



International Journal of Innovative Research in Computer and Communication Engineering

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





International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

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

Comparative analysis of CNN models for Liver Cancer: A Review

Mirza Noushaba Masrur Mirza Saifullah¹, Dr.S.N.Kakarwal²

Department of CSE, ICEEM, Sambhajinagar, India¹

Professor, Department of CSE, ICEEM, Sambhajinagar, India²

ABSTRACT: This project presents a deep learning based liver cancer detection system using a Convolutional Neural Network (CNN). CT scan images and MRI images are used as input to the system. Since CT images and MRI images contain noise and complex organ structures, a CNN model is trained to automatically extract important features such as edges, texture, and tumor patterns from the images. The CNN consists of convolution layers, activation functions, pooling layers, and fully connected layers that work together to classify the liver as cancerous or non-cancerous. The model learns both local and global features of liver tissues during training. This approach reduces human error and improves diagnostic accuracy. Experimental results show that CNN provides reliable and fast liver cancer detection, making it suitable for medical image analysis applications.

KEYWORDS: Liver Cancer Detection, CT and MRI Imaging, Deep Learning, Convolutional Neural Network

I. INTRODUCTION

The liver plays a vital role in maintaining the body's metabolic and detoxification functions. Liver cancer is one of the leading causes of death worldwide due to late diagnosis. Early detection of liver cancer is very important for effective treatment. CT scan and MRI images imaging is commonly used to examine the liver. However, manual interpretation of CT images and MRI images is time-consuming and prone to errors. Therefore, an automatic detection system is required. Deep learning provides an effective solution for this problem. CNN models can analyze medical images with high accuracy.

Convolutional Neural Networks are widely used in medical image processing. CNNs can automatically learn useful features such as tumor shapes, edges, and intensity patterns from CT images and MRI images. Unlike traditional methods, CNNs do not require manual feature extraction. They can directly work on raw image data. This makes them highly suitable for liver cancer detection. CNN-based systems are also faster and more consistent. They help radiologists by providing reliable predictions.

In liver cancer detection, CNN first extracts important patterns from CT images. These patterns represent differences between healthy and cancerous tissues. The CNN then classifies the image into normal or cancer affected. This process reduces dependency on manual diagnosis. With proper training, CNN models can achieve very high accuracy. Hence, CNN is an effective tool for automatic liver cancer detection.

II. MOTIVATION

1. Liver cancer is difficult to detect at early stages using manual diagnosis.
2. CT images and MRI images contain complex patterns that are hard to analyze visually.
3. CNN can automatically extract important features from medical images.
4. Automated detection reduces human error and saves time.
5. Early and accurate detection improves patient survival rates.

III. LITERATURE SURVEY

David Nam [1], In particular, histopathology and radiology image data contain diagnostic, prognostic and predictive information which AI can extract. Ultimately, such AI systems could be implemented in clinical routine as decision



International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

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

support tools. However, in the context of hepatology, this requires further large-scale clinical validation and regulatory approval. Herein, we summarise the state of the art in AI in hepatology with a particular focus on histopathology and radiology data. We present a roadmap for the further development of novel biomarkers in hepatology and outline critical obstacles which need to be overcome.

Irwin M. Arias MD [2], The liver is the largest organ of the mammalian body and has a highly versatile and complex function. Its specialized role is shown by the fact that, despite intense efforts, the activity of the liver cannot be replaced by artificial equipment. The liver participates in the maintenance of the organism's homeostasis as an active, bidirectional biofilter. It is classed as bidirectional because it filters the portal blood that transports nutritional and toxic compounds from the environment through the gastrointestinal tract and also filters the systemic blood (the body's own products, e.g. bilirubin), providing the only channel of the body, the biliary system, through which non-water-soluble substances can be removed.

Rebecca L. Siegel MPH [3], This progress increasingly reflects treatment advancements, which are especially noticeable in the substantial declines in mortality (about 2% yearly between 2016 and 2020) for leukemia, melanoma, and kidney cancer, notwithstanding. For lung cancer, the incidence is either steady or rising or declining more quickly. In conclusion, increased incidence of breast, prostate, and uterine corpus cancers—which also happen to have the highest racial gaps in mortality—may impede future improvement even while cancer death rates are still declining.

Ahmed M. Anter [4], Computer-aided liver diagnosis helps doctors accurately identify liver abnormalities and reduce the risk of liver surgery. Early diagnosis and detection of liver lesions depend mainly on medical imaging techniques such as magnetic resonance imaging (MRI) and computed tomography (CT). Segmentation and identification of hepatic lesions in these images are very challenging because these images often come with low resolution and severe noise. Many new machine learning and image analysis techniques have been gradually used on this topic, and their performance is still limited.

Anurag Mahajan [5], The largest organ in the body is the liver and primarily helps in metabolism and detoxification. Liver segmentation is a crucial step in liver cancer detection in computer vision-based biomedical image analysis. Liver segmentation is a critical task and results in under-segmentation and over-segmentation due to the complex structure of abdominal computed tomography (CT) images, noise, and textural variations over the image.

Raja Ganesan [6], Primary liver cancer is a heterogeneous disease. Liver cancer metabolism includes both the reprogramming of intracellular metabolism to enable cancer cells to proliferate inappropriately and adapt to the tumor microenvironment and fluctuations in regular tissue metabolism. Currently, metabolomics and metabolite profiling in liver cirrhosis, liver cancer, and hepatocellular carcinoma (HCC) have been in the spotlight in terms of cancer diagnosis, monitoring, and therapy. Metabolomics is the global analysis of small molecules, chemicals, and metabolites.

Gap Analysis

1. Manual and traditional methods are slow and less accurate.
2. Noise and low contrast in CT images reduce detection performance.
3. Many existing models fail to capture small tumor patterns.
4. High-complexity models require large computational resources.
5. Lack of fully automated CNN-based systems limits reliable diagnosis.



International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCCE)

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

IV. SYSTEM ARCHITECTURE

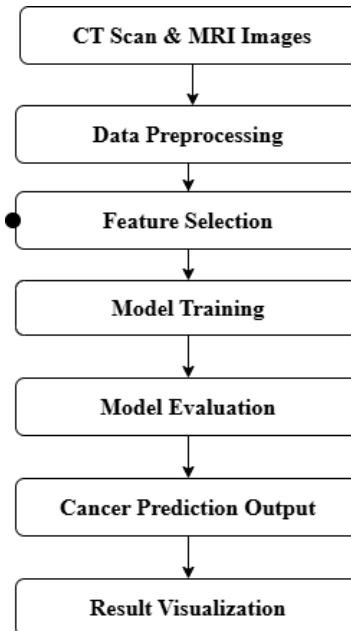


Fig1.1 System Architecture

V. PROPOSED SYSTEM

The proposed system starts by taking CT scan images and MRI images of the liver as input. These images are first preprocessed to remove noise and normalize intensity. The processed images are then given to the CNN model. The convolution layers extract important features such as edges, textures, and tumor shapes. The ReLU activation improves learning by adding non-linearity. Max pooling reduces image size while preserving important features. The extracted features are passed to fully connected layers. Finally, the Softmax layer classifies the image as normal or cancerous and produces the final output.

Algorithms

1. **VGG16** – A deep CNN with 16 layers that extracts detailed texture and shape features from liver CT images to help identify cancer patterns.
2. **ResNet-50** – A 50-layer deep network with residual connections that learns complex liver and tumor features more effectively without accuracy loss.
3. **CNN** – A convolutional neural network that extracts image features and classifies the liver as normal or cancerous.

VI. CONCLUSION

This project demonstrates that a Convolutional Neural Network can effectively detect liver cancer from CT images and MRI images. The CNN model successfully extracts meaningful features and accurately classifies liver conditions. The automated system reduces human effort and improves diagnostic reliability. CNN-based detection is faster and more accurate than traditional manual methods. Therefore, this system can serve as a valuable tool in medical diagnosis for liver cancer.

Future scope

1. Can be extended to real-time hospital systems
2. 3D CT-based tumor volume estimation



International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

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

REFERENCES

1. I. M. Arias, H. J. Alter, J. L. Boyer, D. E. Cohen, D. A. Shafritz, S. S. Thorgeirsson, and A. W. Wolkoff, *The Liver: Biology and Pathobiology*. Hoboken, NJ, USA: Wiley, 2020.
2. R. L. Siegel, K. D. Miller, N. S. Wagle, and A. Jemal, "Cancer statistics, 2023," *CA, A Cancer J. Clinicians*, vol. 73, no. 1, pp. 17–48, Jan. 2023.
3. R. Ganesan, S. J. Yoon, and K. T. Suk, "Microbiome and metabolomics in liver cancer: Scientific technology," *Int. J. Mol. Sci.*, vol. 24, no. 1, p. 537, Dec. 2022.
4. D. Nam, J. Chapiro, V. Paradis, T. P. Seraphin, and J. N. Kather, "Artificial intelligence in liver diseases: Improving diagnostics, prognostics and response prediction," *JHEP Rep.*, vol. 4, no. 4, Apr. 2022, Art. no. 100443.
5. K. M. Napte and A. Mahajan, "Liver segmentation using marker controlled watershed transform," *Int. J. Electr. Comput. Eng. (IJECE)*, vol. 13, no. 2, p. 1541, Apr. 2023.
6. A. M. Anter and L. Abualigah, "Deep federated machine learning-based optimization methods for liver tumor diagnosis: A review," *Arch. Comput. Methods Eng.*, vol. 30, no. 5, pp. 3359–3378, Jun. 2023.
7. P.M. Paithane, Dr.S.N. Kakarwal, Published a chapter "Automatic Determination Number of Cluster for Multi Kernel NMKFCM Algorithm on Image Segmentation " in a book "Advances in Intelligent Systems and Computing", Springer, Volume, ISBN 978-3-030-16659-5, pp.870-879.
8. Rahul Mapari, Dr. S. Kakarwal, Dr. R.R. Deshmukh, Brain Tumor Classification and Segmentation using DTCW Transform, Back Propagation Neural Network and Spatial Fuzzy C-Means Clustering, *International Journal of Innovative Technology and Exploring Engineering (IJITEE)*, ISSN: 2278-3075, Volume-9 Issue-5, Mar 2020, pp. 2073-2079
9. P.M. Paithane , Dr.S.N. Kakarwal, Automatic Pancreas Segmentation using A Novel Modified Semantic Deep Learning Bottom-Up Approach, *International Journal of Intelligent Systems and Applications in Engineering*, Vol.10(1), 2022, ISSN: 2147-6799, pp.98-104



INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

 9940 572 462  6381 907 438  ijircce@gmail.com



www.ijircce.com

Scan to save the contact details