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Performance Enhancement of Cancer Detection and Classification Using Deep Learning Approach

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Abstract
Cancer detection at an early stage is critical for improving patient outcomes and reducing mortality rates. This paper presents a real-time cancer detection system that leverages deep learning algorithms in combination with advanced imaging techniques such as fluorescence imaging and algorithm like VGG 16 and Resnet 50 to analyze the input data better. The Proposed system is trained on extensive datasets of medical images, enabling it to recognize abnormalities and detect cancerous lesions in their earliest stages with high accuracy. Furthermore, the adaptive learning capabilities of the deep learning models ensure continuous improvement in prediction accuracy over time. This innovative approach not only enhances early-stage cancer detection and treatment but also reduces healthcare costs and diagnostic waiting periods. By addressing critical challenges in healthcare, this system demonstrates the transformative potential of deep learning in medical applications.

Keywords: *Real time cancer detection, Deep learning models, VGG16, ResNet50.*

1. Introduction
Cancer represents a significant global health concern, contributing to a substantial number of fatalities and morbidity rates annually. Early detection plays a critical role in improving patient outcomes, as timely diagnosis allows for more effective treatment options and enhances survival rates. This project aims to improve cancer detection using advanced image processing and deep learning algorithms namely VGG16 and ResNet50. High-quality images of tissues are collected using modern medical imaging tools like endoscopy and digital photography. These images are then processed using MATLAB Python used to improve their quality and highlight important details. This improved image quality helps in identifying abnormal tissues more accurately, making cancer detection faster and more effective. In recent years, deep learning has emerged as a powerful tool in healthcare, particularly in the field of cancer detection. Deep learning, a subset of artificial intelligence (AI), uses algorithms that mimic the human brain's ability to learn from large amounts of data. The primary focus of this project is to enhance the performance of existing models by improving their accuracy, reducing errors, and increasing the speed of classification. This can potentially reduce the workload on healthcare professionals and provide faster results for patients, enabling earlier and more effective treatment. ResNet50 is a deep convolutional neural network architecture that uses residual learning to improve the training of very deep networks, enabling better performance in image classification tasks. VGG16, on the other hand, is a simpler deep learning model used for better image observation without any blur and black spots in the background image.

2. Related Works
This paper [1] discuss about the cancer detection using a combination of advanced techniques in artificial intelligence and using image processing. [2] A novel web framework for cervical cancer detection

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uses advanced computer programs to help doctors find signs of cervical cancer early. [3]An end-to-end fully automated lung cancer screening system is a computer program that helps doctors find lung cancer early. It works automatically, without needing human input, to detect and analyze lung cancer in medical image.[4] This paper depicts about the tuna swarm algorithm, analyzes medical images to detect colon and lung cancer. It uses a technique inspired by the behavior of tuna fish, combined with deep learning, to improve accuracy. The goal is to help doctors identify cancer early for better treatment.[5]

3. System Analysis

3.1.Proposed Block Diagram

The proposed method aims to develop a robust and efficient system for the real time detection of cancer, leveraging advanced image processing techniques combined with deep learning algorithms. Initially it captures the images of the cancer tissues using Endoscope and Digital Cameras.Then,the collected images undergo preprocessing to enhance their quality and prepare them for analysis. This includes noise reduction, contrast enhancement, and normalization using MATLAB scripts and Python libraries, ensuring that the images are suitable for accurate segmentation and feature extraction.Image segmentation performs segmentation to isolate areas of interest, particularly in malignant parts.After segmentation, key features related to cancerous lesions are extracted using pre-trained deep learning models such as VGG16 and ResNet50,it will help us to see the affected area clearly without any background black spot,making classification easier. The classified images are trained to differentiate between begin and malignant tissues based on the features obtained from the previous step, allowing for a robust classification of cancer lesions. Finally, the results of the classification are displayed on an LCD screen powered by an Arduino microcontroller, providing immediate feedback to healthcare professionals. (Figure 1)

3.2.Design Flow

The design flow of the integrated system is computed and shown in figure 2. The data were collected through image acquisition tools or medical imaging tools, then the collected data were sent for preprocessing. In preprocessing step, it involves MATLAB scripts and python libraries, they are used to enhance the image quality, noise reduction, help to remove the unwanted distortions. Now, Image segmentation takes place, it helps to reduce the areas that are affected by the background regions. It involves edge detection and rectify it. The data collected is used in preprocessing and segmentation step. They were help to abstract the desired result from the given input data. The feature extraction are obtained using VGG16 and Resent50,these are types of convolutional neural networks(CNN),used to process the segmented images to obtain a high level dimensional feature images ,and also used to analyze the specific affected tissue area.The performance are analyzed through accuracy, precision with clear image. Using the extracted images that are preprocessing models, observing the differences and note the levels of affected area.Finally,the system integration involves a user interface for real time monitoring through LCD display, it will showcast whether “cancer detected” or “no cancer detected”. By this way, it helps the medical professionals to analyze and figure out the problem more quickly and accurately. (Figure 2) [5-6]

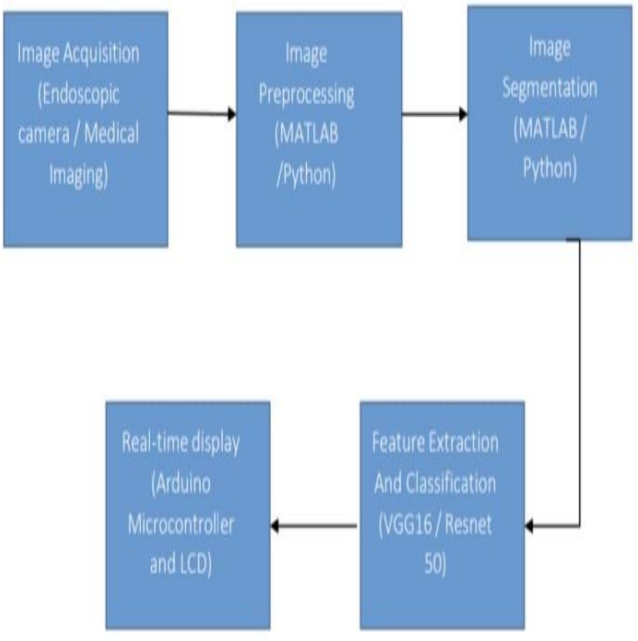

Figure 1 System Model

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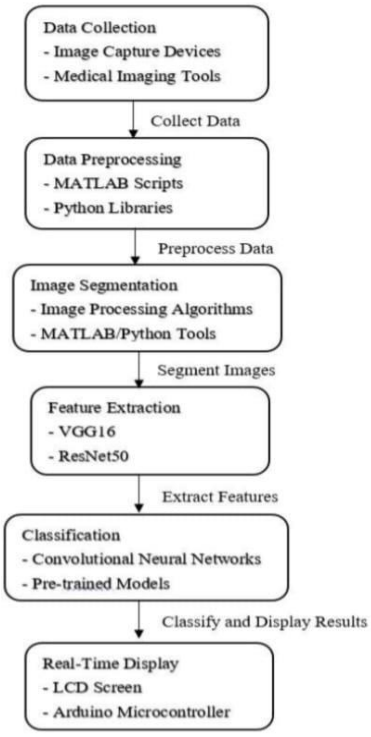

Figure 2 Design Flow

4. Result and Discussion

4.1.Software Implementation

The original image pictured here taken from the hospital and collected various datasets, analyzing the numerous datasets and we taken this image as our input image and loaded it in MATLAB software [3]. (Figure 3) [7-9]

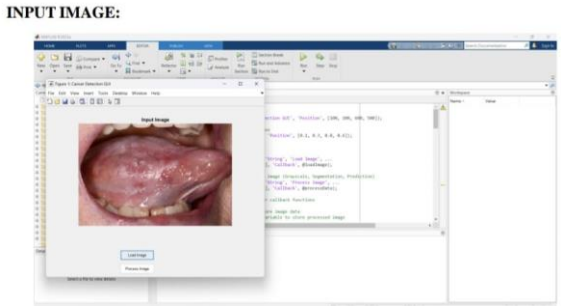

Figure 3 Input Image

The original image is converted to Grayscale image, eliminate the color variations, highlights the boundaries and texture difference in the affected area, also improve the speed for further process [4]. (Figure 4) [11]

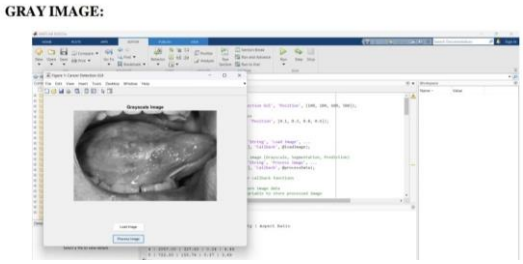

Figure 4 Gray Scale Image

Image abstracted from grayscale image is processed into segmented image, it used to isolates the affected region from healthy area. Here use CNN (Convolutional Neural Networks), for better image segmentation. It highlights the affected lesion for future analysis [5]. (Figure 5) [10]

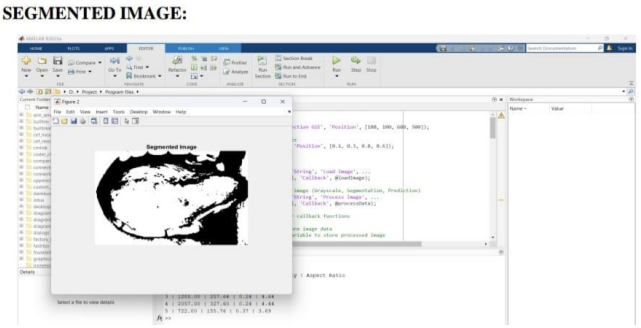

Figure 5 Segmented Image

The segmented image go through the algorithms namely VGG16(Visual Geometry Group) and ResNet50(Residual Network) and pre trained models,and point out the affected area.[6]. (Figure 6)

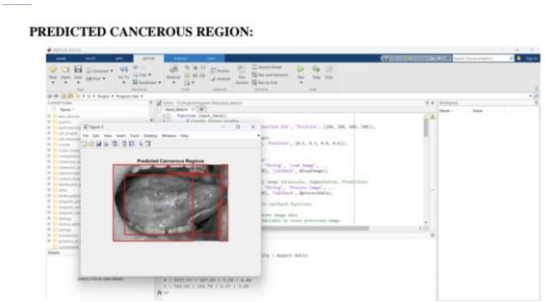

Figure 6 Output Result

The software implementation for cancer detection using Arduino uno and 16x2 LCD display.This code used to detect cancer detection using image processing algorithms,especially VGG16(Visual

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Geometry Group) and ResNet50(Residual Network) present in CNN(Convoutional Neural Networks),it helps to get a clear and accuracy of 95% deep analyzing result of the given input image. The data were collected through image capturing devices and medical imaging tools.After that,it preprocess the data using MATLAB scripts and Python libraries.Preprocessing data were segmented through previously mentioned Image processing algorithms and MATLAB/Python tools,and segemented images were extracted through VGG16 and Resnet50.Extraced images were classified using convolutional neural networks and pre-trained models.The code were created to analyze the input image then into gray scale image and finally it segments, here the code predicted the cancerous region.The uploaded mechanism involves firstly open the Arduino IDE,connect the Arduino to the laptop through USB.In board options select the Arduino UNO,then create the code and upload it to the Arduino.The models performance is evaluated using accuracy and classification. The code runs an Arduino program that uses a 16x2 LCD screen to display messages related to cancer detection,it shows scanning to evaluate the final exteacted image and display as “Cancer Detected” and give a brief data analysis about it[7]. (Figure 7) [12]

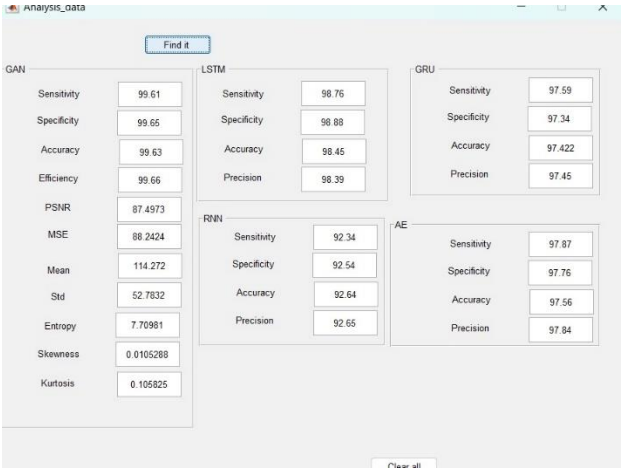

Figure 7 Data Analysis

4.2.Hardware Implementation

This paper includes Arduino UNO, LCD Display, and breadboard. Arduino Uno collects the real-time data sets that we are collected from the hospitals.The data is then transmitted to MATLAB for advanced analysis and visualization.Ardunio uno acts as a data acquisition unit,sending the processing values to MATLAB via USB. The code integrated with MATLAB were examine the image and give the scanned result,that were displayed over LCD screen,also it show “Cancer Detected” and “seek medical help”,If no cancer detected through the input image,it exhibit “No cancer detected”. (Figure 8) (Table 1) [13]

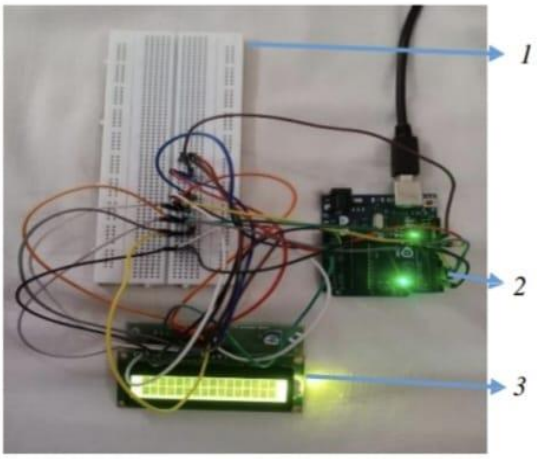

Figure 8 Hardware Implementation

Table 1 Name of the Component

Comp. No.	Name of the component
1.	Breadboard
2.	Arduino Uno
3.	LCD Display

5. Results and Discussion

5.1. Results

The proposed system for real-time cancer detection demonstrates a significant advancement in the use of image processing and deep learning technologies in the medical field. By combining robust image preprocessing, effective segmentation, and accurate classification, the system provides a reliable tool for healthcare professionals. The results indicate that the

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system can accurately identify potential malignancies in real-time, supporting timely interventions and improving patient outcomes. [14]

5.2.Discussion

Using deep learning algorithms,the medical professionals can detect the cancer early and classify them according to the levels of affected and diagnose early.It also be enhanced in many ways, expanding the dataset to include a more diverse range of lesions and demographic variations. [15]

Conclusion

Future developments could include integrating additional data modalities, such as histopathological data or genetic information, to create a more comprehensive diagnostic tool that provides deeper insights into cancer progression. The system can be expanded and adapted for more complex real-world applications, including actual medical detection systems in the future.

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