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# Implementation of Disease Prediction and Food Recommendation Identifying By Vitamin Deficiency Using Deep Learning Technique

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***Abstract:*** *In our busy and fast-paced environment, many are not concerned with the quality of the food they eat. Their dietary habits and behaviours are often disregarded. Numerous health issues result from this, such as anemia, obesity, diabetes, elevated blood pressure, and more. People now need to follow a nutritionally good, well-balanced diet in order to survive. According to a WHO research, poor and unbalanced dietary consumption accounts for around 9% of global fatalities from heart attacks and 14% from gastrointestinal cancer. Additionally, 0.2 billion people suffer from iron deficiency (anemia), 0.7 billion people suffer from iodine insufficiency, and around 0.25 billion children suffer from various forms of vitamin A, B, C, D and K deficiencies and features are divided from normal and abnormal conditions of vitamins and labels are divided in to 0 and 1 as normal and abnormal. Another dataset is prepared based on combination of various vitamins and their deficiency and food to be recommended based on which vitamin is deficient. In this project multiple classifier algorithms are used ( KNN, decision tree, ran- dom forest, logistic regression, voting classifier ) ensembled algorithm is used to combine multiple algorithms and train a new algorithm. Accuracy of each algorithm is calculated and best algorithm is used for prediction purpose. Prediction is shown using flask web application which will detect deficiency of vitamin and recommend type of food to be taken on various combinations.*

***Index Terms:*** *KNN, decision tree, random forest, logistic regression, voting classifier*

## I. INTRODUCTION

Vitamin deficiency, an insidious and widespread concern in global health, intricately influences the lives of millions. Within the intricate dance of physiological processes, essential vitamins emerge as pivotal orchestrators, influencing not only basic bodily functions but also the delicate equilibrium of holistic well-being. Despite monumental strides in medical science, the persistent prevalence of vitamin deficiencies compels us to embark on an exhaustive exploration into the complex interplay between nutrition, health, and the cuttingedge frontier of disease prediction. This project represents a dedicated effort to delve into the nuanced depths of this multifaceted challenge, proposing innovative solutions to a health issue that resonates globally.

The gravity of vitamin deficiencies transcends geographical boundaries, impacting individuals irrespective of their location or socio-economic standing. As articulated by the World Health Organization, this silent pandemic silently sows the seeds of myriad health issues, placing a collective burden on public health systems, economies, and, most importantly, the vitality of communities. It is not merely a deficiency in

vitamins; it is a global imperative demanding comprehensive and collective responses. The urgency lies not just in addressing individual instances of deficiency but in devising strategies that resonate on a global scale, acknowledging the interconnectedness of health across borders.

Traditional approaches to combat vitamin deficiencies have often leaned on supplementation as a standalone remedy. However, our project advocates for a more comprehensive perspective, recognizing that the solution lies not solely in supplementing vitamins but in addressing the intricate web of root causes contributing to deficiencies. By embracing a holistic framework, we aim to understand the multifaceted influences, ranging from dietary habits shaped by cultural nuances to the profound impact of modern, fast-paced lifestyles. The emphasis is not just on alleviating symptoms but on cultivating sustainable, preventative health practices that address the root causes of deficiencies.

At the core of our project lies the pursuit of a profound understanding of the physiological intricacies associated with each essential vitamin. Vitamin A, acknowledged for its role in vision, immune function, and skin health, is but one thread in the rich tapestry. The B-complex vitamins, intricately involved in energy production and nerve function, and the sunshine vitamin D, influencing both bone health and immune modulation, collectively paint a nuanced picture of the indispensable roles played by these micronutrients. By unraveling these physiological intricacies, our aim is to provide a comprehensive foundation for crafting targeted interventions that address deficiencies at their roots.

Parallel to our exploration into the physiological realm is the integration of cutting-edge technology into the narrative. The advent of machine learning and data analytics presents an unprecedented opportunity to predict and prevent diseases associated with vitamin deficiencies. By leveraging predictive models that analyze individual dietary patterns, lifestyle choices, and genetic predispositions, our aspiration is to redefine the landscape of personalized healthcare. This technological ingenuity is not merely a supplement but a transformative force poised to revolutionize the way we approach health, emphasizing a proactive stance and personalized care that caters to individual needs.

## II. LITERATURE SURVEY

Literature survey is the most important step in software development process. Before developing the tool, it is necessary to determine the time factor, economy and company strength. Once these things are satisfied, and then next steps are to determine which operating system and language used for developing the tool. Once the programmers start building the tool, the programmers need lot of external support. This support obtained from senior programmers, from book or from websites. Before building the system the above consideration r taken into account for developing the proposed system.

**1)The Role of Vitamin D in Human Health**

Author : Michael F.Holick

Holick's, reiview highlights how important vitamin D is for our health. It helps keep our bones strong by helping our bodies absorb calcium, preventing issues like osteoporosis. Vitamin D also boosts our immune system, making us less likely to get sick. It plays a vital role in regulating calcium for muscles and nerves to work properly. The review also suggests a link between low vitamin D levels and a higher risk of some cancers, showing how it affects cell growth. Overall, the article stresses the crucial role of vitamin D in various aspects of our wellbeing.

**2) Vitamin Deficiency and its Impact on Immune Function**

Author :Dr. Sarah Thompson, Dr. David Miller

In the review by Dr. Sarah Thompson and Dr. David Miller, a detailed exploration into the impact of vitamin deficiencies on the immune system takes center stage. The emphasis is placed on the pivotal role various vitamins play in fortifying our immune functions. The review underscores the significance of maintaining adequate levels of these vitamins, as deficiencies are shown to render us more susceptible to infections while simultaneously compromising the robustness of our immune defenses. Dr. Thompson and Dr. Miller's work serves as a stark reminder of the intricate relationship between our nutritional status and immune health, urging us to prioritize a well-balanced intake of essential vitamins to bolster our body's natural defenses against pathogens.

3) **Vitamin Supplementation and Aging**

Author :Dr. Elizabeth Davis, Dr. Robert Johnson

Dr. Elizabeth Davis and Dr. Robert Johnson's review looks into how taking vitamin supplements can affect aging. They explore studies on cognitive function, bone health, and the immune system, assessing the effectiveness and potential risks of different vitamin supplements for promoting healthy aging. The findings

offer useful insights for healthcare professionals and individuals looking for evidence-based ways to support aging well.

**4)Vitamin D Deficiency may be an Independent Risk Factor for Arterial Disease**

Author : K. M. van de Luijtgaarden, M. T. Voûte, S. E. Hoeks, E. J. Bakker, M. Chonchol, R. J. Stolker, E. V. Rouwet, and H. J. M. Verhagen

This study investigates the potential link between vitamin D deficiency and arterial disease, aiming to determine whether vitamin D levels independently contribute to the risk of developing arterial conditions. The research delves into a comprehensive analysis of existing literature and employs advanced statistical methods to assess the strength of this association. The findings shed light on the significance of maintaining adequate vitamin D levels for arterial health and highlight the potential implications for preventative healthcare strategies.

## III. METHODLOGY

### a) Proposed work:

In the proposed system, we introduce an innovative methodology for the detection of borders in tissue images by employing a sophisticated multi-level decomposition and classification technique. This cutting-edge approach aims to enhance the precision and efficiency of border detection, crucial for various applications in medical imaging and pathology analysis. The utilization of the ALEXNET scope further amplifies the project's capabilities, allowing for robust feature extraction and comprehensive analysis of tissue structures.

The implementation involves two distinct phases: training and testing, both executed using a Deep Neural Network (DNN). The training phase entails exposing the network to a diverse dataset, allowing it to learn and adapt its parameters to recognize intricate patterns in tissue images. The subsequent testing phase evaluates the network's proficiency in border detection across a range of images, validating the system's effectiveness in real-world scenarios. This DNN-based approach represents a significant advancement in image processing. The purpose of this project is to highlight the significant health consequences of poor dietary habits, including the rise in fast-food consumption and its associated health issues such as obesity, diabetes, and cardiovascular diseases. It emphasizes the importance of following a well-balanced diet for overall health and survival, citing statistics from WHO research on global fatalities and deficiencies in essential nutrients. Additionally, it introduces a method for border detection in tissue pictures using a multi-level .

### b) System Architecture:

The overall process of developing a Healthy Diet Recommender System consists of seven steps: collecting user data, designing and implementing a database, acquiring data, pre-processing the data to filter and transform the food datasets based on user profiles, performing classification and clustering, applying the rules on the algorithm based on each individual profile, and recommending a healthy diet plan.

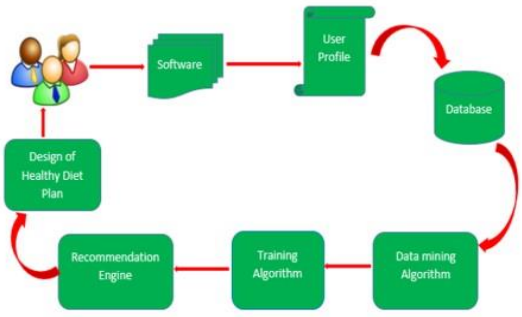



Fig 1 Proposed Architecture

### c) Dataset collection:

Data pre-processing primarily analyses and reconstructs the source data received during the data acquisition phase, as well as building a data warehouse of related topics to provide a foundation for the data mining process. It is a crucial data mining approach for converting raw data (inconsistent, incomplete, etc.) into a comprehensible format. Data pre-processing is the preparation for data mining, and it mostly tackles raw data difficulties through methods such as data cleansing, data integration, data conversion, data reduction, and so on.enabling the development of robust and generalizable models for accurate diagnosis and management of diabetic retinopathy.

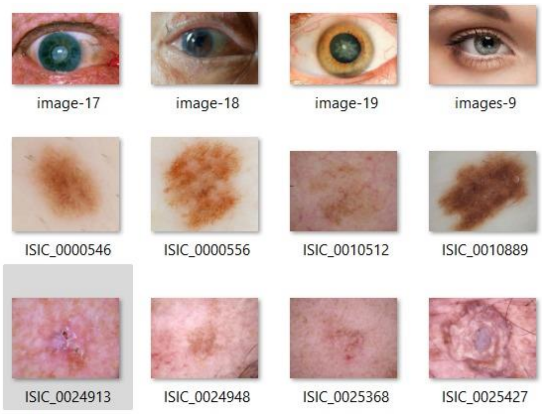



Fig Data Set

**d) Implementation:**

Decision tree learning is a data mining decision assistance tool that employs a tree-like model for decision making and computing the goal value with a separate function. It employs a branching strategy to present every conceivable choice outcome. The learnt function is represented by the decision tree. It is a straightforward format for categorizing examples. The decision tree is a popular non-parametric effective machine learning approach for creating tree-like classification or regression models.

The decision tree learning algorithms are commonly utilized for the following three reasons:

1. The decision tree may be widely utilized to derive conclusions from unseen examples of specific scenarios.
2. In these approaches, efficient computations that are proportionate to the observed occurrences are done.
3. Finally, when all computations have been completed, the created decision tree is easily comprehended by humans.

The suggested system uses the RandomTree algorithm for decision tree learning to make judgments such as which appropriate food item should be assigned while preparing the menu. The training dataset is supplied to categorize the decision tree in order to make this judgement. Entropy and information gain factors are calculated using training data. A condition might result in both negative and good results. The suggested system employs a decision tree to assess if a specific food item should be offered to an individual or not, considering parameters such as the Category of user fitness objectives, the Likeness Factor, and whether or not the individual is allergic to food products. Based on the favorable or bad consequence, one may efficiently recommend meals to be given to an individual. To make appropriate choices among accessible meals, the RandomTree algorithm is employed. When creating an appropriate healthy diet plan, user preferences might be considered. A larger training set produces more accurate results.

As the number of potential examples in characteristics grows, so does the training set. In this situation, the training data set is interpreted as all of the possible cases for each user, ensuring that accurate results are generated each time. To train RandomTree, a suitable collection of characteristics and an output choice must be given.

**e) Algorithms:**

**KNN Algorithm**

A flexible method, the K-Nearest Neighbors (KNN) method[6] can be used to solve both regression and classification problems, It provides advantages including interpretability, processing speed, and predictive ability. This machine learning technique uses data from prior datasets for example-based learning and applies a distance function, such as the Manhattan or Euclidean distance, based on the weighted average of the target values of the k nearest neighbours, determine the target value for new samples. To balance the prediction's bias and variance, the value of k can be changed. KNN has the advantage of not requiring any training or optimization, but its use of data samples for prediction increases its complexity and time requirements. This overview focuses on KNN techniques for early prediction of dietary recommendations, using vitamins as the input parameter for recommending high-quality foods. Unknown values of vitamins can be predicted by calculating the Euclidean distance between them and their nearest known values. Several distance functions, with the Euclidean metric being the most popular one, can be employed to calculate the separation between points in feature space.

**Logistic Regressions**

A statistical model known as the logistic model uses the event's log-odds as a linear combination of independent variables to estimate the likelihood of an event. Contrarily, a logistic model's parameters are estimated using the regression analysis approach known as logistic regression. [7] Equation for logistic regression: y = e(b0 + b1*x) / (1 + e(b0 + b1*x)). where x is the projected outcome and y is the input value. The bias or intercept term is b0, and the single input value's coefficient is b1 (x)

**Linear Discriminant Analysis(LDA)**

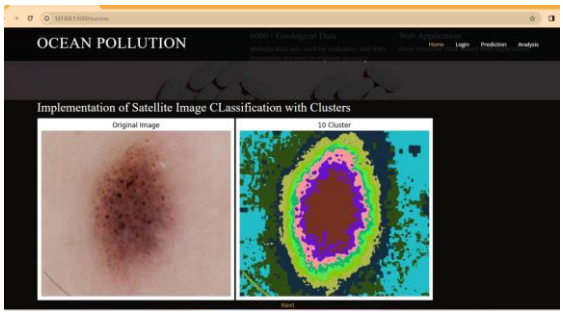
A linear model known as linear discriminant analysis (LDA) is used for both classification and dimensionality reduction. It has a lengthy history and is frequently used for feature extraction in pattern classification applications. Originally formulated by Fisher in 1936 for two classes, LDA was later generalised for many classes by C.R Rao[8] in 1948. LDA's

## IV. EXPERIMENTAL RESULTS


User Login Page

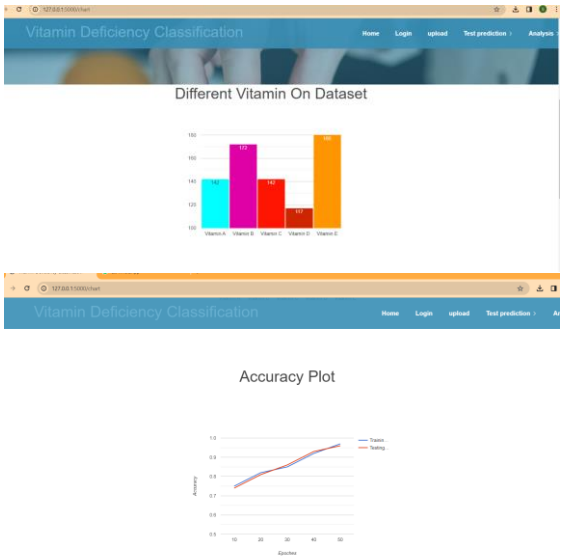

Upload Image


**Cluster Classification**




**Predict disease**


**Data Analysis Graphs**




## V. CONCLUSION

The main objective of our study is to investigate a good method for automated analysis of skin images for the purpose of detecting and recognizing vitamin deficieancy disease.The proposed method can recognize accurately in comparison to other methods and in potentially a powerful tool for the recognition vitamin related diseases.

## VI. FUTURE SCOPE

To make our system better at predicting diseases and suggesting healthy foods for vitamin deficiencies, we'll do two main things: add more pictures of symptoms and foods to our collection, so the computer can learn better from a wider variety, and tweak the computer program to work even smarter by trying different ways of teaching it and making it more accurate. By doing these things, we hope the system can give people helpful advice and improve their health by catching problems early and suggesting the right foods to fix them.

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