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Vitamin Deficiency Detection Using Image Processingand Artificial Intelligence

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Abstract -*Vitamins are an important part of our diet. Without an proper amount of vitamins, a deficiency will occur. In this paper we are introducing AI System to diagn- osis of vitamin deficiency at early stage of deficiency .It is a cost-free Mobile Application which do not requires any blood sample to detect vitamin deficiency, system requires user's photos of eyes, lips, tongue, and nails. Application will provide report of vitamin deficiency found in user with necessary food suggestions to improve vitamin levels to fight against deficiency. The application is trained to distinguish between normal people photos of eyes, lips, tongue, and nails with user photos and people having vitamin deficiency. The detection of vitamin deficiency at early stage can prevent from major causes these include death from infectious diseases, anemia, death during pregnancy or childbirth and impaired cognition and physical development.*

Key Words: Vitamins, AI, Android Application, Deficiency, NLP, Fuzzy Membership Function and Defuzzification

1. INTRODUCTION

Vitamin deficiency is a problem that affects over two billion people around the world. The WHO said that one in three children do not get enough vitamin. Vitamin deficiency is a global problem that affects over two billion people around the world. The WHO said that one in three children do not get vitamin. 33% of children under the age of five have deficiency of vitamin A. This deficiency causes low immunity and night blindness. Vitamin deficiencies affect all ages and frequently co-exist with mineral (zinc, iron, iodine) deficiencies. The groups most susceptible to vitamin deficiencies are pregnant women, children, because of their needs for these compounds and susceptibilities to their absence. Most common deficiencies relate to vitamin A, vitamin B, folate and vitamin D. Supplementation programs have made diseases like scurvy and pellagra rare.

Many of deficiencies are preventable through consumption of a healthy diet containing diverse foods, as well as food fortification and supplementation, where needed. Most vitamin and mineral deficiencies can be picked up with a blood test, like a venous blood test and finger-prick blood test. In venous blood test a trained professional will use a needle to puncture a vein, usually in your arm, to collect a blood sample and in finger-prick blood test using lancet, you can prick your own finger and collect blood sample. In hospitals these blood tests can be done or we can also order home vitamin and mineral test kits online and do it our self. The cost of venous blood test and finger-prick blood in India is on an average of Rs.1000 and Rs.800 respectively. Home vitamin and mineral testkits costs around Rs.8000. We proposed a cost free android application which can give instant results using user's images of body parts only and there is no need of blood samples for test.

2. BACKGROUND

U.S. researchers evaluated blood samples of 235 patients admitted to the hospital with COVID then checked them to determine how they fared. People who had adequate vitamin D levels were less likely to die from COVID.

On May-18-2020 a new studies state that having heathy blood level of Vitamin D helps to avoid intensive care unit and death if you become infected with COVID-19. He researched the difference between vitamin D deficiency and differences in death rates in some countries. Among the most recent studies quite 80% of 200 patients hospitalized with COVID-19 had

vitamin D deficiency. Patients with low vitamin D also had high blood levels. But the researchers found no link between low D levels and the way severe the disease was. The recent studies state that the appropriate level of vitamins can help to reduce risk of having major medical problem. Thus vitamin deficiency is important to detect.

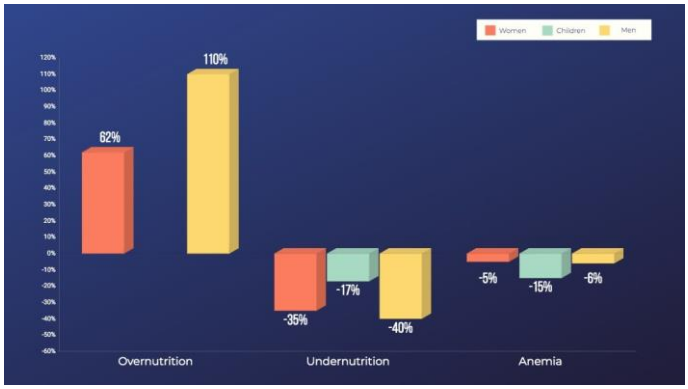
3. METHODLOLOGY

3.1 Analysis

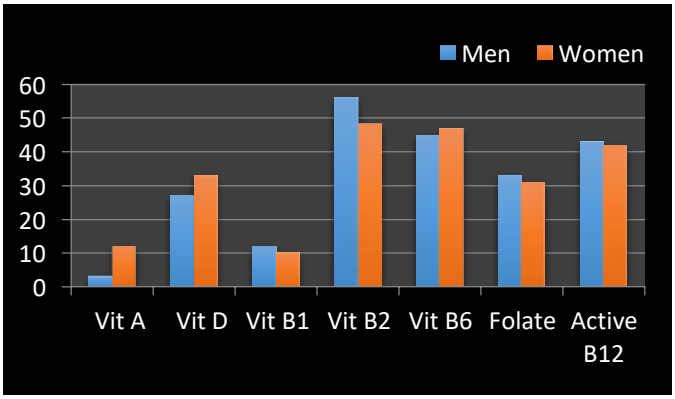
A diet lacking in nutrients could cause some varied symptoms. These symptoms are body's manner of human action potential victuals and mineral deficiencies. Recognizing them will facilitate to regulate diet consequently. The symptoms of a biological process deficiency depend upon that nutrient the body lacks. However, there are some general. These will include: Brittle nails [1]Mouth ulcers or cracks within the corners of the mouth [2] Poor twilight vision, white growths on the eyes and redness of eyes[3] [4] sleek Tongue [5]. If the color of the nails is yellow, the condition normally signifies anemia. A deficiency of fat-soluble vitamin, B and C is additionally detected by brittle nails. In different survey, around twenty eighth of patients with mouth ulcers had deficiencies in vitamin B1 (B1 vitamin), B complex (B2 vitamin), and vitamin B6 (B6 vitamin). Your mouth may well be a decent place to identify any shortage of B6. Your lips could be scaly, and therefore the corners may well be cracked. Your tongue would possibly swell. The amount of B6 you would like day after day depends in the main on your age. Babies 7-12 month's previous want zero.3 milligrams on a daily basis. you would like additional as you grow. If you're over age fifty, you would like a minimum of five times as much: one.7 milligrams on a daily basis for men and one.5 milligrams forladies. Pregnant girls want

it most of all 1.9 milligrams on a daily basis. Angular inflammation, a condition that causes the corners of the mouth to crack, split, or bleed, will be caused by excess secretion or dehydration. However, it should even be caused by associate too little intake of iron and B vitamins, notably B complex. For instance, low intakes of fat-soluble vitamin are usually joined to a condition called moon blindness, that reduces people's ability to ascertain in low lightweight or darkness. That's as a result of fat-soluble vitamin is critical to supply visual purple, a pigment found within the retinas of the eyes that helps you see in the dark. Tiny bumps on your tongue known as papillae begin to waste away. that produces it look and feel quite sleek and shiny. Infections, medication, and different conditions will cause it, too. however if not enough B12 or different nutrients is responsible, your tongue conjointly could also be sore.

3.2 Graphs



Graph-1: Decimal point changes within the triple burden of malnutrition in India. Source: NFHS 2005–06and NFHS 2015–16; supported authors calculations



Graph-2: Pervasiveness of vitamin deficiencies in an urban adult population.

Assessed by subclinical status and dietary intakes. Among the study population (char), the general prevalence of deficiency of vitamin B2 was strikingly high (50%) followed by the vitamins B6 (46%), active B12 (46%), total B12 (37%), folate (32%), D (29%), B1

(11%), and A (6%). Hyperhomocysteinemia (HHcys) was widely prevalent (52%) within the study participants. just in case of dietary intakes, PA was lowest for vitamin B12 (4%) and folate (9%) followed by vitamins A (22%), B2 (33%), B6 (30%), and B1 (59%). The mean PA of these vitamins was low (28%). The unenriched logistic statistical method found men and other people with a deficiency of folate and total and active B12 to be at higher risk for HHcys. within the adjusted model, the danger for active B12 deficiencyalmost doubled.

3.3 AI and NLP

Natural language processing (NLP) may be a apart of AI where we apply computational techniques to the analysis and synthesis of tongue and speech. within the medical field, patient records usually contain plenty of important data that medical professionals need to extract. This information may include medications, immunization records and lab test results. NLP tasks are often separated into low-level tasks and high-level tasks. A number of these tasks have direct applications, while others are sub-tasks that are used to help solve larger tasks, with the low level tasks usually feeding into the high level tasks.

3.4 Neural Network Training and Android Application

A simple Android Application are often designed to prompt the user to capture photos of the mentioned organs. An intelligent application is often built to accumulate, process, analyze and extract the features of interest from these photos. to make a platform capable of this task, Machine Learning algorithms were wont to train a Neural Network for symptoms detection. Since Fully Connected Neural Network can't be wont to perform analysis on A x B x 3 colored images (in which A x B is pixel density and three is that the number of color channels in matrix representation) thanks to the large number of weights created within the first neural layer which can hamper the training process, Convolutional Neural Network (CNN) is employed to coach the neurons thanks to its effective efficiency. Arrays with different pixel weights representing the color scale between -1.00 and 1.00 are used as filters by convolved multiplication across the target photo array. The summation then is split by the entire number of pixels within the filter to supply an output weight value for subsequent convolutional layer. Similarly speaking, the Sigmoid Squishification Weight Activation Function was replaced with Rectified linear measure (ReLU) to asses with the speed and accuracy [20] of the propagation process by removing the negative values that represent dissimilarities between pixels. A bias is often added to elevate the activation range.

Fig -1: Sample Dataset Images (Nails, Lip, Eyes, Tongue)

3.5 Fuzzy Membership Function and Defuzzification

As multiple iterations of the Convolutional Neural Network (CNN) are done using numerous photos containing the targeted attributes within the study mentioned earlier, the arrogance level of every extracted feature is fetched and fed during a Mamdani – based symbolic logic Membership Function built using MATLAB. The symbolic logic rules are written in accordance with the strength and commonality of the analyzed visual attributes; during which the deficiency detected in one among the variables gains higher certainty the more it's detected within the other variables and the other way around (Fig. 3) Finally, a separate code will acquire the Defuzzification results to display an inventory of suggested and updatable nutritional sources of the detected deficient vitamins.

4. CONCLUSION

The System is capable to diagnosis the vitamin deficiency spectrum from the images of user's tongue, nails, lips and eyes using Artificial Intelligence. Application uses the Neural Network Training to detect symptoms and Natural Language Processing to extract features. Fuzzy logic algorithm is used to specify the type of deficiency. After specifying visual symptoms through pathological research, a TensorFlow classifier trained using number of labeled images of segmented symptoms. One more layer of decision making algorithm shows a list of nutrients as well as suited medications and supplementary products.

The system is a innovative approach that allows self-diagnosis in a short span of time without any blood sample. The accuracy of proposed system can be improved by adding more data with contribution from Doctors, medical researchers and experts. The proposed solution's capabilities are not limited to vitamin deficiencies only, but they can be extended to detect other health problems.

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