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VITAMIN DEFICIENCY DETECTION USING IMAGE PROCESSING AND NEURAL NETWORK

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Abstract: A wide spectrum of vitamin deficiencies can show one or more visually distinguishable symptoms and indications that appear in multiple locations in the human body. The application provides individuals with the capability to diagnose their possible vitamin deficiencies without the need to provide blood samples through the analysis of photos taken of their eyes, lips, tongue, and nails. This process is implemented using the deep learning based CNN algorithm. Here we have considered the dataset of eyes, lips, tongue and lips. Once after the consideration of dataset, the pre-processing is performed and then CNN algorithm is used to train the data. Once after the training, model is saved and the testing is performed using the dataset.

***Index Terms* - Vitamin deficiency, deep learning, CNN, dataset.**

I. INTRODUCTION

Vitamin deficiency is the condition of a long-term lack of a vitamin. When caused by not enough vitamin intake it is classified as a primary deficiency, whereas when due to an underlying disorder such as malabsorption it is called a secondary deficiency. An underlying disorder may be metabolic – as in a genetic defect for converting tryptophan to niacin or from lifestyle choices that increase vitamin needs, such as smoking or drinking alcohol. Government guidelines on vitamin deficiencies advise certain intakes for healthy people, with specific values for women, men, babies, the elderly, and during pregnancy or breastfeeding. Many countries have mandated vitamin food fortification programs to prevent commonly occurring vitamin deficiencies.

Conversely, hyper vitaminosis refers to symptoms caused by vitamin intakes in excess of needs, especially for fat-soluble vitamins that can accumulate in body tissues. The history of the discovery of vitamin deficiencies progressed over centuries from observations that certain conditions for example, scurvy could be prevented or treated with certain foods having high content of a necessary vitamin, to the identification and description of specific molecules essential for life and health. During the 20th century, several scientists were awarded the Nobel Prize in Physiology or Medicine or the Nobel Prize in Chemistry for their roles in the discovery of vitamins.

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II. LITERATURE SURVEY

[1] Vitamin a deficiency and clinical disease: Vitamin A deficiency has a plethora of clinical manifestations, ranging from xerophthalmia (practically pathognomonic) to disturbances in growth and susceptibility to severe infection (far more protean). Like other classical vitamin deficiency states (scurvy, rickets), some of the signs and symptoms of xerophthalmia were recognized long ago. Reports related to vitamin A and/or manifestations of deficiency might conveniently be divided into "ancient" accounts; eighteenth to nineteenth century clinical descriptions (and their purported etiologic associations); early twentieth century laboratory animal experiments and clinical and epidemiologic observations that identified the existence of this unique nutrient and manifestations of its deficiency; and, most recently, a flowering of carefully conducted clinical studies and field-based randomized trials that documented the full extent and impact of deficiency among the poor of low- and middle-income countries, which in turn changed global health policy.

Summary: Vitamin A deficiency has a plethora of clinical manifestations, ranging from xerophthalmia (practically pathognomonic) to disturbances in growth and susceptibility to severe infection (far more protean). Like other classical vitamin deficiency states (scurvy, rickets), some of the signs and symptoms of xerophthalmia were recognized long ago. Reports related to vitamin A and/or manifestations of deficiency might conveniently be divided into "ancient" accounts; eighteenth to nineteenth century clinical descriptions (and their purported etiologic associations); early twentieth century laboratory animal experiments and clinical and epidemiologic observations that identified the existence of this unique nutrient and manifestations of its deficiency.

[2] Glossitis with linear lesions: The classic oral manifestations of vitamin B(12) deficiency are considered nonspecific. We describe 4 patients with oral linear lesions associated with vitamin B(12) deficiency. Patients were free of neurologic symptoms and anemia at diagnosis. We believe that glossitis with linear lesions is an early clinical sign of vitamin B(12) deficiency. We recommend the determination of vitamin B(12) in such patients, even in the absence of anemia.

Summary: The classic oral manifestations of vitamin B(12) deficiency are considered nonspecific. We describe 4 patients with oral linear lesions associated with vitamin B(12) deficiency.

[3] M. C.Chuang, J. N.Hwang, and C. Rose: Glossodynia, or painful sensation of the tongue, can have a spectrum of etiologies, such as local infection, trauma, nerve damage, glossitis, or the enigmatic neuropathic pain syndrome, burning mouth disorder (BMD; also known as burning mouth syndrome). Careful history-taking, physical examination, and appropriate laboratory screening can differentiate these causes of glossodynia and direct further therapy. A 73-year-old woman presented with several months of glossodynia having previously been diagnosed by her primary care physician with primary BMD. Subsequently, she consulted an otolaryngologist, who pursued further diagnostic evaluation. Examination revealed the presence of a beefy, red, smooth tongue, and further laboratory evaluation yielded a low serum vitamin B(12) level and macrocytosis. Three months of oral vitamin B(12) supplementation led to partial restoration of serum vitamin B(12) levels and a modest improvement in symptoms. Her final diagnoses were atrophic glossitis and glossodynia secondary to vitamin B(12) deficiency, most likely due to pernicious anemia.

Summary: The results of this case have important clinical implications for the diagnostic evaluation and management of patients with glossodynia and apparent BMD. Pathogenic mechanisms of nutrient deficiency in atrophic glossitis are discussed.

III. Functional and Non Functional Requirements

FUNCTIONAL REQUIREMENTS

Data Collection and Processing:

Ability to collect various types of data (dietary patterns, physical symptoms, patient history, etc.).

Efficient preprocessing of data to format it suitably for analysis.

Algorithm Implementation:

Developing and integrating machine learning and deep learning algorithms capable of identifying signs of vitamin deficiencies.

Implementing algorithms that can learn from new data to improve accuracy over time.

User Interface:

A user-friendly interface for both healthcare professionals and patients.

Features for users to input data and view results.

Diagnostic Reporting:

Generating comprehensive reports indicating the likelihood of vitamin deficiencies.

Providing recommendations or alerts based on the analysis.

Data Management:

Secure storage of all user data and analysis results.

Functionality for data retrieval, update, and deletion as per user request or legal compliance.

Integration Capabilities:

Compatibility with existing healthcare systems and databases.

APIs or other means to integrate with electronic health records (EHR) systems.

NON-FUNCTIONAL REQUIREMENTS

Non-functional requirements define how the system operates and include:

Performance:

High accuracy and reliability in detecting vitamin deficiencies.

Fast processing and response time.

Scalability:

Capability to handle an increasing amount of data and users without performance degradation.

Usability:

Ease of use for individuals with varying levels of tech proficiency.

Accessibility features for users with disabilities.

Security and Privacy:

Robust security measures to protect sensitive health data.

Compliance with data protection regulations (like GDPR, HIPAA, etc.).

Maintainability and Support:

Ease of updating and maintaining the system.

Availability of technical support and user documentation.

Compatibility:

Compatibility with various devices and operating systems.

Interoperability with different data formats and healthcare IT systems.

Hardware Requirements

- PROCESSOR - I3/INTEL PROCESSOR
- Hard Disk - 160GB
- Key Board - Standard Windows Keyboard
- Mouse - Two or Three Button Mouse
- Monitor - SVGA
- RAM - 8GB

Software Requirements:

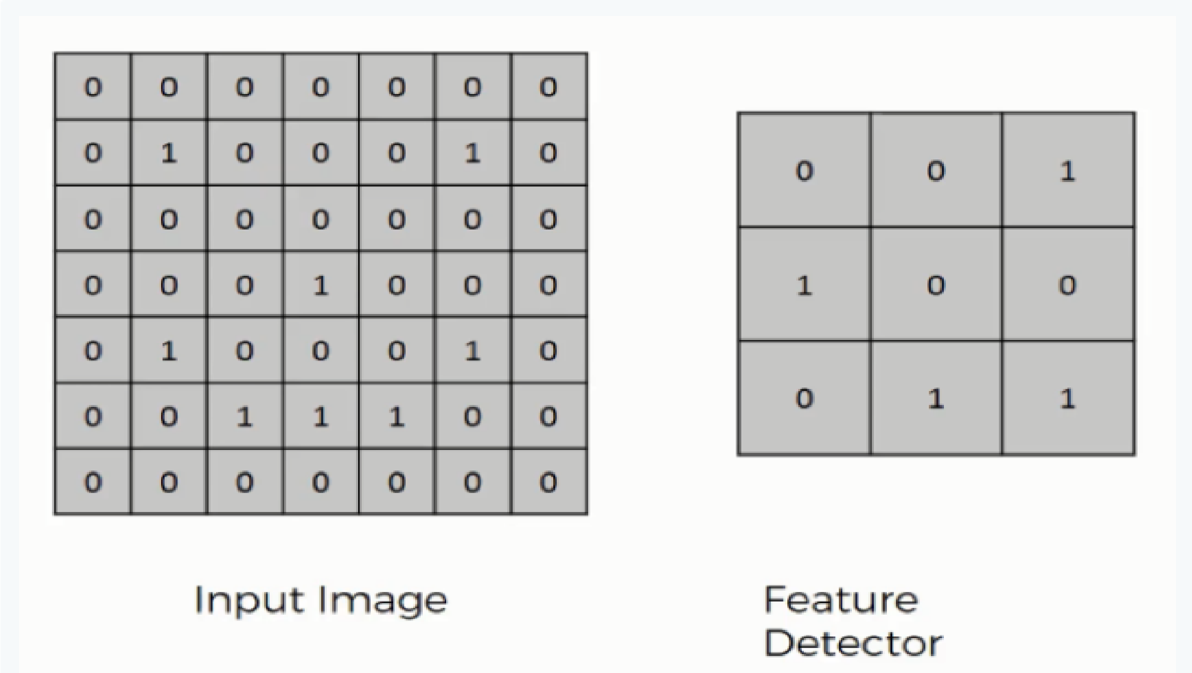
- Operating System : Windows 7/8/10
- Server side Script : HTML, CSS, Bootstrap & JS
- Programming Language : Python
- Libraries : Flask, Pandas, Mysql.connector, Os, Smtplib, Numpy
- IDE/Workbench : PyCharm
- Technology : Python 3.6+
- Server Deployment : Xampp Server
- Database : MySQL

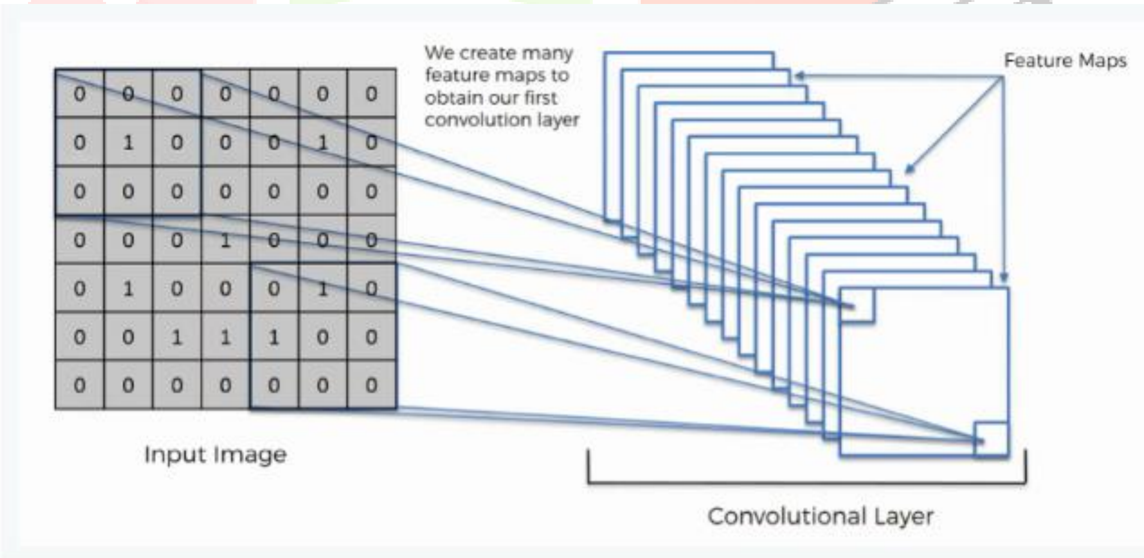
IV. METHODOLOGY

Step1: convolutional operation

The first building block in our plan of attack is convolution operation. In this step, we will touch on feature detectors, which basically serve as the neural network's filters. We will also discuss feature maps, learning the parameters of such maps, how patterns are detected, the layers of detection, and how the findings are mapped out.

The Convolution Operation

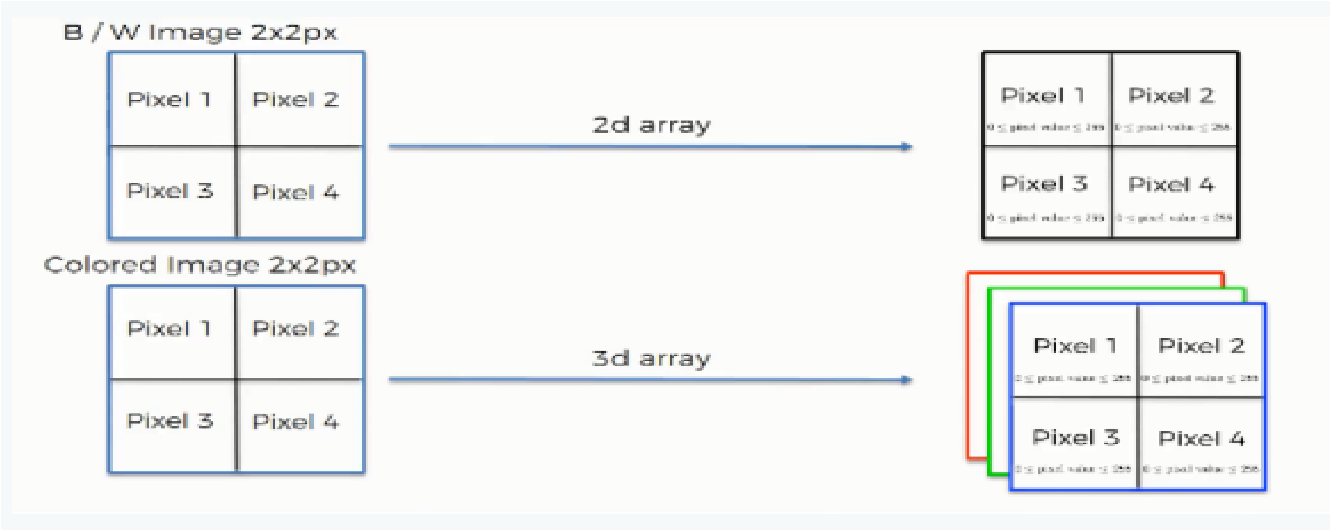




Step (1b): ReLU Layer

The second part of this step will involve the Rectified Linear Unit or Relook. We will cover Relook layers and explore how linearity functions in the context of Convolutional Neural Networks.

Convolutional Neural Networks Scan Images



Step 2: Pooling Layer

In this part, we'll cover pooling and will get to understand exactly how it generally works. Our nexus here, however, will be a specific type of pooling; max pooling. We'll cover various approaches, though, including mean (or sum) pooling. This part will end with a demonstration made using a visual interactive tool that will definitely sort the whole concept out for you.

Step 3: Flattening

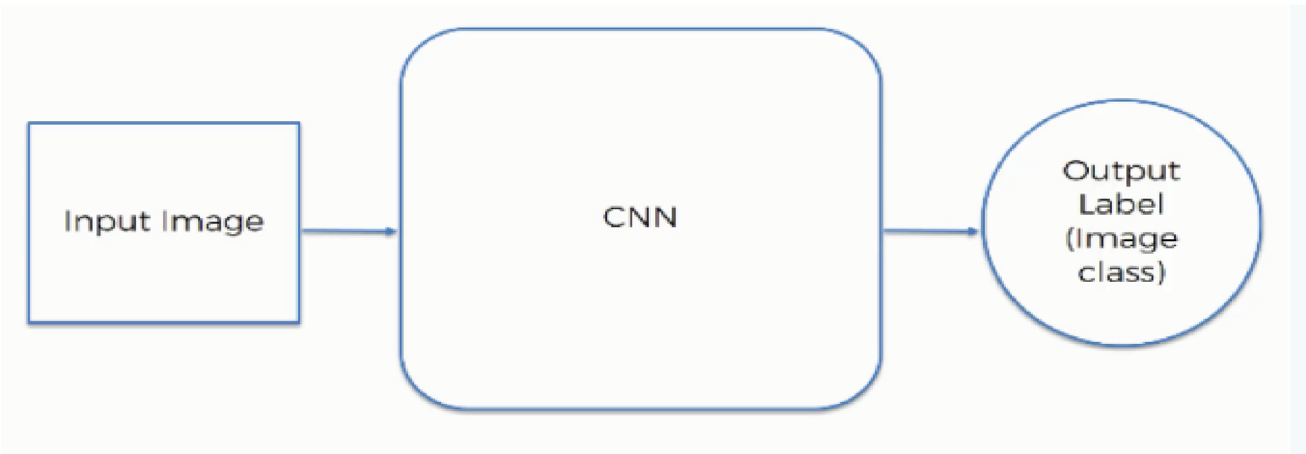
This will be a brief breakdown of the flattening process and how we move from pooled to flattened layers when working with Convolutional Neural Networks.

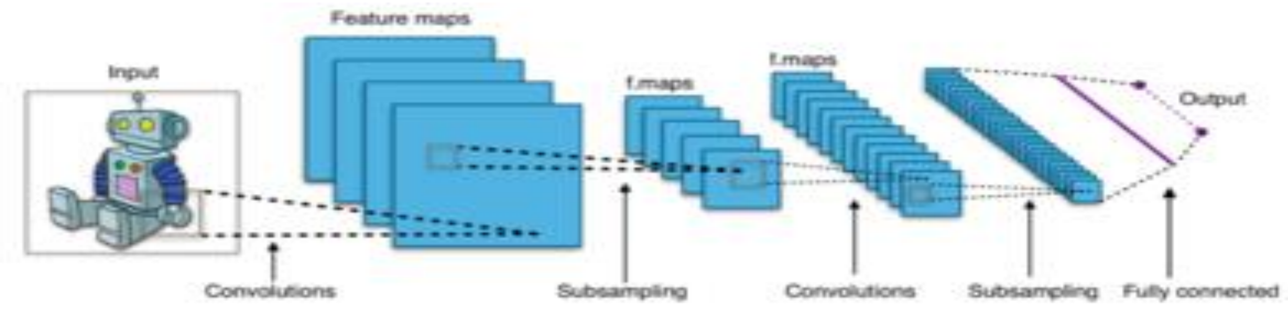
Step 4: Full Connection

In this part, everything that we covered throughout the section will be merged together. By learning this, you'll get to envision a fuller picture of how Convolutional Neural Networks operate and how the "neurons" that are finally produced learn the classification of images.

Summary

In the end, we'll wrap everything up and give a quick recap of the concept covered in the section. If you feel like it will do you any benefit (and it probably will), you should check out the extra tutorial in which Softmax and Cross-Entropy are covered. It's not mandatory for the course, but you will likely come across these concepts when working with Convolutional Neural Networks and it will do you a lot of good to be familiar with them.

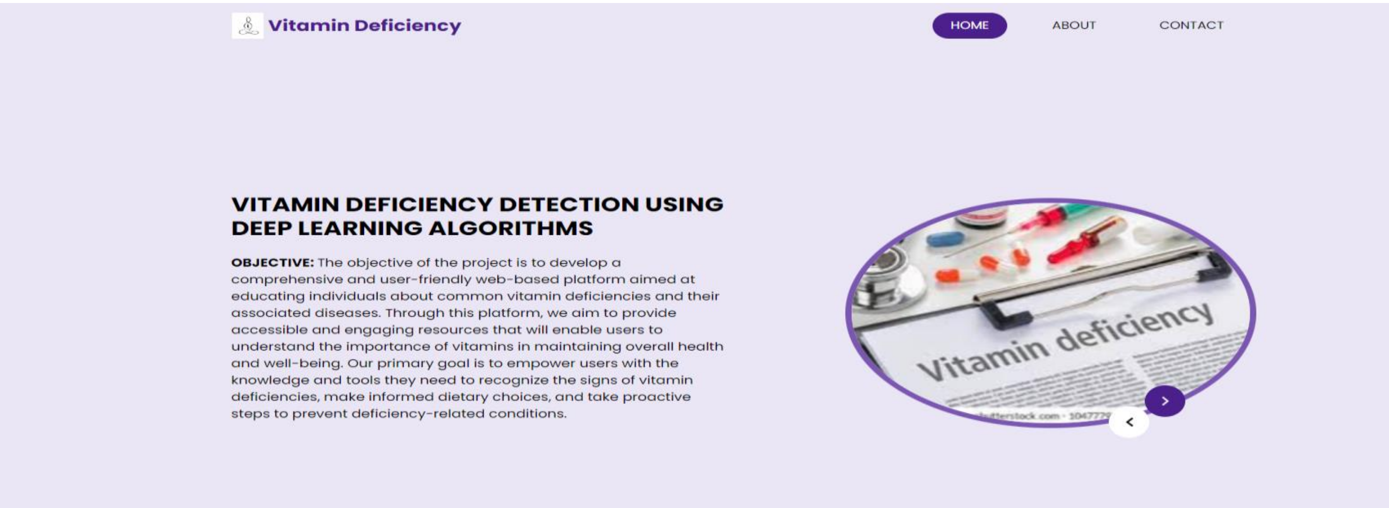




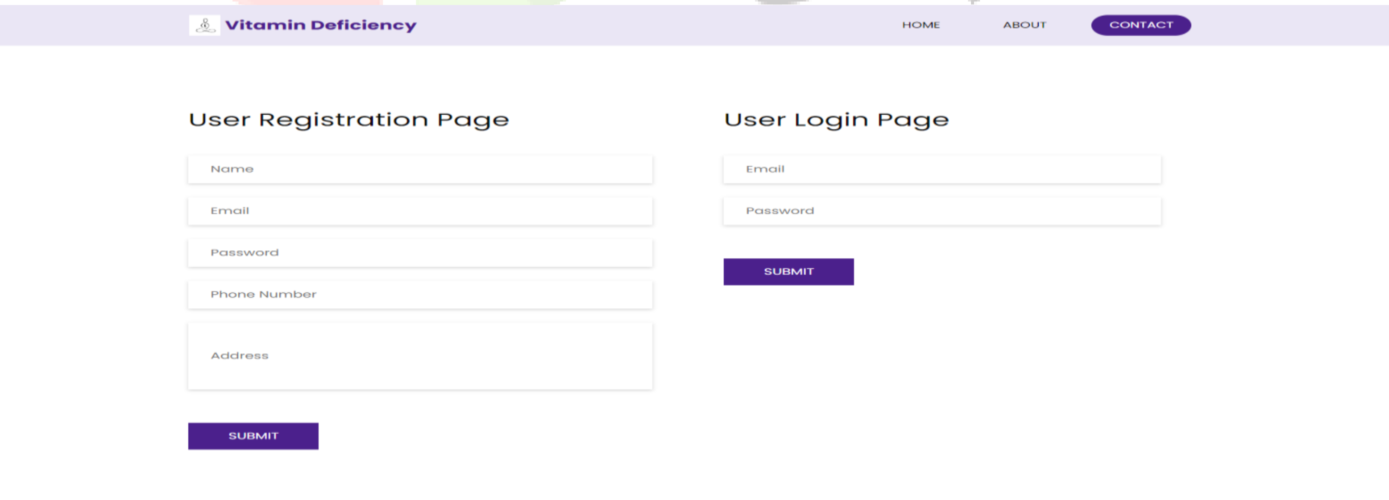
V. RESULTS

In this application, we have considered the dataset trained using Mobile net algorithm along with Deep learning and ANN machine learning methods. In the testing the image is uploaded and the image is classified.

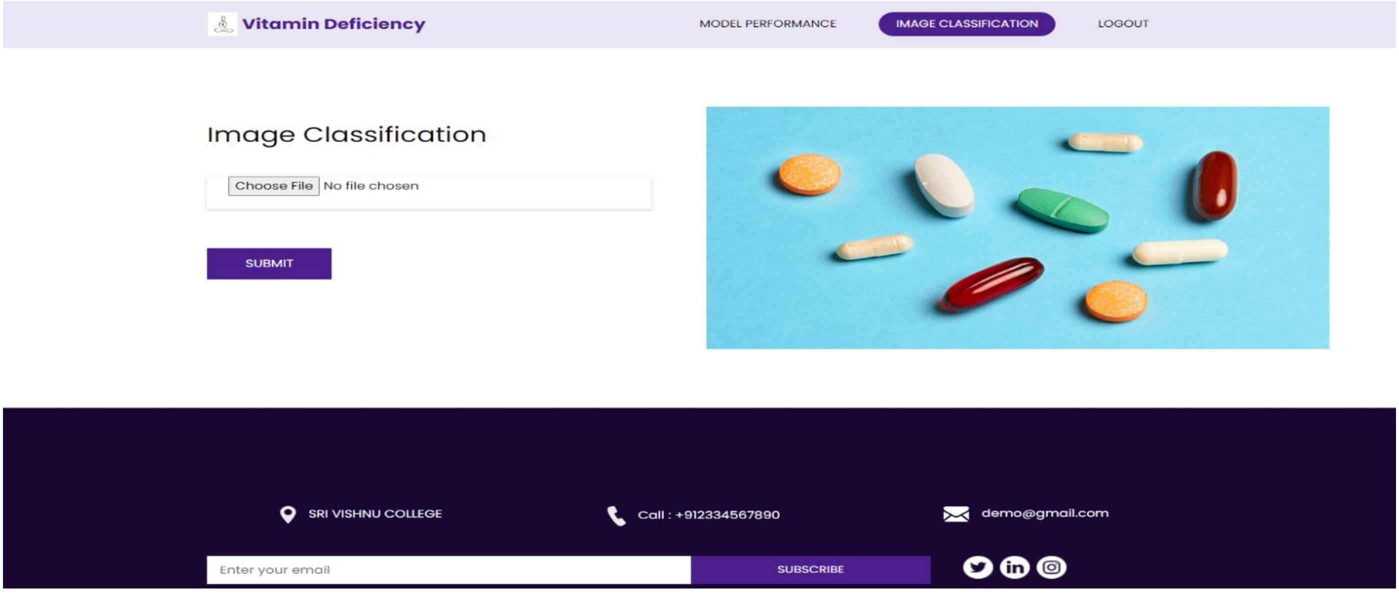
Figures:



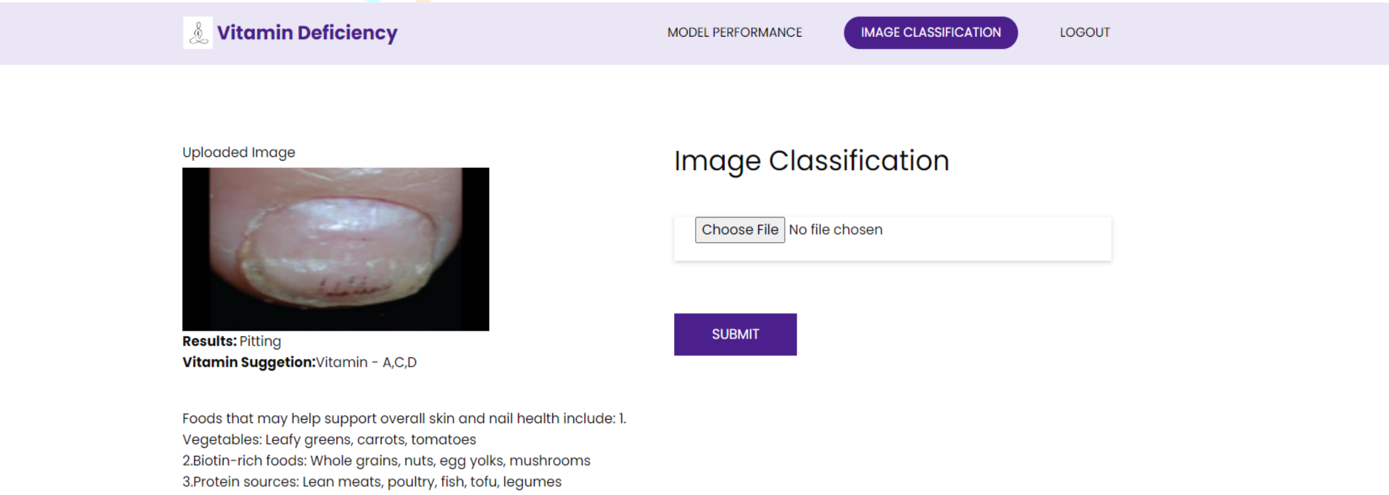
Result Fig.1-Homepage



Result Fig.2-Login and Signup page



Result Fig.3-User Home page



Result Fig.4-Final Result

VI. Conclusion and Future scope

In our proposed model we made the predictions of vitamin deficiency using Convolution Neural Network (CNN) from the deep learning. We considered a dataset of lips and tongue ,nails and trained using the CNN algorithm of deep learning. Once the training is completed, we used CNN model for recognising and make predictions of vitamin deficiency.

This process can be extended in future to classify the more types of predictions of different classifications and we can also use the different types of transfer learning algorithms for better predictions.

VII. References

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