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Early-Stage Hepatic Tumor Detection Segmentation and Prediction Using Deep Learning Models

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Abstract: ***Hepatocellular Carcinoma (HCC), which accounts for 75% of instances of liver cancer, is the most prevalent form of the disease. Liver cancer, also known as hepatic cancer, is caused by abnormal cell development in the liver. It is challenging to detect this tumor, which is typically discovered at an advanced stage and poses a serious threat to life. Thus, it is crucial to find the tumor at an early stage. Therefore, the primary goal of this study is to use image processing to detect liver cancer at an earlier stage. Liver cancer contributes to the increasing mortality rate in the world. Therefore, early detection may lead to a decrease in morbidity and increase the chance of survival rate. This research offers a computer-aided diagnosis system, which uses computed tomography scans to categorize hepatic tumors as benign or malignant.***
Keywords: Liver Cancer, CNN, Tumor, Segmentation, Analysis, CT scan.

I. INTRODUCTION

The Utilizing computers to process images with the required algorithms is known as digital image processing. 460–370 BC marked the development of the word "cancer." Hippocrates, the "FATHER OF MEDICINE," a Greek physician, is given credit for it. Our body splits billions of cells every day to create new ones.

A dead cell's place is taken up by freshly created cells. Essentially, cells join forces to create tissues, and those tissues join forces to create organs. It might be challenging for radiologists to locate and categories liver cancers. The liver cells with the least amount of abnormality must be distinguished from the abdominal parenchyma before being labelled as malignant or benign tumors. CT images continue to be one of the top modalities of choice because of its superior cross-sectional view, great spatial resolution, fast interpretation, and high signal to noise ratio.

Because of this, cells can divide more quickly than the body demands in some pathological conditions, resulting to lumps or growths that are commonly referred to as tumor. In this work, we suggested a simple method of cancer care using image processing.

The leading cause of cancer-related death worldwide is hepatic cancer. Computed tomography has the potential to save millions of lives annually through the early diagnosis of liver cancer (CT). It is a taxing endeavor for radiologists to read hundreds, if not tens, of these CT scans. This calls for the quick, accurate reading, detection, and interpretation of CT images using automation.

II. LITERATURE SURVEY

Rong Zhu, et al. suggested that the most often used technique for eliminating noise is anisotropic diffusion filter in their article [1]"Application of Improved Anisotropic Diffusion Filter on Image Processing." In order to eliminate salt and pepper noises from the photos, this work describes an improved anisotropic diffusion filter algorithm.

In their article [2] "Morphological Operations for Image Processing: Understanding and its applications," Ravi S. et al. described how morphological operations are simple to use and operate according to the set theory idea. The purpose of utilizing this type of procedure is to fix the flaws in the way the picture structures are put together.

III.PROPOSED WORK

The proposed system is designed to be able to perform image enhancement on the data uploaded, perform segmentation and successfully detect the occurrence of cancer in the uploaded CT scan. It also provides the ability to perform comparative study.

The suggested network is compact, quick, dependable, and precise. An oncological professional can take advantage of it, which will make the diagnosis straightforward. Additionally, the suggested network achieves excellent accuracy without picture curation, saving time and money.

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IV. METHODOLOGY

The proposed system uses the following modules where CT-Scan image is our main Dataset which helps us use it for Image processing from our modules we can extract the damage cells and we can find out the where the cell is damaged or not and it can also segmentation of the liver it will helps to get know more about the cancer levels and we are using VGG16 and CNN for processing of the Ct-Scan Images.

The initial step from the issue domain to the solution domain is taken using this approach. In other words, meeting human needs is the main objective of architecture. The system design, which also has a significant influence on testing and maintenance in later phases, may have the greatest impact on the program's quality.

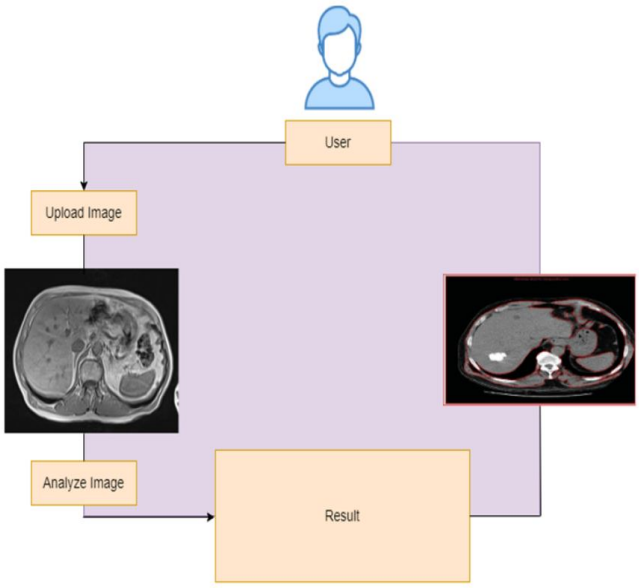


Fig. 1 Overview of the Proposed System

The above figure Fig 1 describes the overall functioning of the proposed system. The user first uploads the image of the CT scan. The image is uploaded to the system and is saved on the proposed system. The uploaded image is then analysed by the deep learning model. The model then analysed the image based on the trained dataset and the result is generated. The result is the output image of the CT scan where the cancer cells are circled out so the user can then identify the cancer cells present in the CT Scan of the image.

A. Dataset

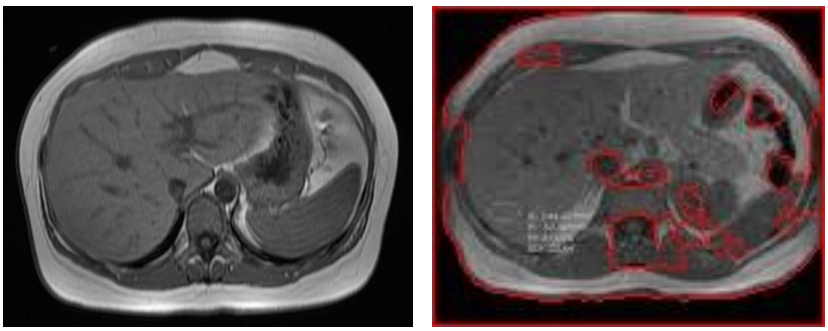


Fig. 2 Sample Liver Dataset and Segmentation

The All of the patients in the CT-Scan dataset used for the proposed system's image processing are liver cancer patients, making it useful for us as we train and test the information and work on image processing and segmentation. From the above figure 2 we can take the CT-Scan dataset of the liver which has the liver cancer where we can find the cell damage in the other CT-Scan image which is knows as Segmentation from this we can predict the liver cancer cells and can find out the Accuracy also.

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B. Login Module

The Login Module is used by the users to log into the system. It is integrated into the system to ensure that the system is secured from unauthenticated users. Therefore, ensuring data privacy in the system. The module takes in the username and password and checks with the provided credentials. If the given credentials are correct, the system redirects the user to the home page.

C. Image Upload Module

In this module, the user uploads the CT scan image to the proposed system. The proposed system then takes in the images and stores it in a local folder. Using this image, the proposed system can further train the model or even predict cancer in the image.

D. Model Training Module

This module is used to train the CNN model of the proposed system. The proposed system takes in the uploaded image and trains the model. Hence the system can then be able to predict cancer in the uploaded CT scan. This is a critical phase in the system to ensure that the system is able to predict cancer in the liver.

E. Segmentation Module

This module is used to be able to distinguish the healthy cells from the unhealthy cells. After the model has been trained, the trained model analyses the uploaded CT Scan image and performs segmentation, where the system separated in the image the healthy cells from the unhealthy cells.

F. Prediction with VGG16 Module

This module consists of the model which is used to make prediction of the existence of cancer in a liver. The module first uses the image and analyses the image by analysing each individual pixel of the image. Based on how the module was trained, the module at individual pixel level determines if the cell being analysed is a cancer cell or not.

G. Predicting with Random Forest Algorithm Module

In this module the system uses multiple decision trees to make decisions if it is a cancer cell or not. It then uses the decision of multiple decision trees and takes an average of all the decisions taken. And uses voting to take the final decision to determine the existence of cancer or not.

V. RESULT ANALYSIS.

The dashboard of the proposed system where the user can navigate to all the functionalities of the proposed system. The dashboard used for upload the CT-Scan Liver Image and get all the Result on the dataset and it shows the comparative study for CNN and Random forest methods. After Uploading of Image, it is used for the segmentation of the liver cells as shown in the below figure Fig 3.

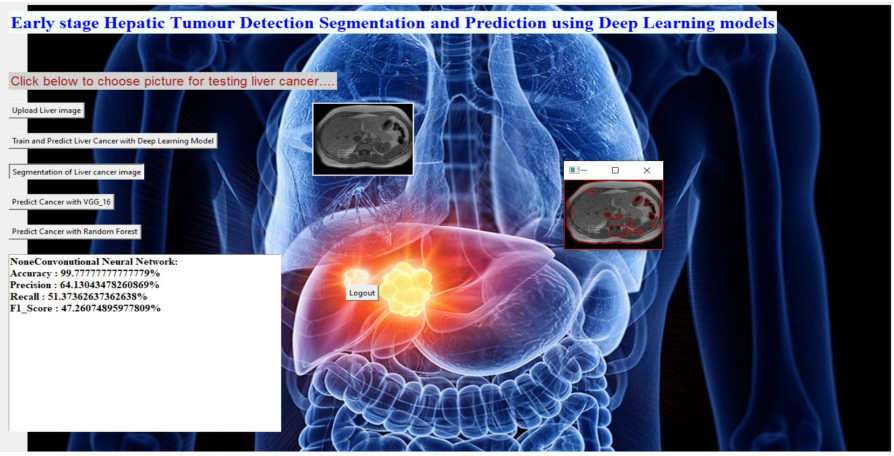


Fig. 3 Segmentation of the liver and CNN Results

The below figure Fig 4 shows the Results of the CNN and Random Forest Method where we can make a comparative study and can get the High results in the CT-Scan image with CNN method compare to Random Forest Method. From the Comparative study we can say that CNN Gives more accuracy than the Random Forest method and it is helpful to get the Analysis of the CT-Scan Images

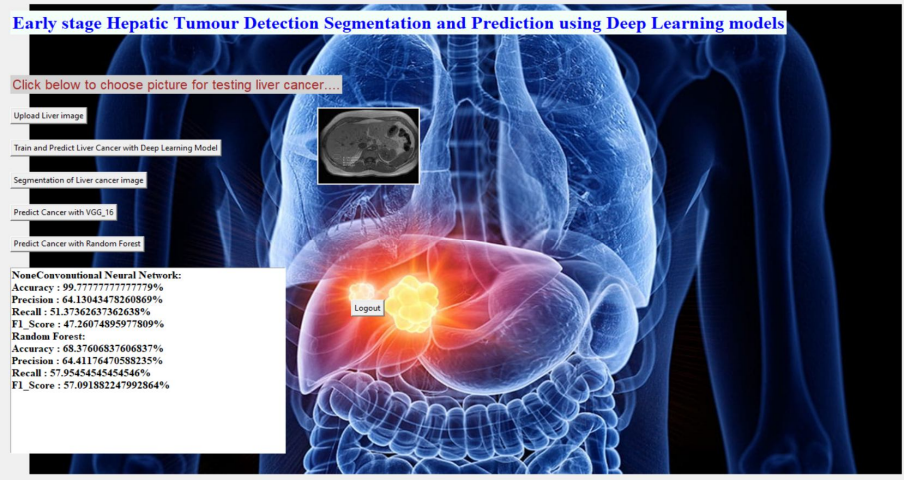


Fig. 4 Results of the CNN and Random Forest Method

Comparative analysis is the practice of contrasting different algorithms and identifying their similarities and differences. It can develop methods to address the problem and get a deeper understanding of it via comparative study. The results of CT-Scans with flaws showed tumor segments in an accurate and clear manner. By analysing and decoding little quantities of information from segments, CNNs were able to successfully identify even the smallest tumour cells

Algorithm	Accuracy (%)	Precision (%)	Recall (%)	F1_Score (%)
CNN	91.2307	70.2597	59.1282	62.2950
Random Forest Method	67.5213	62.7784	56.7045	55.3972

Table. 1 Analysis of Proposed System

Based on the above graphical representation on all the data. We can identify that the Convolutional Neural Network performs better under all circumstances. Hence the CNN model is determined to be more accurate in its prediction towards liver cancer.

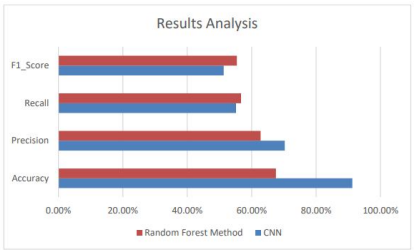


Table. 2 Result Analysis

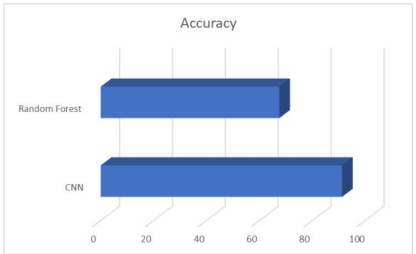


Table. 3 Accuracy of the system

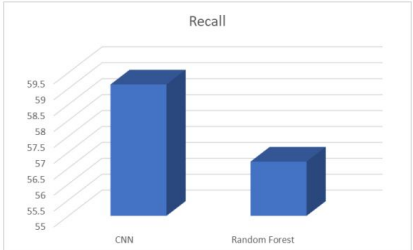


Table. 4 Recall of the system

The Above graphs represents the accuracy and recall score of the proposed system and Recall between the two algorithms the recall is determined as the proportion of Positive samples that were correctly identified as Positive to all Positive samples. The recall measures how well the model can identify positive samples.

By seeing the Result Analysis, we can identify that the Convolutional Neural Network performs better under all circumstances. Hence the CNN model is determined to be more accurate in its prediction towards liver cancer.

VI. CONCLUSION

Due to the disease's late discovery, patients with liver cancer have a significant fatality rate. Early detection of liver cancer can be facilitated by computer-aided diagnostic systems based on a range of medical imaging techniques. The proposed method for liver cancer identification and segmentation is a valid tool for liver tumour diagnosis. The tumors location is identified using medical images and image processing to identify liver cancer. And It is suggested to classify and segment the liver tumor from the abdominal CT imaging. It helps doctors predict liver tumors, analyses them, and perform tumor surgical analysis. This project has a lot of room for improvement, other methods may be used to increase accuracy

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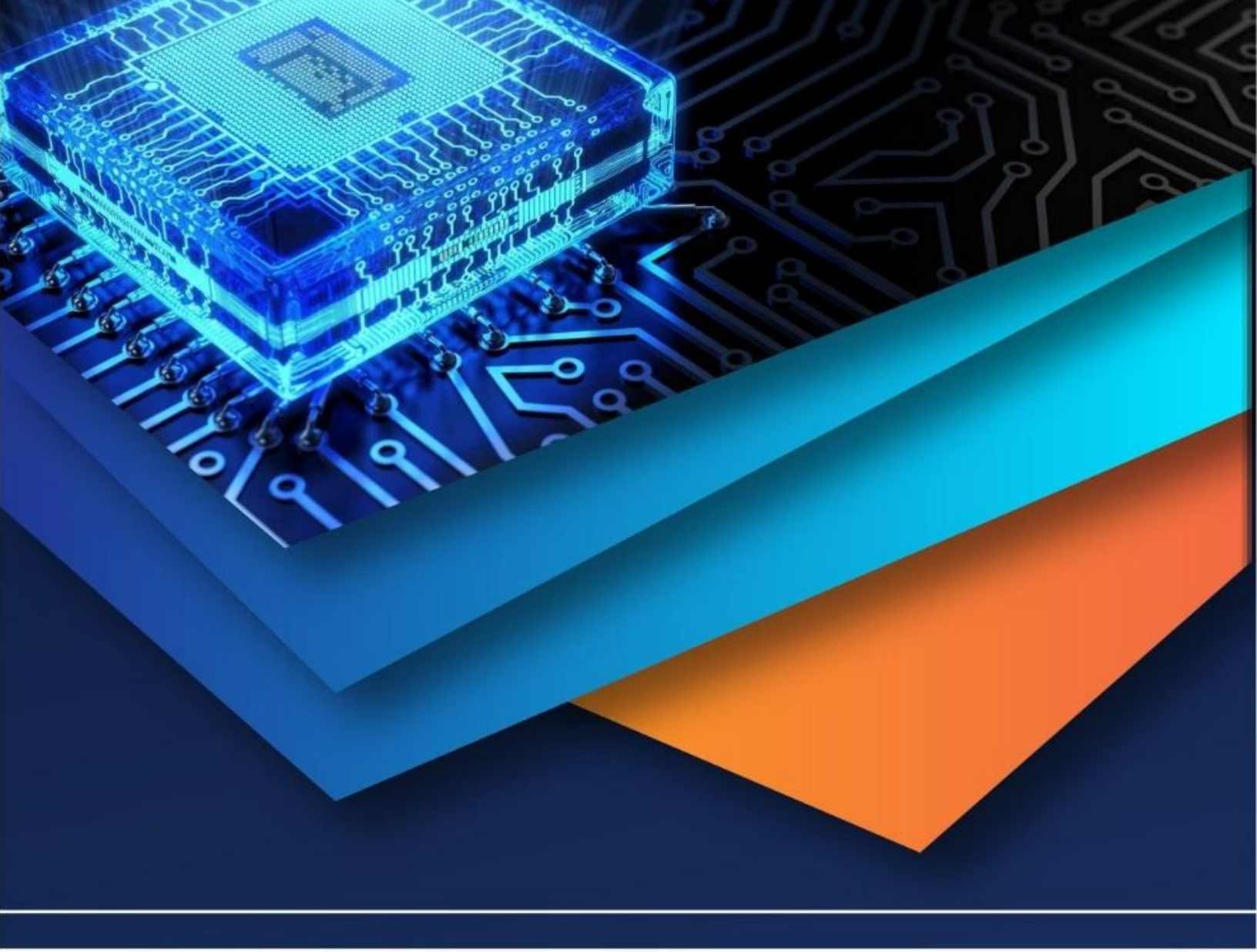
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