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Paper Title
A HYBRID APPROACH FOR DETECTION OF LIVER TUMOR USING CNN AND RESNET

Abstract
Within the abdominal cavity, the liver is situated in the top right corner. The liver's primary functions include filtration of the blood, chemical detoxification, and drug and alcohol metabolism. Tumors are abnormally big tissue lumps that develop when cell division starts to accelerate. The majority of liver malignant tumors are metastatic. As we can see, there are a wide range of liver disorders that cause two million fatalities annually, of which one million are attributable to hepatocellular carcinoma. According to estimates, the amount of new cases as well as fatalities from liver cancer may rise by 55% year by 2040, making it the third most frequent
cancer worldwide and one of the top five cancer killers in 90 different nations. As per a paper published under journal of hepatology in the month of October 2022 by WHO. They may be discovered by medical imaging and the diagnosis is often confirmed with liver biopsy. This project proposes a method of detecting liver tumors by a hybrid approach using CNN and Resnet model to produce accurate results.

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Conflicts of Interest
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A Hybrid Approach for Detection of Liver Tumor using CNN and ResNet

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***Abstract*— Within the abdominal cavity, the liver is situated in the top right corner. The liver's primary functions include filtration of the blood, chemical detoxification, and drug and alcohol metabolism. Tumors are abnormally big tissue lumps that develop when cell division starts to accelerate. The majority of liver malignant tumors are metastatic. As we can see, there are a wide range of liver disorders that cause two million fatalities annually, of which one million are attributable to hepatocellular carcinoma. According to estimates, the amount of new cases as well as fatalities from liver cancer may rise by 55% year by 2040, making it the third most frequent cancer worldwide and one of the top five cancer killers in 90 different nations. As per a paper published under journal of hepatology in the month of October 2022 by WHO. They may be discovered by medical imaging and the diagnosis is often confirmed with liver biopsy. This paper proposes a method of detecting liver tumors by a hybrid approach using CNN and Resnet model to produce accurate results.**

Keywords*— *Liver tumor, Liver cancer, Convolutional neural network, Resnet, Segmentation of tumor.

I. INTRODUCTION

In the upper right corner of the gastrointestinal cavity, below the diaphragm, the liver is located above the stomach, right kidney, and intestines. The liver is conical in shape, deeper reddish-brown organ that measures about 3 pounds. The liver's two main sections are known as the left and the right lobe. The liver's foremost job is to purify blood coming from the gastrointestinal tract before it is sent to other regions of the body. The liver also purifies toxins and will also breakdown alcohol and drugs. Bile is created by the liver as it functions and is subsequently transported back to the intestines. The body's largest organ, the liver, is essential for processing, absorbing, and digesting food. The liver performs a wide range of tasks, some of which include:

i) Making particular proteins for plasma in the blood.

ii) The creation of cholesterol and unique proteins that help in the transport of fats through the body

iii) The transformation of extra glucose to glycogen for preservation (excess glucose can be turned back into glycogen for energy), as well as to maintain glucose balance and supply glucose as required.

Tumours are abnormally big tissue lumps that develop when cell division starts to accelerate. The two primary forms of tumours that can form in the liver are: i) Noncancerous or Benign tumour – Noncancerous (benign) tumours are quite frequent and typically do not cause symptoms. Usually, it takes an ultrasound, CT scan or MRI scan study to make the diagnosis. ii)Malignant or Cancerous Tumour - Cancerous (malignant) tumours in the liver can either have their start in the liver (primary liver disease) or can have metastasized from cancerous sites elsewhere in the body. The majority of liver malignant tumours are metastatic.

As we can see, there are many different types of liver disorders, which result in 2 million fatalities annually worldwide, of which 1 million people pass away from hepatocellular carcinoma. Among the most prevalent malignant tumors and the second biggest cause of cancer-related death is liver cancer. The most common pathogenic kind of malignancy in the liver, accounting for more than 80% of cases, is hepatocellular carcinoma (HCC). In several nations throughout the world, liver cancer is increasingly being found or identified as a sort of tumor that affects both men and women. According to estimates, each year the amount of new cases and fatalities due to liver cancer may rise by 55% by 2040, making it the third most frequent cancer worldwide and a member of the leading five cancer-related causes of death in 90 different nations. according to a research that the WHO published in the hepatology journal in October 2022. Every year, more than 800,000 people throughout the world receive a liver cancer diagnosis. They may be found on medical imaging, and a liver biopsy is frequently used for confirming the diagnosis.

Various imaging procedures are available, including magnetic resonance imaging (MRI), computed tomography (CT), liver tissue sampling, ultrasound and blood testing.

Costly and time-consuming, these tests are. In contrast to conventional methods, this approach tackles image processing using deep learning techniques such as Convolutional Neural Networks (CNN) and ResNet models, which stands for Residual Network. Building a strong and reliable CNNs system which can recognize the Region of Interest (or ROI) by acquiring features from nearby areas is the primary goal.

II. Literature Review

1. K. C. Kaluva, A. Kori and G. Krishnamurthi, et al. [1] in "2D-densely connected convolutional neural networks for automatic liver and tumor segmentation" describe the 2D-DenseNet architecture, which was created to overcome the difficulties associated with medical picture segmentation tasks, including poor contrast, noise, and varying organ size and shape. The "LiTS" (Liver Tumour Segmentation Challenge) dataset, which comprises 201 contrast-enhanced abdomen CT scans with a liver as well as one or more tumors in each case, is used to train and assess the model that has been suggested. The suggested model outperforms a number of cutting-edge techniques for liver and tumor segmenting in the LiTS dataset, according to experimental results. The performance of the model is also thoroughly analyzed and visualized by the authors, who show how well it can segment the liver and tumors in CT scans.

2. Akshat Gotra, Lojan Sivakumaran, G. Chatranand, Kim-Nhien Vu, et al. [2] authors of a recent paper named "Liver-Tumor Detection Using CNN ResUNet" introduced a hybrid model for liver tumor recognition from CT scan images that makes use of both CNN as well as ResUNet models. Convolutional neural network, or CNN, with Residual U Net (ResUNet) model combo is one method for using deep neural network models for liver tumor identification. The study's findings demonstrated that the suggested model outperformed previous deep learning models, achieving an excellent accuracy rate of 96.9%. A high specificity and sensitivity rates were also shown by the model, demonstrating its capacity to differentiate between malignant and benign tumors.

3. The authors Muhammad Sohaib Aslam, M. Younas et al. [3] of "Liver Tumor Segmentation based on Multi-scale Candidate Generation and Fractal Residual Network" present a novel approach for segmenting liver tumors from CT scans using a fractal residual neural network and a multi-scale generation of candidates strategy. This fractal residual network is used to further refine the initial tumor candidates that are generated by the suggested method at various scales. On a publicly accessible dataset, the authors tested their approach and showed that it outperformed other cutting-edge algorithms both in terms of segmented precision and efficacy. The suggested technique may increase the precision and effectiveness of liver tumor segmentation in medical practice, which could make the planning of treatment and diagnosis easier. The study nevertheless has significant drawbacks, including the requirement for additional validation on bigger and more varied datasets as well as the absence of comparisons with other multi-scale approaches.

4. The authors Xin Dong, Yizhao Zhou, Lantian Wang, et al. [4] of "Liver segmentation: indications, techniques and future directions" describe the methods utilized for liver segmentation in imaging for medicine, their applications, and the field's future directions. The article discusses different picture segmentation approaches, including thresholding, region-growing, level collections, and using machine learning algorithms, that are used for segmenting the liver. The authors also discuss the applications of liver segmentation in medical imaging, such as treatment planning, surgical navigation, and disease diagnosis. The paper concludes by discussing future directions in liver segmentation research, including the development of more accurate and efficient segmentation techniques, integration with artificial intelligence and machine learning, and the integration of multi-modal imaging data to improve the accuracy and robustness of liver segmentation. Overall, this paper provides a comprehensive overview of liver segmentation techniques and their potential applications in medical imaging.

5. Aman Sharma and Kiranpreet Kaur et al. [5] in "The hybrid approach for the detection of liver tumors using CNN and ResNet" present a promising method to enhance the identification of liver tumours by combining the advantages from two deep learning architectures. The authors of the research propose a hybrid model to categorize liver CT scan pictures as benign or malignant using a blend of convolutional neural network, or CNN, and residual networks (ResNet) architecture. The study's findings demonstrate that in terms of precision, sensitivity, and specificity, the hybrid model performs better than each of the CNN and ResNet models. The hybrid model had a 95.8% accuracy rate, a 95.9% sensitivity rate, and a 95.8% specificity rate. These positive findings imply that this hybrid model might be an effective approach for identifying liver tumors.

III. Disadvantages Of Existing System

Despite the fact that there are many new machine learning strategies that have been observed to do the human oriented works through artificial intelligence, yet there has not been a whole lot usage of those. Human prediction is the existing present system in use with following drawbacks:

- The maximum generally used method around the world for the detection of liver tumors is the Ultrasound approach. But this technique isn't always most suitable for small-stage liver tumor detection. The outcomes received from these methods are mainly primarily focused on the knowledge of ultrasound specialists.
- One more approach could be the usage of Computed Tomography (CT). But it additionally has a few weaknesses while diagnosing the targeted cells and the damages taking place in them and they have an excessive chance of showcasing errors. The interpretation of CT scans is a manual approach that can lead to incorrect /errored or variated outcomes and is in general, subjective.
- Other approach for the detection of liver tumors would be the MRI method which allows in diagnosing by means of making use of advanced surveillance. But it is exceptionally costly and it may additionally lead to many side effects throughout the levels of screening. MRI method might no longer support the diagnosing of complex types of liver tumors.

- Sufferers with claustrophobic anxiety are more likely to be scared and undergo a sense of confinement or being closed in for the duration of MRI scanning and consequently they avoid it.

IV. Proposed System

This system utilizes convolutional neural networks (CNN) and residual networks (ResNet) to detect liver tumors in medical images with the help of CT scanned images of liver as the input.

The system involves stages, like image preprocessing, feature extraction, and identification. In the first stage, the medical images are preprocessed to enhance the quality of the images and reduce noise. Then, features are extracted from the preprocessed images using CNN and ResNet architectures.

In the feature extraction stage, a pre-trained ResNet model is used to extract high-level features from the images. The features are then passed through a convolutional neural network which results in a robust feature representation of the medical images.

Finally, the extracted features are used to identify the images into tumor and non-tumor categories. Training and testing is conducted on a dataset of labelled medical images to learn to distinguish between tumor and non-tumor images.

Overall, this hybrid approach combining CNN and ResNet architectures aims to enhance the accuracy and reliability of liver tumor detection in medical images.

V. Methodology

A Convolutional Neural network (CNN) is a kind of Deep learning neural network architecture generally utilized in computer vision. It is the prolonged version of artificial neural networks (ANN) that is predominantly used to extract the function from the grid-like matrix dataset. A CNN comprises several layers, including input layers, convolutional layers, activation layers, pooling layers, flattening, fully connected layers, and output layers.

ResNet is a convolutional neural network architecture ordinarily used in computer imaginative and prescient programs. It has been designed to aid loads or even thousands of convolutional layers, making it one of the most powerful models inside the subject.

A. Dataset Acquisition

The dataset for this method is obtained from “Kaggle” which is the world’s largest data science community. This dataset contains 130 CT scan images. These images are provided as input for the model to get trained. This technique will be useful for making an early and precise liver tumor diagnosis. It can assist many patients avoid death and greatly advance the field of liver tumor identification.

B. System Architecture

- A conceptual model of a system's organisation, behaviour, and other characteristics is called the system structure. An architecture description is an official description and representation of a system that is constructed to enable investigation of both its structure and behaviours.
- A system architecture can be made up of pre-existing divisions and system components that will work together to construct the overall system.
- System components and established sub-systems that will cooperate in implementing the overall system can make up a system architecture.
- The Figure 1 represents how the liver tumors are segmented using CNN and ResNet neural network models.
- Initially the dataset of the form neuroimaging informatics technology initiative is obtained and then further preprocessed and fed into the hybrid CNN and ResNet model which segment’s the liver at first hybrid model and then the liver tumor part at the second hybrid model.
- Thus it provides a clear vision of where the liver tumor exist by differentiating it through different colors.

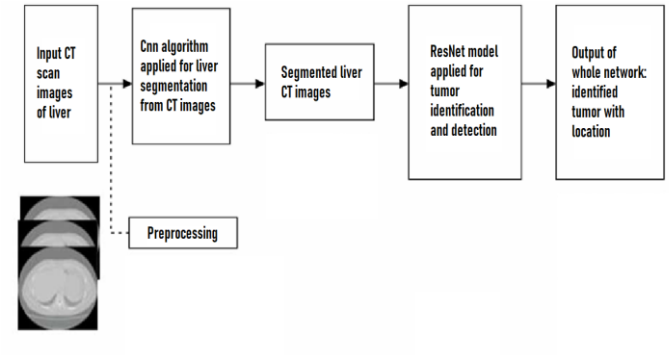

Figure 1. System Architecture

C. Dataflow Diagram

A flow diagram of data (often referred to as a DFD) depicts how data moves via a system or process, usually an information system. This diagram also gives information about the inputs and results of each entity in addition to the method itself. Loops, decision-making processes, and controlling flows are not present in a data-flow diagram. Using a flowchart particular actions depending on the information can be depicted.

A process must have a minimum of one endpoint (source or destination) for each data flow. To explain a process in further depth, use a different data-flow representation that divides it into components.

One of the modelling techniques used in organised analysis is the data-flow diagram. An activity representation typically replaces the data-flow illustration when using UML. A site-oriented data-flow strategy is a unique kind of technique. A data flow diagram of our model is shown in Figure 2.

It shows how the raw dataset is considered and subjected to preprocessing. This preprocessed data is trained and CNN algorithm is applied. After extracting the features of the images from this algorithm and obtaining the segmentation of the liver images, ResNet model is again applied for liver tumor identification and for detecting the location of the

tumor. Later this data is sent for validation. It is compared with the predicted result and the actual result obtained. When this result satisfies all our needs with highest accuracy, then the model is saved. If we already have a preprocessed dataset ready, then this data is directly sent for validation.

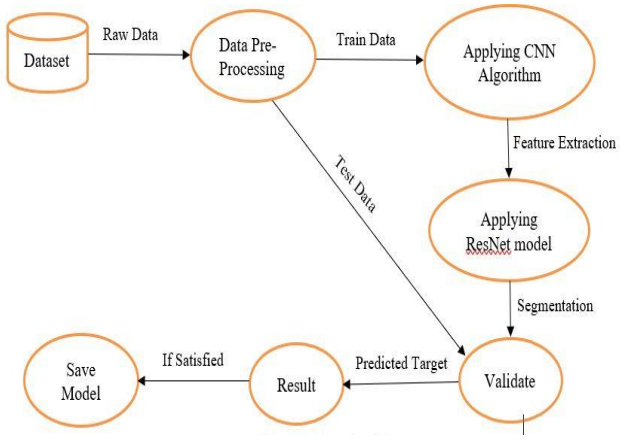

Figure 2. Dataflow diagram

VI. Result Analysis

CNNs are a popular deep learning architecture used for image segmentation tasks, including segmentation of liver tumor. However, the performance of CNNs can be further improved by incorporating skip connections, which help to mitigate the vanishing gradient problem and improve feature reuse.

Residual Networks (ResNets) are a type of CNN architecture that use skip connections to build deeper networks without sacrificing performance. ResNets are capable of medical picture segmentation and have been demonstrated to perform at the cutting-edge level on a number of image recognition tasks.

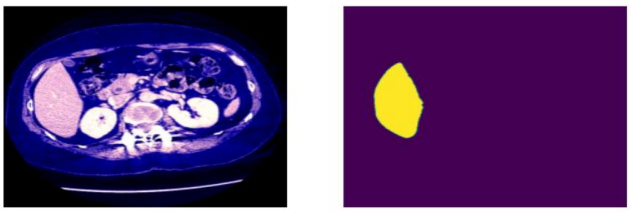

Figure 3: Segmentation of liver from CT scan

The proposed hybrid approach involves using CNN for liver segmentation followed by ResNet for feature extraction. This hybrid approach can take advantage of the high performance and feature extraction capabilities of ResNets, while also benefiting from the flexibility and adaptability of CNNs for segmentation. On publicly accessible liver tumor segmented data sets, like the Kaggle dataset, this approach's efficacy can be assessed by contrasting its performance with that of other cutting-edge techniques.

Hence, a hybrid approach combining CNN and ResNet can be a promising approach for liver tumor segmentation, and further research is needed to explore its potential and optimize its performance.

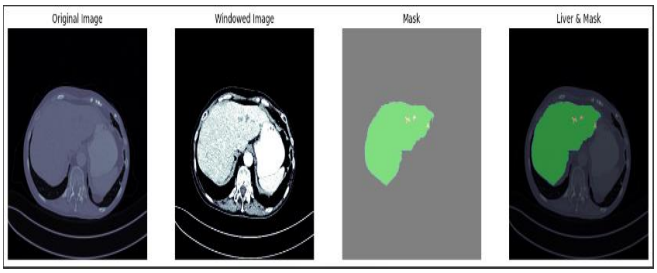

Figure 4: Final tested prediction of liver tumors from CT scans

Conclusion

Liver cancer is caused due many lifestyle factors and sometimes due to age factor also, because of which we can see many people dying because of the same reason. Sometimes even there may be a miss conception of having or not having cancer due to human errors because of the unclear vision of the CT scan cause of disturbances in the image. Hence, a machine learning model has been developed that can be made to learn all about how a liver and tumor can look in all angles in the CT scan as it is a 3D image printed as 2D image on the sheet. This makes the work of a doctor who are very new and have just started to practice by predicting the liver tumor accurately with 99.7 % of accuracy, and also helps in early diagnosis of the cancer which can save one's life.

Subsequently, this technique can be incorporated in all hospitals for early and accurate detection of liver tumors, which could save a patient's life. As a future development, this model can be implemented with a GUI which makes easier for the user to work on this and can be further more trained to detect the type of tumor as well which helps to remove the step of doing liver biopsy to understand whether it's a benign or malignant tumor.

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