



# International Journal of Innovative Research in Science Engineering and Technology (IJIRSET)

*(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)*



**Impact Factor: 8.699**

**Volume 14, Issue 6, June 2025**

# Malnutrition Detection using AI Deep Learning

Pranavi. D, Gayatri. V, Nikitha.k, Deekshitha.P

Dept. of Electronics & Communication Engineering, Hyderabad Institute of Technology and Management (HITAM),  
Hyderabad, India

Kondalarao Punati

Associate Professor, Dept. of Electronics & Communication Engineering, Hyderabad Institute of Technology and  
Management (HITAM), Hyderabad, India

**ABSTRACT:** "Malnutrition detection using AI deep learning " is a widespread health issue that can lead to various diseases and developmental problems. Early detection and intervention are crucial to preventing the long-term effects of nutrient deficiencies. This project focuses on developing an AI-based deep learning solution using Convolutional Neural Networks (CNNs) for malnutrition detection through image analysis. The system takes images of individuals, such as facial or skin texture scans, and analyzes physical signs associated with nutrient deficiencies (e.g., pale skin, brittle nails, etc.). The CNN model is trained on a large dataset of labeled images that reflect different nutrient deficiency symptoms. Once an image is input into the system, the CNN processes it, extracting key features and predicting which nutrient deficiencies are present. The model provides actionable insights by recommending specific nutrients or dietary changes to address the detected deficiencies. This system aims to offer a non-invasive, cost-effective, and scalable solution for identifying malnutrition in communities, particularly in regions with limited access to healthcare services. The project's goal is to contribute to global health improvement through AI driven preventive care.

## I. INTRODUCTION

Malnutrition remains a significant global health issue, affecting millions, particularly in developing countries. Early detection and personalized intervention are crucial to prevent long-term health complications. This project aims to address this challenge by leveraging Artificial Intelligence (AI) and Deep Learning techniques to develop an intelligent system for the detection of malnutrition and recommendation of suitable nutrition plans. The system utilizes deep learning models trained on medical data, including images (e.g., facial features, body measurements) and clinical parameters (e.g., BMI, hemoglobin levels, age, and dietary intake). By analyzing these inputs, the AI model can accurately classify individuals into various malnutrition categories such as undernutrition, overnutrition, or micronutrient deficiencies. Convolutional Neural Networks (CNNs) are primarily employed for image analysis, while other models like Artificial Neural Networks (ANNs) or Recurrent Neural Networks (RNNs) handle temporal and tabular data.

Once malnutrition is detected, the system generates personalized nutrition plans based on the user's age, health condition, and severity of malnutrition. These recommendations include dietary adjustments, food supplements, and lifestyle changes tailored to improve the individual's nutritional status. The system can also be integrated into mobile or web-based platforms for easy accessibility in remote areas. This AI-powered solution has the potential to revolutionize malnutrition screening and intervention, making it faster, more scalable, and accessible. It not only supports healthcare professionals in decision-making but also empowers individuals with actionable insights to manage their health effectively in remote areas.

## II. LITERATURE SURVEY

A disease detection concept has detailed by using the human images and analyzing the data from the color of the image. This might not work in every case as some people might look lean and are not malnourished [6]. Tensor Flow algorithm is used to train the dataset which supports various features. The data obtained from semi structured interviews were analyzed using frame analysis and MaxQDA software. The gathering of data required much amount of time and improper data might lead to incorrect results [7]. The nutritional status of the



population is characterized using height, weight, and MUAC based anthropometric indicators. The study also revealed that the removal of data based on SMART flag cut-off points improves the data quality of anthropometric surveys. The quality improvement measures are described rather than identifying the children affected with malnutrition [8].

The white paper [9] detailed the role of CNS in the prevention and treatment of malnourished patients who were hospitalized. The accurate documentation of the malnourished patients will help in the appropriate coding, funding reimbursement, and treatment [10]. A compositional analysis was conducted using two waves (2004-2005 and 2011-2012) data from Indian Human Development. The z-scores of Weight-for-Height (WHZ), Height-for-Age (HAZ), Weight-for-Age (WAZ), and the composite index of Anthropometric Failure were used for undernutrition measures. The analysis provided the up-to-date profile of the nutritional status of India's children using the z-scores [11].

A system was developed to show the dashboard representation of malnutrition. The final output is the graphical representation of the data in the form of a pie chart or bar graph which contains the data that is maintained in the database and is displayed based on the selected. It represents the data in the form of pie chart or bar graph which might not help to treat the malnourished children but can help us to take preventive measures to decrease the rate of malnourished children [12]. Malnutrition among under-five children is one of the major concerns in India. This review has identified the determinants and strategies that are required to prevent malnutrition under age of five years children in India. Prevention measures are explained and [13]. A system was developed using ID3, Random forest tree algorithm to generate a general result about the nutritional status of the children. Random forest tree algorithm is beneficial to train the data. However, it is comparatively slow to create predictions out of trained data [14].

In 2011 a complete nutrition data about children under five years were collected. Based on this data, a predictive model is developed using PART pruned rule induction which helps program managers and government to identify the children who are at risk. [15]. A Rule-based classification technique with a Multi-Agent System was used to detect malnutrition in children. The final decision is made based on the number of rules used and shows that there is connectivity between the number of rules and the optimality of final decision. It requires lot of manual intervention like generating rules out of facts and also depletes time while we generate rules for complex data or system [16]. The study says that weight-height based case-detection technique performs worse in identifying malnutrition. MUAC is the best case-detection method and helps to identify severely malnourished children for their admission into community based therapeutic care programs. MUAC is the best method to measure each and every child to know about their nutritional status [17]. The study resulted that 21.7% of children fewer than three years of being affected with undernutrition in rural Western China in 2005 and stated that childhood malnutrition is a large health challenge. This work depicts the overall rate of malnourished children under three years but not techniques to identify malnourished children [18].

### **III. PROPOSED SOLUTION**

Malnutrition remains a critical health issue affecting millions worldwide, particularly children and vulnerable populations. Early detection is key to effective intervention. This project proposes an AI-based solution leveraging deep learning to detect signs of malnutrition using facial and physical images. By using Convolutional Neural Networks (CNNs), the system aims to identify visual indicators of malnutrition such as facial asymmetry, sunken eyes, or visible bone structures.

The proposed system follows a pipeline approach:

Image Acquisition: Users will upload facial or body images to the system.

Feature Extraction and Classification: A CNN model will be trained on a dataset of labeled malnourished and healthy individuals to extract deep features and classify malnutrition severity.

Result Interpretation: Based on the classification, the system will interpret the level of malnutrition.

Dietary Plan Recommendation: Using expert-curated nutrition data, the system will generate a suitable dietary plan tailored to the user's condition.

#### IV. SOFTWARE REQUIREMENTS

##### 4.1 .GOOGLE COLAB

Google Colab (short for Colaboratory) is a free, cloud-based platform developed by Google that allows users to write and execute Python code in a web-based environment. It is particularly popular among data scientists, machine learning enthusiasts, and students due to its simplicity, accessibility, and powerful features.

Colab provides a Jupyter Notebook interface, enabling users to write and run code in cells, display visualizations, and document their work with Markdown — all in one place. One of its major advantages is that it supports free access to powerful hardware accelerators like GPUs (Graphics Processing Units) and TPUs (Tensor Processing Units), which are essential for training deep learning models. Users can save notebooks directly to their Google Drive, making collaboration easy. Multiple users can edit and run code simultaneously, much like Google Docs. It also supports integration with GitHub and various Python libraries like TensorFlow, PyTorch, NumPy, OpenCV, and more. Google Colab eliminates the need for complex local setup, making it ideal for education, experimentation, and prototyping machine learning models quickly. Overall, it is a valuable tool for anyone working in data science, AI, and research.



##### 4.2 CONVOLUTIONAL NEURAL NETWORKS(CNNs)

Convolutional Neural Networks (CNNs) are a class of deep learning algorithms specifically designed for processing data with a grid-like structure, such as images. CNNs are widely used in image recognition, object detection, facial recognition, and medical imaging due to their ability to automatically and adaptively learn spatial hierarchies of features from input images.

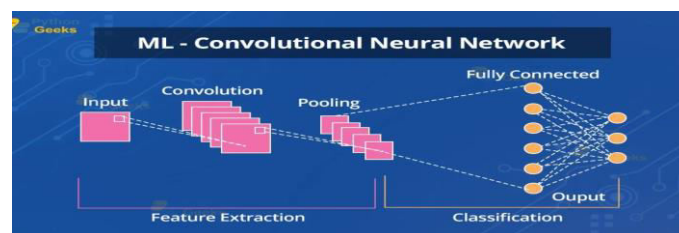
A CNN is composed of multiple layers, each with a specific function:

**Convolutional Layers:** These layers apply filters (kernels) to the input image to extract features such as edges, textures, and shapes. Each filter scans the image and produces a feature map highlighting the presence of specific patterns.

**Activation Function (ReLU):** After convolution, the ReLU (Rectified Linear Unit) function introduces non-linearity, allowing the network to learn complex patterns.

**Pooling Layers:** These layers reduce the spatial dimensions of the feature maps (e.g., using max pooling), which helps in reducing computational cost and overfitting while preserving important features.

**Fully Connected Layers:** At the end, fully connected layers interpret the extracted features and produce the final classification output.



##### 4.3 IMAGE PROCESSING UNIT

An Image Processing Unit (IPU) in software refers to the set of algorithms and tools used to manipulate and analyze digital images. It plays a crucial role in various applications such as medical imaging, computer vision, robotics, and multimedia.

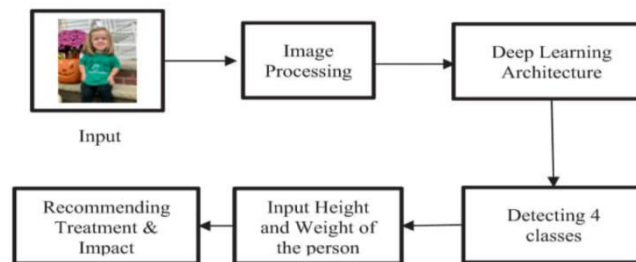
The IPU in software handles tasks like image enhancement, filtering, transformation, segmentation, and feature extraction. These processes help in improving image quality, detecting patterns, and preparing images for further analysis such as classification or object detection.

Key functions of a software-based IPU include:

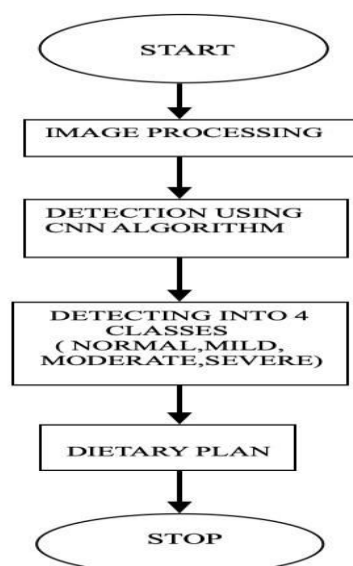
- Preprocessing: Adjusting brightness, contrast, and removing noise to prepare the image for analysis.
- Filtering: Applying filters (e.g., Gaussian, median) to enhance or detect specific features like edges or textures.
- Transformation: Rotating, resizing, cropping, or converting images to grayscale or binary formats.
- Segmentation: Dividing an image into meaningful parts or regions (e.g., separating an object from the background).
- Feature Extraction: Identifying and extracting key information (e.g., corners, contours) that helps in recognizing patterns.

Unlike hardware IPU (used in mobile devices or cameras), software IPU are implemented through programming libraries such as OpenCV, Pillow, or scikit-image. These tools provide high-level functions to process images efficiently on standard CPUs or GPUs.

#### V. BLOCK DIAGRAM



#### VI. FLOW CHART



## VII. WORKING PRINCIPLE

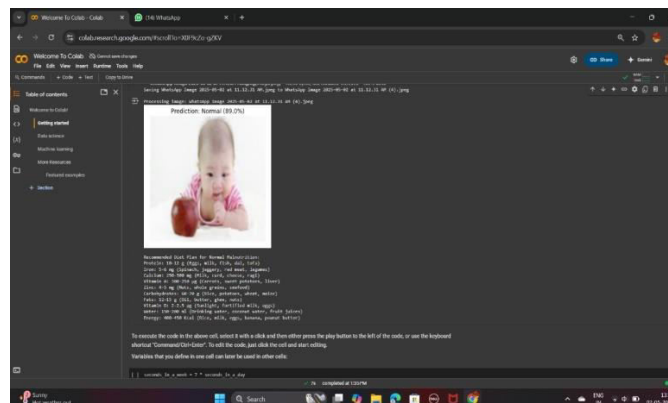
The project Malnutrition Detection Using AI and Deep Learning focuses on identifying malnutrition in individuals through image analysis and suggesting personalized dietary plans. This system leverages the power of Convolutional Neural Networks (CNN), a class of deep learning algorithms particularly effective in image classification tasks.

The core idea is to use facial images or body features to detect physical signs of malnutrition, such as sunken cheeks, pale skin, thin limbs, or other visible symptoms. A CNN model is trained on a dataset containing labeled images of individuals with various types of malnutrition, including protein-energy malnutrition, vitamin deficiencies, and mineral imbalances. The model learns to recognize subtle patterns and features that indicate specific nutritional deficiencies.

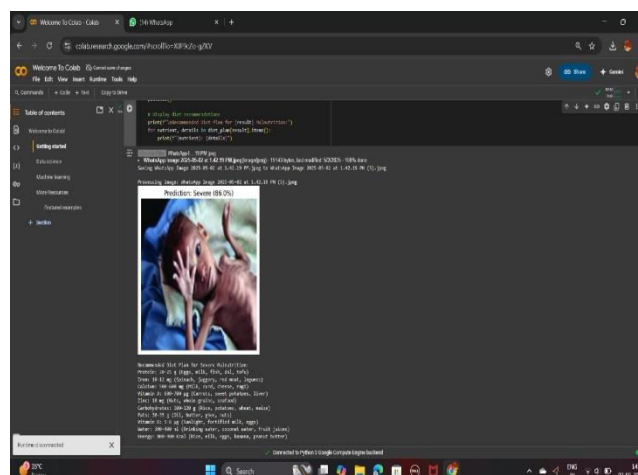
Once the model detects the type and extent of malnutrition, it maps the result to a dietary recommendation system. This module suggests food plans rich in the nutrients the individual lacks. For example, if the model detects iron deficiency, the system recommends iron-rich foods like spinach, legumes, and red meat. The project pipeline includes image preprocessing, CNN model training, classification, and dietary recommendation. This approach enables early detection, especially in areas with limited access to healthcare professionals. It can be deployed as a mobile or web-based application, making it accessible and scalable.

## VIII. RESULTS

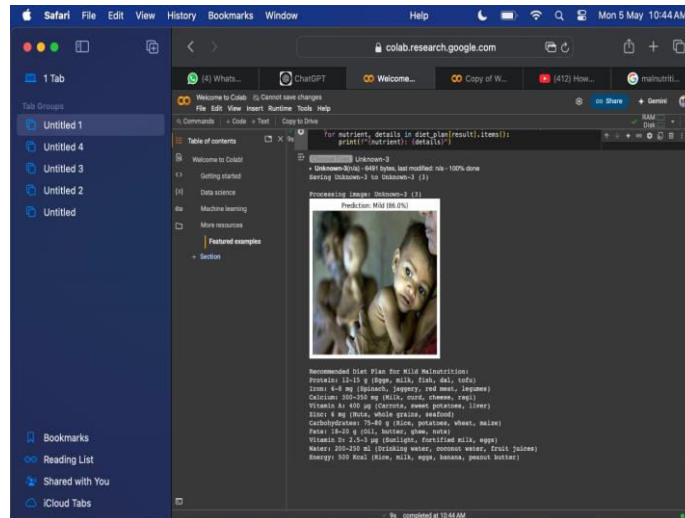
### 1.NORMAL



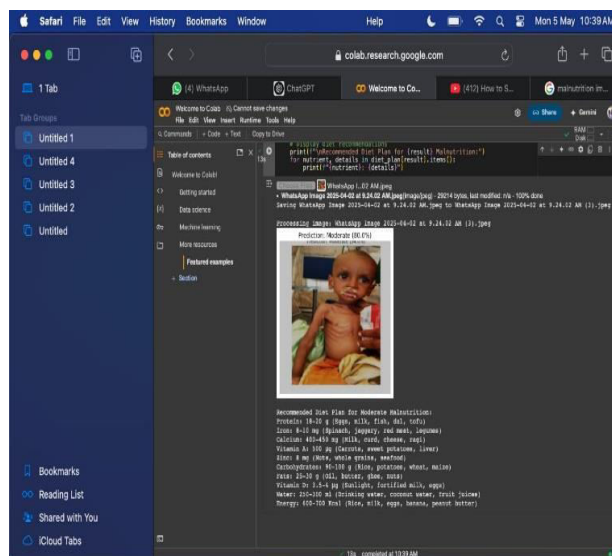
### 2.SEVERE



### 3.MILD



### 4.MODERATE



## IX. CONCLUSION

The project on Malnutrition Detection Using AI and Deep Learning demonstrates the significant potential of modern technology in addressing critical public health issues. By leveraging deep learning algorithms, the system accurately identifies the type of malnutrition—whether it is protein-energy malnutrition, micronutrient deficiencies, or obesity—based on physical, medical, and dietary input data. Once detected, the AI recommends a personalized dietary plan tailored to the specific deficiency, ensuring more effective and targeted nutritional intervention. This solution not only enhances early diagnosis but also supports healthcare providers in managing and reducing malnutrition-related health risks. The model's ability to learn and adapt over time ensures improved accuracy and performance. Overall, this project contributes to advancing healthcare accessibility and efficiency, particularly in underserved communities, and underscores the value of integrating AI with nutrition science to combat one of the world's most persistent health challenges.



**REFERENCES**

- [1] Kadam, N., Dabhade, V., Baravkar, R., Saravade, V., & Mankar, C.(2019). Detect Malnutrition in Underage Children by using TensorFlow Algorithm of Artificial Intelligence. (Vol. 06, Issue 12).
- [2] Markos, Z., Doyore, F., Yifiru, M., & Haidar, J. (2014). Predicting Under nutrition status of under-five children using data mining techniques: The Case of 2011 Ethiopian Demographic and Health Survey. J Health Med Inform, 5, 152.
- [3] Sahu, S. K., Kumar, S. G., Bhat, B. V., Premarajan, K. C., Sarkar, S., Roy, G., & Joseph, N. (2015). Malnutrition among under- five children in India and strategies for control. Journal of natural science, biology, and medicine, 6(1), 18.





INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  [ijirset@gmail.com](mailto:ijirset@gmail.com)



[www.ijirset.com](http://www.ijirset.com)

Scan to save the contact details