to visit a dietician. The users can take advantage of the app by registering themselves, entering the basic details and signing in with a username and password. The prime objective of the app is to list all the possible diet plans along with the nutrient value of the food items for the user in accordance with his/her lifestyle by taking their height, weight, working hours, and eating hours and practices as inputs. The app is beneficial for the young generation who live away from their homes and cannot have a proper diet maintained. This app provides them with alternatives to manage the balance.**

**The main aim of the project is to building a model which is used for classifying the fruit depends on the different characteristics like Sugar, Fibre, Protein, Calories 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**

**METHODOLOGIES:**

**Neutrino: The platform provides nutrition-based data services, analytics, and technologies to its consumers and wants to turn itself into a leading source of nutrition-related insight platform. To enable individualised compilation of data, the platform uses NLP and mathematical models from the optimisation theory and predictive analysis.**

**Further, using API and SDK integrations, it enables its partners can purchase data regarding food, nutrition so as to help improve their product offering and services.**

**Fitness: The app heavily relies on AI to produce customised data regarding calorie intake and make food suggestions accordingly. Their advanced diet analysis and combines tools of calorie counter with to make dynamic and adaptive macronutrient adjustments thus providing high-quality nutrient plan each week for its users which is generated from its 1+ million foods.**

**Calorie: The app uses AI and image classification technology to identify the food correctly and accurately and also calculated the amount the calories just from the picture. Their proprietary API, called Food AI API has been trained to identify cuisines from across the world, thus making it the most culturally diverse food identification system in the world. Further, by connecting the API with diverse data sets, the food which is automatically recognised by the platform is paired with detailed nutrition information.**

**AI in Nutrition: Is yet another online platform which uses deep learning and image recognition to analyse what the users eat and determine what is trending in terms of each popular dish that the user eats and consumption time. The machine learning facilitates provisions like recognition of past meals, make hierarchical predictions that is detect high-level categories like beverages and soup as well as specific dishes and ingredients. It also integrates with their Food Knowledge Graph that contains a large set of commonly eaten foods, with nutrition facts, and hierarchical structure. The platform also further breaks down the nutrition information calories, macro and micronutrients as well as ingredients.**

**FEATURES:**

* **Diet chart.**
* **Healthy food recommendations.**
* **Water consumption feature.**
* **Sugar and fat control features.**
* **The calorie tracking feature.**
* **Physical activity observation.**
* **Shopping list organizer.**

**FUTURE SCOPES:**

**• This application can be further improved by feedback suggestions from the users.**

**• This application can be improved with the help of an expert nutritionist who can help us creating different types of programs for different classification of users.**

**• The project is easily extensible and can be improved by further incremental releases of the same.**

**• We plan to focus on improving the overall performance of the system.**

**• Some more ways to achieve dietitian will be focused.**

**ADVANTAGES:**

* ***Food Science:*AI automates recipe building by performing in-depth market analysis and ensures safety measures.**
* ***Distribution and Supply Chain:*AI in nutrition helps via predictive analytics in minimizing wastes, saving costs, visual pattern recognition, agile, and accurate forecasting.**
* ***Customer Experience:*Artificial intelligence monitors customer traffic and engagement and learns from insights to promote self-service and sales systems.**
* ***Manufacturing:*It involves reducing risk and predictive maintenance with IoT to create better-connected businesses.**

**DISADVANTAGES:**

* **The android mobile user will not be able to insert or view details if the server goes down. Thus there is disadvantage of single point failure.**
* **Time-Consuming Food Entry Systems**
* **Unrealistic Weight Loss Goals**

**CONCLUSION:**

**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.**

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Literature has indicated that accurate dietary assessment is very important for assessing the effectiveness of weight loss interventions. However, most of the existing dietary assessment methods rely on memory. With the help of pervasive mobile devices and rich cloud services, it is now possible to develop new computer-aided food recognition system for accurate dietary assessment. However, enabling this future Internet of Things-based dietary assessment imposes several fundamental challenges on algorithm development and system design. In this paper, we set to address these issues from the following two aspects: (1) to develop novel deep learning-based visual food recognition algorithms to achieve the best-in-class recognition accuracy; (2) to design a food recognition system employing edge computing-based service computing paradigm to overcome some inherent problems of traditional mobile cloud computing paradigm, such as unacceptable system latency and low battery life of mobile devices. : An artificial intelligence model for precision nutritional analysis allows the user to enter the name and serving size of a dish to assess a total of 24 nutrients. A total of two AI models, including semantic and nutritional analysis models, were integrated into the Precision Nutritional Analysis. A total of five different algorithms were used to identify the most similar recipes and to determine differences in text using cosine similarity

Advantages

* The application also eliminates the travelling cost in visiting a dietician.
* The usage of this application greatly reduces the time required to get the best diet plan as it is standalone application and there is no danger of one point failure

Disadvantages

* The android mobile user will not be able to insert or view details if the server goes down. Thus there is disadvantage of single point failure.
* There is another challenge, which is related to training the deep learning model. It is an extremely computationally expensive and time-consuming task to train the model again and again. This can be solved by using cloud-based services.

METHODOLOGIES

### a)Food Identification

As the same food can be taken at different depths to generate different picture sizes we need a method to calculate calorie or estimate the size of the food in a real-world scenario. After we get the desired food items detected along with their masks, we need the real object sizes, which is not possible through a pin-hole camera images alone. So, we take a referencing approach that references the food-objects to the size of the pre-known object to extract the actual size of the food contained in that specific image.

To identify what’s on the plate, we need to instance-segment the given food image into the possible food categories. Instance Segmentation classifies individual pixel in the given picture into possible classes ie. foods in our case. Given the problem of instance segmentation, the architecture of Mask R-CNN would be a matching solution. Mask R-CNN takes an image and spits out three outputs, masks of the identified items, bounding boxes and classes for each mask detected. Masks are the binary coded single-channel matrices of the size of the input image which denote the boundaries of the identified object.

Mask R-CNN is developed based on Faster R-CNN, which is a region-based Convolutional Neural Network. A Convolutional Neural Network (CNN) is a Deep Learning algorithm that can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and can differentiate one type of image from the other. To have object detection, we need to know the class of the object and also the bounding box size and location. Conventionally, for each image, there is a sliding window to search every position within the image as below. It is a simple solution. However, different objects or even the same kind of objects can have different aspect ratios and sizes depending on the object size and distance from the camera.

### b)Food Calorie Estimation

As the same food can be taken at different depths to generate different picture sizes we need a method to calculate calorie or estimate the size of the food in a real-world scenario. After we get the desired food items detected along with their masks, we need the real object sizes, which is not possible through a pin-hole camera images alone. So, we take a referencing approach that references the food-objects to the size of the pre-known object to extract the actual size of the food contained in that specific image.

### **c)Volume Estimation**

The labelled food type along with the segmented image is sent to the automatic portion estimation module where camera parameter estimation and model reconstruction are utilized to determine the volume of food, from which the nutritional content is then determined. Our volume estimation consists of a camera calibration step and a 3D volume reconstruction step. Two images are used as inputs: one is a meal image taken by the user, the other is the segmented image described in the previous section. The camera calibration step estimates camera parameters comprised of intrinsic parameters (distortion, the principal point, and focal length) and extrinsic parameters (camera translation and orientation). We use the fiducial marker discussed above as a reference for the scale and pose of the food item identified. The fiducial marker is detected in the image and the pose is estimated. The system for volume estimation partitions the space of objects into “geometric classes,” each with their own set of parameters. Feature points are extracted from the segmented region image and unprojected into the 3D space. A 3D volume is reconstructed by the unprojected points based on the parameters of the geometric class. Once the volume estimate for a food item is computed, the nutrient intake consumed is derived from the estimate based on the USDA Food and Nutrient Database for Dietary Studies

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