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Food Recommender: Deep Learning Approach for Predicting Daily Diet Based on Body Prakriti

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Abstract--Daily diet plays crucial role in maintaining human body healthy. A healthy diet protects us from diseases such as obesity, diabetes, cancer and heart disease. According to Ayurveda, body is made up of aakash, jala, prithvi, teja, and vayu. Combination of these five elements decides the body prakriti called as doshas i.e. Vaat, pitta, and kapha. Human body has a unique proportion of these doshas and it is decided at the time of birth. Depending upon which dosha present in more quantity human body will be either Vata, pitta or kapha. Imbalance in these doshas leads to illness and different diseases. This can be avoided by following diet based on body prakriti. The proposed system uses deep learning and knowledge of suitable diet based on body prakriti as per the different season to recommend best possible diet chart.

Keywords---prakriti, season, healthy body, deep learning, diet, food recommendation.

Introduction

Health is one of the important factors of every human being in order to work happily and efficiently. Daily diet plays very important role to remain healthy and disease free. which diet should be followed as per the different season? is a question need to be answered in order to follow a proper diet. As per the Ayurveda, prakriti is important factor and proper balance of which maintain human body healthy and disease free. Whenever there will be any imbalance in prakriti, person fall sick. It also leads to an unbalance physical as well as mental health.

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If the food is consumed in proper quantity and quality then it is called as balanced diet. Depending upon body prakriti (Vat, pitta, kapha) balanced diet is decided. Ayurvedic practitioner will help person to tell which kind of prakriti he has. Accordingly, dietician can suggest food to be consumed by the person to keep him healthy. While recommending a food to a person, his clinical as well as non-clinical factors need to be considered. Clinical factors include prakriti, any disease like diabetes, cancer, obesity, allergy etc. and non-clinical factors includes age, weight, gender, demographic region in which person is living etc. Not only clinical and non-clinical factors but also nutrition value of each food item need to be considered while recommending any food in diet chart. It is very difficult job to recommend proper food by manually checking all these factors leads to an approximate and many times not exact recommendation. To avoid this problem and exact recommendation of food automatic system need to be developed. Such system will help person to follow proper diet to get prevented from illness and different diseases. This system will assist dietician to reduce their load to recommend proper food to the person.

Deep learning technology and its algorithm has paved the way in various sectors. And healthcare is not exception for this. Deep learning algorithms like Convolution Neural Network (CNN), Artificial Neural Network(ANN), Recurrent Neural Network(RNN),Long Short Term Memory(LSTM) etc. have better results in various use cases in healthcare sectors. CNN is used to capture the image features, which is one of the important aspects in healthcare for reading X-ray image seamlessly and accurately. ANN is used in diagnosis and assist in management decision of healthcare. RNN is used in clinical event prediction and LSTM is type of RNN used in the application where time series forecasting is required. Deep learning algorithms accepts any number of inputs, which is the most important requirement of model, and by training-learning adjust the weights of input parameters.

Proposed deep learning-based food recommender system in paper will accepts the various parameters, which need to be considered while recommending a food in best possible way. System will be trained using real time data, which will be collected by structured interview of the people in last 24/7. The trained system will recommend diet chart based on persons prakriti. It also recommends quantity and quality of the food to be consumed based on persons health. It also considers nutrition value of food while recommending it in diet chart.

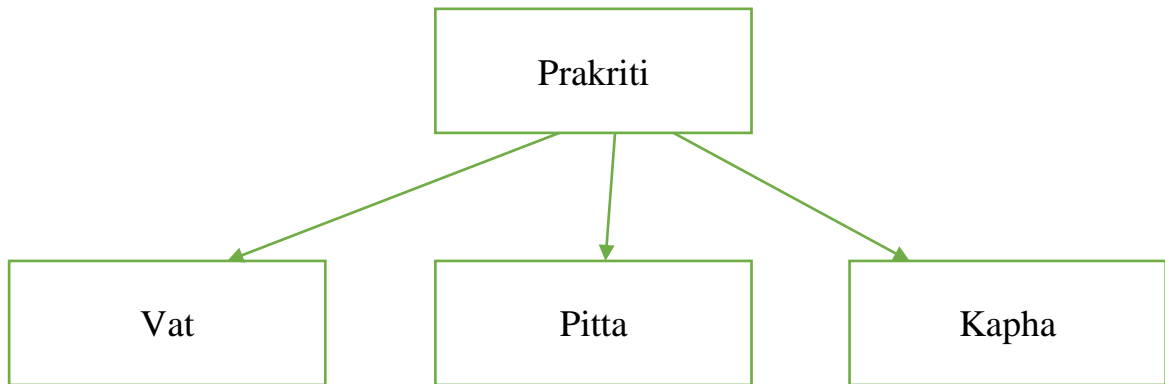
Rest of the paper is organized in following way: Aurveda background information is mentioned in section II. Section III represents existing work done in food recommendation. Section IV depicted a system architecture and methodology used to recommend a food. Conclusion is explained in Conclusion section.

Paper proposed the method, which collect dataset from participants by structured interview in which participants are asked to recall all food and drink they have consumed in the previous 24/7 days and predict the dietary chart based on person's body prakriti, proportion and quality of food. Also, proposed method recommends the food need to be consumed in sequence for the day in order to avoid any health issues because of wrong time and proportion of food consumption.

Ayurveda Background

Prakriti

Prakriti is made up by five elements i.e. aakash, jala, prithvi, teja, and vayu. It consists 3 types vat, pitta, kapha. Majority contribution of any one of the types is responsible to decide prakriti and each human being prakriti is set at the time of birth and will remain same throughout the life. Whenever there will be any imbalance in proportion of doshas(prakriti), body will try to get back to its original state of doshas.



Type I Prakriti: Vata

Air and space are two main elements of Vata. This type of person's mood is highly dependant on outside weather. They learn quickly, think out of the box and highly creative and naturally slim. As per ayurveda, such type of people should avoid cold weather and consume warm food and drinks. They should follow regular daily routine and perform some meditation activities for optimal health.

Type II Prakriti: Pitta

This type of prakriti is based on water and fire. They are very sensitive to hot temperature. Such people tenacious in nature, highly motivated and serve as strong leaders. But, because of their aggressive nature sometimes they have conflicts with another person. Such people should follow a regular diet and avoid extreme heat.

Type III Prakriti: Kapha

This type of prakriti is based on earth and water. Such type of people are calm, happy, caring, thick-boned, patient, empathetic, trusting in nature. Their weaknesses includes prone to weight gain, over sleeping, lethargy, breathing problems like asthma and allergies, susceptible to depression. Kapha dominant people should maintain regular diet, always do exercise, and maintain body temperature warm for optimal health.

Diet:

According to Ayurveda, one should follow regular diet in order to promote good health. Imbalanced in doshas leads to a poor health and diseases. Ayurveda recommends food to be consumed and to be avoided as per the season and doshas of individual.

Following is the diet suggested by dietician

| Prakriti/Doshas | Sensitive season | Food to eat | Food to avoid |
|------------------------|-------------------------|------------------------------|------------------------------|
| Vata | Autumn | Soft, warm and moist food. | Cold , dried and bitter food |
| pitta | Early winter | Energizing, cold, sweet food | Spicy, heavy and sour food |
| Kapha | Summer | Acidic, spicy, filling food | Processed food, heavy food |

Literature survey

In first paper, “A Recommender System for Healthy Food Choices: Building a Hybrid Model for Recipe Recommendations using Big Data Sets” [1] author has studied business problems in recommending food using big data and different filtering approaches. Comparative study of three types of recommender model-Content based, Collaborative and hybrid filtering model in terms of accuracy, recall and precision is demonstrated. Data set for the model is taken from open-source data set- Kaggle.com. Dataset is based on reviews and ratings of recipes extracted from AllRecipes.com. Structured data is generated with features like ingredients, cooking method, Calories, Percentage Daily Value, and User information. Three approaches are explored and evaluated on collected data. Finally, author has proved that hybrid filtering approach performance is better as compared to others.

In Second paper, “Personalized food recommendation using Deep Neural Network” [2] author has proposed Integration of deep neural network and recommendation system. As per the method, Ingredients are extracted from the user selected dish recipes. Based on ingredient extracted user profile is predicted using deep neural network. Using temporal model with input as user profile and history of selected dishes, next food is recommended. Performance is evaluated based on user selected the dish or not as hit ratio.

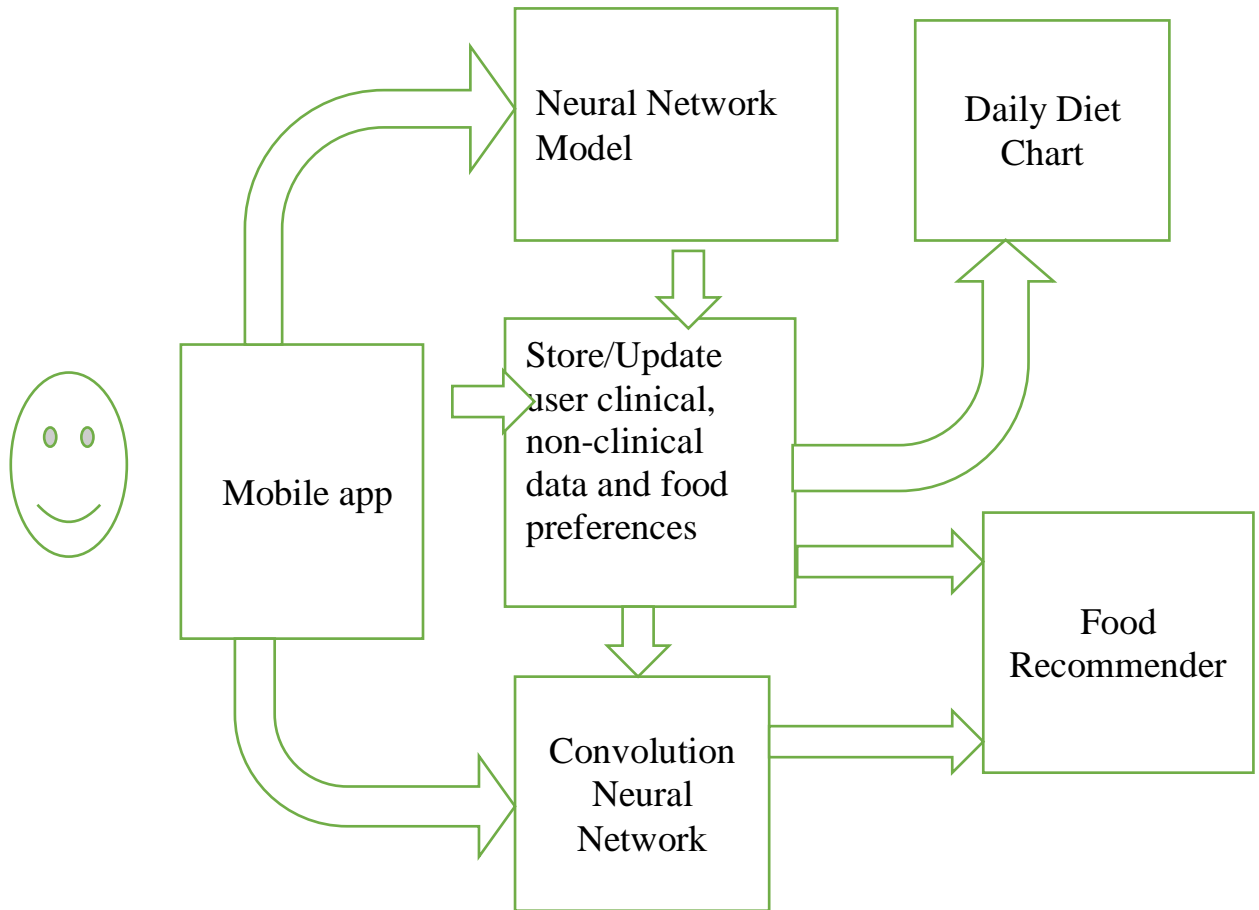
In third paper, “Realizing an Efficient IoMT-Assisted Patient Diet Recommendation System Through Machine Learning Model” [3] recommender model is built to predict best suitable food for diabetic patients. Data set considered for the model consists patients’ clinical, non-clinical information and product features. Random forest algorithm is used to visualize features importance. Model is trained using different machine learning and deep learning classification algorithms. Performance of model built using different approaches is evaluated in terms of performance metrics. LSTM and GRU performed well in terms of precision, recall and F1 score as compare to other algorithms.

In fourth paper, “A Comparison of Several Approaches for Image Recognition used in Food Recommendation System” [4] comparison of Several approaches for image Recognition used in food recommendation system. Author has addressed the issue of collecting data of user preferences manually in food recommender system. Total 12000+ images are captured from 15 dishes as a data set. Different machine learning algorithm (HOF,SIFT) and modern deep learning algorithms (ANN, DenseNet, VGG16, MobileNet etc.)are used to capture real time image of the food user consumed. Logistic regression is used to further classify the image as which type of food based on extracted features. Finally, comparison is made among all tested models to evaluate performance using scales like F1 score, accuracy, Top 5 accuracy to find best one to classify the food.

In fifth paper, “Food Nutritional Detection, Visualization and Recommendation for Health Monitoring using Image Processing” [5] implemented an android based model to recommend nutrition value of food the user want to consume. System is divided into admin and user module. Admin module used to create dataset comprised of food components and it's details like calorie content, food is fresh or stale, fruit is naturally ripened or artificially ripened etc. Also, it keeps track of user and food it consumes, users count of low, high and healthy BMI to suggest proper food to the user based on its nutrition value. Food identification is done through admin module by performing series of steps of converting image to greyscale, image segmentation, calculating histogram, feature extraction, and classification. various algorithms are used at each step. Some of them are shift based Fuzzy C-Means algorithm used for segmentation, Fast- Scale Invariant Feature Transform algorithm is used for feature extraction, and CNN is used in food image classification. At User end, the food image is captured and food is identified along with its nutrition value by performing the steps mentioned in admin module.

In sixth paper, “Diet Recommendation based on Prakriti and Season using Fuzzy Ontology and Type-2 Fuzzy Logic IEEE-Feb 2017” Human body prakriti plays important role in deciding which type of food one should consume to remain healthy and prevent diseases. Food is recommended based on body prakriti and season. Data is collected from various websites where dietician mentioned different diet plan based on body prakriti as per season. In order to handle uncertainty in food Type 2 Fuzzy logic is used. To represent food knowledge, Fuzzy food ontology is integrated in Type 2 Fuzzy logic. Proposed model recommends more relevant food to the user and having accuracy 94%.

Methodology: System Flow



Conclusion

According to Ayurveda, body is made up of aakash, jala, prithvi, teja, and vayu. Combination of these five elements decides the body prakriti called as doshas i.e. Vaat, pitta, and kapha. Human body has a unique proportion of these doshas and it is decided at the time of birth. Depending upon which dosha present in more quantity human body will be either Vata, pitta or kapha. Imbalance in these doshas leads to illness and different diseases. This can be avoided by following diet based on body prakriti. The proposed system uses deep learning and knowledge of suitable diet based on body prakriti as per the different season to recommend best possible diet chart throughout the day.

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