AI BASED LIVER DISEASE PREDICTION USING CNN ALGORITHM

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ABSTRACT

Liver cancer remains a significant global health concern due to its high mortality rates and the scarcity of reliable methods for early-stage detection. In response to this challenge, this study introduces an advanced deep learning framework based on the Residual Neural Network (ResNet) architecture to enhance the prediction of liver cancer. Leveraging the strengths of ResNet in managing complex data structures and extracting critical patterns, the model is trained and tested on a comprehensive dataset that includes clinical details, demographic information, imaging results, and biomarker profiles. Model performance is assessed through key metrics such as accuracy, sensitivity, specificity, and the area under the ROC curve (AUC-ROC). Additionally, feature importance analysis is performed to determine which input variables most significantly influence prediction outcomes. Experimental results reveal that the ResNet-based system achieves high predictive performance, surpassing conventional machine learning approaches. This work contributes to the growing field of AI-driven medical diagnostics and supports efforts aimed at facilitating earlier detection and improved clinical management of liver cancer.

Keywords: Liver Cancer Detection, Deep Neural Networks, ResNet Architecture, Clinical Data Analytics, Imaging-Based Diagnosis, Biomarker Evaluation, Predictive Modeling, AUC-ROC, Feature Analysis, AI in Oncology.

INTRODUCTION

Liver cancer, also known as hepatic cancer, is a significant global health concern marked by the abnormal growth of cells within the liver. It is one of the most prevalent and deadliest cancers worldwide, posing serious challenges to healthcare systems and severely impacting individuals' quality of life. The disease represents a substantial burden on public health, with its incidence varying across different regions and populations. According to the World Health Organization (WHO), liver cancer ranks as the sixth most common cancer globally and the fourth leading cause of cancer-related deaths.the rise in its incidence over recent decades is largely attributed to factors such as hepatitis B and C infections, alcohol consumption, obesity, and non-alcoholic fatty liver disease (NAFLD). Regions like sub-Saharan Africa and East Asia are disproportionately affected due to the high prevalence of viral hepatitis infections .In conclusion Liver cancer poses a significant global health threat due to its high mortality rate and often late diagnosis. Key contributors to liver cancer development are long-term hepatitis infections, excessive alcohol use, and being overweigh

LITERATURE SURVEY

1.Leveraging Machine Learning for Accurate Liver Cancer Diagnosis:

Liver cancer has seen a notable increase in incidence, largely driven by poor lifestyle choices. To address this challenge, machine learning techniques are increasingly used for more reliable and accurate diagnoses. After performing necessary preprocessing steps such as handling missing data and encoding categorical variables, various machine learning models are applied. Among the seven models tested, the Support Vector Machine (SVM) and LightGBM (LGB) classifiers yielded the highest accuracy with minimal loss. However, when evaluating based on recall, F1 score, and precision, the Random Forest model emerged as the most effective approach for overall diagnostic performance.

2.Automated Liver Cancer Diagnosis Using Structured Databases:

The liver, being the body's largest internal organ, plays a critical role in various physiological functions. For diagnosing liver cancer, CT imaging is a common and important tool. Given the need for rapid and reliable diagnoses,

automated systems have become essential. Traditional diagnostic methods are time-consuming and often rely heavily on physician judgment. To address these limitations, researchers have proposed an integrated system that combines liver cancer-related data from multiple sources. While many existing systems focus primarily on detecting liver tumors, this study highlights the importance of organizing and structuring data for better integration and more efficient use in automated diagnostic systems. The proposed system aims to create a seamless flow of data for enhanced liver cancer detection through computer-aided methods.

3. Hybrid Approach for Enhanced Liver Cancer Detection Using CT and MRI Fusion:

Liver cancer is a highly aggressive disease, and detecting it accurately using imaging data is often complicated due to noisy CT scan images. Anatomical differences across patients further challenge tumor recognition. To improve detection accuracy, this research proposes the fusion of CT scan and MRI images for better results. The fusion process uses a discrete wavelet transform (DWT) to merge the two modalities, followed by advanced feature extraction techniques. Additionally, the study applies a Cuckoo search algorithm to perform feature selection, combined with machine learning models for optimal prediction. The resulting system is fully automated, minimizing the need for human intervention while enhancing diagnostic precision.

4.Comparative Evaluation of Liver Cancer Detection Methods

Liver cancer is a significant health issue worldwide, especially in regions like Asia and Africa, where its prevalence is high. As the largest internal organ, the liver plays a crucial role in various vital processes such as metabolism, detoxification, and protein production. It is also a common site for metastatic cancers, making it a challenging target for detection. Early detection is crucial for improving treatment outcomes and survival rates for liver cancer patients. In this study, we compare different techniques for early liver cancer detection, including machine learning, genetic methods, and digital image processing. Among these, digital image processing has proven to be particularly effective for early diagnosis, leveraging imaging technologies to identify potential signs of cancer at an early stage. After evaluating these methods, the study further focuses on genetic techniques, especially microarray expression data analysis, which has become a key tool for understanding the genetic factors involved in liver cancer. By examining gene expression profiles under various conditions, researchers can identify genes associated with disease progression. This study applies various parametric statistical methods to microarray data, which helps classify genes based on their expression and provides insights into the mechanisms underlying liver cancer development. Additionally, the study investigates the conditions under which these methods perform optimally, using simulated datasets to assess and compare their effectiveness.

5.Online Search Log Analysis for Early Liver Cancer Detection

Liver cancer is often diagnosed at an advanced stage, which limits treatment options and reduces the chances of survival. Early detection is essential for improving outcomes, and new technologies are being explored to facilitate this process. One innovative approach is analyzing online search logs, as many individuals search for health symptoms related to liver cancer. These search behaviors can reveal early warning signs of the disease. This research focuses on using machine learning algorithms to process search logs for detecting liver cancer in its early stages. As the symptoms of liver cancer are often vague in the initial phase, this makes timely diagnosis difficult. The proposed method involves organizing the search logs, which include symptom-related queries and the timing of those searches, to identify patterns that may signal liver cancer. The study tested several machine learning algorithms, including the Support Vector Machine (SVM), with the highest accuracy of 94.30% achieved using specific kernel parameters. Furthermore, the Random Forest model was evaluated and found to have the highest performance, with a classification accuracy of 97.50%. This method of analyzing online search logs provides a novel approach to early detection, leveraging existing digital data to help identify potential health risks.

PROPOSED SYSTEM

The proposed method introduces a novel approach to liver cancer detection by harnessing the capabilities of deep learning-based Res-Net (Residual Network) architecture. Liver cancer stands as a significant contributor to cancer-related mortality globally, presenting formidable challenges for early detection due to its nuanced and diverse characteristics. The utilization of Res-Net, a robust deep learning framework, offers a promising avenue for addressing these challenges by automating the analysis of medical imaging data, including CT scans or MRI images, to identify potential signs of liver cancer with exceptional precision and speed.

Liver cancer's complex nature necessitates advanced computational methods capable of discerning subtle patterns indicative of malignancy. The Res-Net model serves as a powerful tool in this regard, leveraging its deep architecture to extract intricate features from medical imaging data. Unlike traditional machine learning approaches, which may struggle to capture the intricate nuances of complex diseases like liver cancer, Res-Net excels at learning hierarchical representations of data, enabling it to discern subtle abnormalities associated with cancerous tissues.

Central to the proposed method is the training of the Res-Net model on a substantial dataset of annotated medical images. This dataset comprises a diverse array of liver scans, meticulously labeled to indicate regions of interest corresponding to cancerous tissues. Through an iterative training process, the Res-Net model learns to recognize and prioritize distinctive features associated with liver cancer, honing its ability to discriminate between healthy and diseased tissue with increasing accuracy.

SYSTEM SPECIFICATION

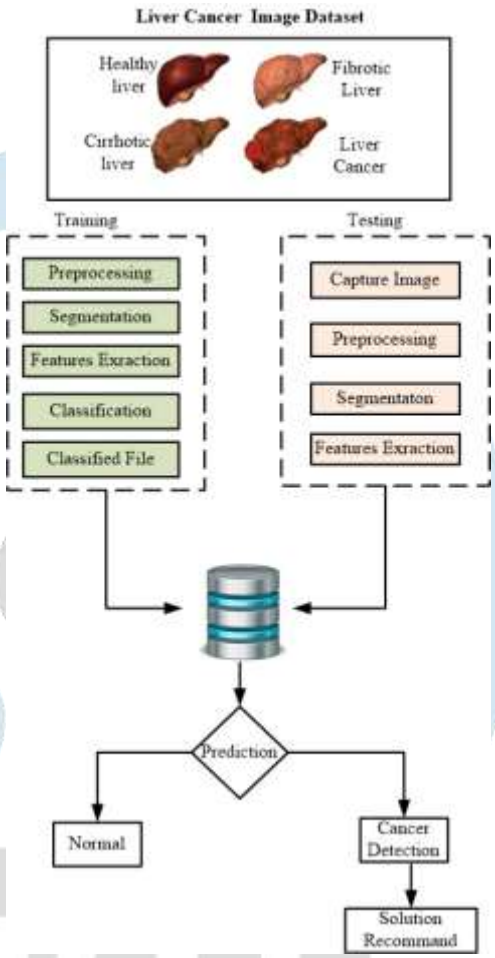
HARDWARE SPECIFICATION

- ✓ Processors:Intel®Core™i5processor4300Mat2.60GHzor2.59GHz(1socket,2cores,2threadsper core),8 GBof DRAM
- ✓ Diskspace:320GB
- ✓ Operatingsystems:Windows®10,macOS*,andLinux*

SOFTWARE SPECIFICATION

- ✓ ServerSide:Python3.7.4(64-bit)or(32-bit)
- ✓ ClientSide:HTML,CSS,Bootstrap
- ✓ IDE :Flask1.1.1
- ✓ Backend: MySQL5.
- ✓ Server :WampServer2i
- ✓ OS :Windows1064–bitorUbuntu18.04LTS“BionicBeaver”

System Architecture



PROJECT DESCRIPTION

Module List

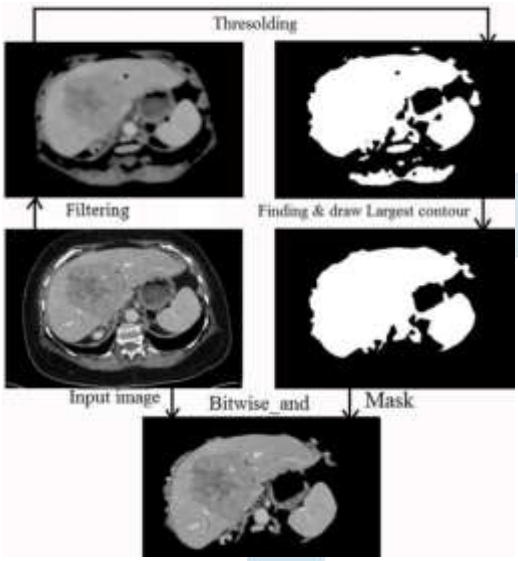
- Liver cancer web dashboard
- Data Preprocessing Module
  - ➢ Preprocessing
  - ➢ Segmentation
  - ➢ Feature Extraction
  - ➢ Classification
- Prediction Module
- Model Evaluation Module
- Recommendation

LIVER CANCER WEB DASHBOARD

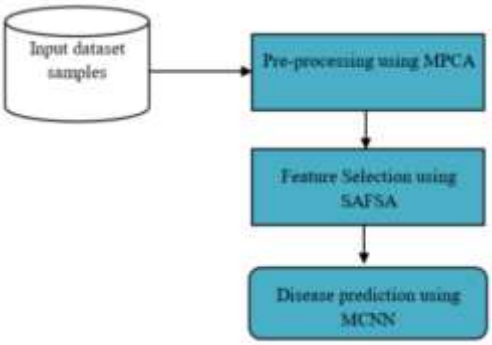
This module represents a pivotal advancement in healthcare technology, offering real-time tracking capabilities for liver cancer cases. By harnessing the power of data analytics and visualization, healthcare providers gain immediate access to critical information regarding the prevalence, progression, and treatment outcomes of liver cancer patients. This real-time tracking functionality empowers clinicians, researchers, and policymakers to make informed

decisions swiftly, enabling timely interventions and personalized patient care.

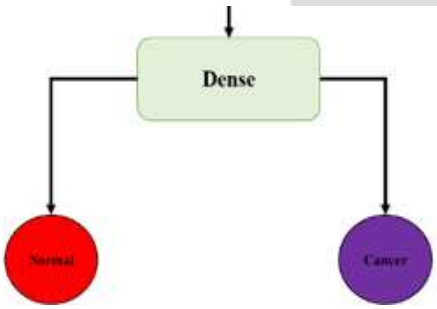
DATA PREPROCESSING



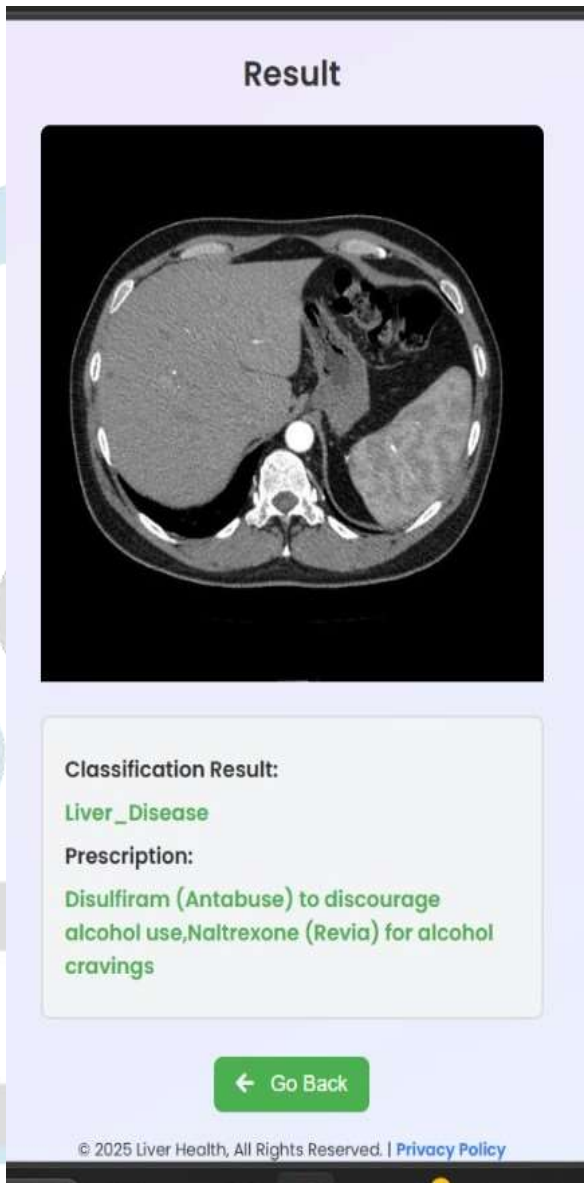
PREDICTION MODULE



MODEL EVALUATION MODULE



Project Result



CONCLUSION

The proposed method represents a pioneering breakthrough in the realm of early liver cancer detection, aiming to overcome the substantial challenges posed by the disease's nuanced and heterogeneous nature. Through the utilization of deep learning-based Res-Net architecture, our approach revolutionizes the analysis of medical imaging data, particularly CT scans and MRI images, with unprecedented precision and efficiency. By leveraging the sophisticated capabilities of Res-Net, which excels in extracting intricate features from complex datasets, our method enhances the accuracy and speed of liver cancer diagnosis. This innovative approach holds immense potential to revolutionize current diagnostic practices, facilitating earlier detection and intervention, ultimately leading to improved patient

outcomes. By enabling healthcare professionals to identify liver cancer at its nascent stages, our method empowers timely treatment initiation, potentially extending survival rates and enhancing quality of life for affected individuals.

FUTURE ENHANCEMENT

Future enhancements for the proposed method include the integration of multi-modal imaging data to further improve diagnostic accuracy. By incorporating additional imaging modalities such as ultrasound, PET scans, or genetic markers, we can provide a more comprehensive and nuanced analysis of liver cancer. Additionally, the development of a user-friendly interface or mobile application could facilitate widespread adoption of our method in clinical practice, allowing healthcare professionals to easily access and interpret diagnostic results.

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