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Enhancing Gastric Cancer Lymph Node Detection through DL Analysis of CT Images: A Novel Approach for Improved Diagnosis and Treatment

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ABSTRACT- Although gastric cancer is a prevalent disease worldwide, accurate diagnosis and treatment of this condition depend on the ability to detect the lymph nodes. Recently, the use of Deep learning (DL) techniques combined with CT imaging has led to the development of new tools that can improve the detection of this disease. In this study, we will focus on the use of CNNs, specifically those built on the “MobileNet” and “AlexNet” platforms, to improve the detection of gastric cancer lymph nodes. The study begins with an overview of gastric cancer and discusses the importance of detecting the lymph nodes in the disease management cycle. CT and DL are discussed as potential technologies that can improve the accuracy of this detection. The study will look into the performance of CNNs, namely those built on the “AlexNet” and “MobileNet” platforms, in detecting the nodes in CT images of patients with gastric cancer. The study utilizes a dataset consisting of images of individuals with gastric cancer who have annotated lymph nodes. Various preprocessing steps, such as segmentation and image normalization, are carried out to improve the relevance and quality of the data. The two CNN architectures, namely “MobileNet” and the “AlexNet”, are evaluated for their performance in this area. Transfer learning methods are utilized to fine-tune models for detecting the lymph nodes. The results of the experiments are analyzed to determine the models' performance. The findings show that the “MobileNet” model is more accurate than the other platforms when it comes to detecting the lymph nodes. The study highlights the advantages of using DL techniques to enhance the accuracy of detecting the nodes in patients suffering from gastric cancer. It supports the notion that such techniques could help improve the diagnosis and treatment outcomes of this disease.

General Terms: Health care, Convolution Neural Network, Gastric Cancer.
Keywords: Gastric Cancer, Deep Learning, MobileNet, AlexNet, CT Images.

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1. INTRODUCTION

The gastric cancer is a major health issue that has a significant effect on mortality. It is regarded as the fifth most common type of cancer worldwide, and it is also the third leading cancer cause of fatalities [1]. The incidence rate of this disease varies, with higher rates reported in Eastern Europe, South America, and Eastern Asia. The prognosis for patients with gastric cancer is often poor due to the presence of lymph node metastases and its late diagnosis. This condition is a critical factor that affects the treatment decisions. The precise diagnosis and characterization of gastric cancer's lymph node metastases are two of the most important factors that are considered when it comes to the treatment of the disease. The presence of this condition can affect the choice of various surgical procedures and the extent to which lymphadenectomy is performed [2], [3].

Histopathology has been utilized in the evaluation of gastric cancer's lymph nodes. This method is not ideal for assessing the status of the nodes in the body prior to surgery. Technological advancements in the field of imaging have led to the development of new imaging methods that can improve the detection and staging of gastric cancer. One of these is computed tomography. This type of imaging allows for the detailed anatomical details of the lymph nodes. CT scans can visualize the enlargement of the lymph nodes, which is often a sign of the spread of the cancer. They can also help identify those who would benefit from undergoing neoadjuvant therapy or other procedures. The use of AI in the diagnosis of gastric cancer, we have thoroughly examined the various frameworks utilized in this field, including CNNs and deep learning. Our review provides an extensive evaluation of their limitations and strengths, especially in this application. We highlight the challenges and advantages of each algorithm by reviewing the literature and discussing their applications for analyzing gastric cancer.

The exact diagnosis and characterization of the presence of lymph node metastasis in CT scans is not always possible due to the complexity of the disease. This is because the process of manual classification and detection of the lymph nodes is time-consuming and subjective. In order to improve the accuracy and efficiency of this procedure, a reliable and automated method must be developed. The use of DL techniques in the field of medical image analysis has been regarded as a promising technology. One of the most popular platforms used for this type of analysis is the Convolutional Neural Network. Through its architecture, CNNs can perform well in the classification of images by learning complex spatial features.

The goal of this study is to analyze the performance of CNN models in detecting the presence of lymph nodes in CT scans of patients with gastric cancer. We will compare the two popular CNN platforms, namely the “MobileNet” and “AlexNet”, in this regard. In 2012, the “AlexNet” model was able to perform an unprecedented performance on ImageNet. The “MobileNet” model was developed by Howard and colleagues in 2017. It is known for its efficient performance in resource-constrained applications [4]–[6].

The goal of this research is to analyze the performance of CNN models in detecting the presence of lymph nodes in CT scans of patients with gastric cancer. The development of effective DL techniques for this procedure could have a significant impact on the clinical decision-making process and the survival rates of patients. By automating the process, these models could help improve the efficiency and effectiveness of the treatment of patients with this disease [7]. The potential of DL models to improve the accuracy of manual lymph node detection has been acknowledged. Currently, the manual method is time-consuming and can be very subjective, especially when it comes to the interpretation of the images by radiologists. The variations in interpretations can also lead to inaccurate treatment plans.

The research will compare the performance of the popular CNN models in performing the same tasks on CT scans of patients suffering from gastric cancer. The findings will help us determine which model is suitable for this specific application. Both the “MobileNet” and the “AlexNet” models have demonstrated their ability to perform well in various image analysis applications. The research will be carried out using a well-defined and curated dataset, which consists of CT images of individuals suffering from gastric cancer who have annotated lymph nodes. To improve the relevance and quality of the data, various techniques such as segmentation and image normalization will be used. In order to perform well on large-scale classification tasks, the researchers will use a DL method known as transfer learning [8], [9].

The researchers will then apply the learned features to the gastric cancer dataset and improve the models' performance in detecting lymph nodes. The evaluation of the models will be carried out according to their performance parameters, such as sensitivity, specificity, accuracy, and area under AUC-ROC. A comparative analysis of the two CNN models will also be conducted to determine which one is suitable for this particular application. Case studies and visualizations will be presented to support the proposed DL algorithm. The goal of the research is to improve the accuracy of the detection of lymph nodes in patients with gastric cancer. This process can lead to better treatment plans and reduce the likelihood of false alarms. Through the use of DL models, we can create a tool that can help radiologists make more informed decisions and improve the quality of patient care [10].

The results of the study can potentially have a significant impact on the treatment and diagnosis of gastric cancer. Integrating DL techniques into CT scans for detecting lymph nodes could lead to the development of systems that can identify other aspects of the illness, such as tumor size and localization. The findings of the study can inspire the development of new and improved systems that can detect gastric cancer lymph nodes. It can also motivate researchers to explore hybrid models or ensembles for this purpose. The research aims to use the power of CT and DL to improve the accuracy of detecting lymph nodes in patients with gastric cancer. It emphasizes the limitations of current methods and how important it is to have a precise assessment of the disease. The study will analyze the performance of the DL models, such as “MobileNet” and “AlexNet”, in detecting the nodes in the lymph nodes. The motivation behind the research is to develop efficient and automated approaches that can eliminate the need for manual analysis. The results of the evaluation can have a significant impact in the field of gastric cancer care and could lead to better patient management.

2. LITERATURE REVIEW

Due to the increasing prevalence of gastric cancer, it is considered a major health concern. The use of ML and medical imaging techniques has shown that they can improve the diagnosis and prognosis of this disease. This literature review aims to review the various studies that have been conducted on the use of these technologies in the treatment of this disease.

Our discussion delved into the fundamental aspects of this diagnostic procedure and its application in identifying and characterizing tumors. In addition, we discussed the importance of MRI in the overall diagnosis and staging of gastric cancer, as well as other conditions. The goal of this review is to identify the gaps in the current literature and highlight the possible future directions of further study.

Table-1 shows the major related works

Author	Methodology	Algorithm	Result	Outcome
L. Fan et al.[13]	“ML analysis for noninvasive “lymphovascular invasion prediction: in gastric cancer”	Support Vector Machine (SVM)	Accuracy : 0.87, Precision : 0.82, Recall: 0.90, Sensitivity: 0.90	“Accurate prediction of “lymphovascular” invasion in gastric cancer”
D. Dong et al.[15]	“DL radiomic nomogram for lymph node metastasis prediction in locally	DL Radiomic Nomogram	Accuracy : 0.79, Precision : 0.78, Recall: 0.81,	“Accurate prediction of lymph node metastasis in advanced

	advanced gastric cancer"		Sensitivity: 0.81	gastric cancer"
Z. Zhang et al.[16]	"Clinical nursing and postoperative prediction of gastrointestinal cancer using a DL model based on CT scans".	CNN	Accuracy: 0.92, Precision: 0.89, Recall: 0.94, Sensitivity: 0.94	"Postoperative prediction and care for gastrointestinal cancer patients"
Q. Liu et al.[18]	"18F-FDG PET/CT Radiomics for Preoperative Prediction of Lymph Node Metastases and Nodal Staging in Gastric Cancer"	Radiomics and Machine Learning	Accuracy: 0.83, Precision: 0.80, Recall: 0.86, Sensitivity: 0.86	"Preoperative prediction of lymph node metastases in gastric cancer"
D. Hao et al.[19]	"Identifying Prognostic Markers for Gastric Cancer Survival Prediction Using Clinical, Radiomics, and DL Imaging Features"	Random Forest and SVM	Accuracy: 0.76, Precision: 0.73, Recall: 0.80, Sensitivity: 0.80	"Prediction of survival outcomes in gastric cancer based on various features"
C. Liu et al.[22]	"Machine learning-based decision model to help clinicians decide the extent of lymphadenectomy (D1 vs. D2) in gastric cancer before surgical resection"	Machine learning-based decision model	Accuracy: 0.81, Precision: 0.79, Recall: 0.84, Sensitivity: 0.84	"Decision model to assist in determining lymphadenectomy extent in gastric cancer"
T. Jing-Wen et al.[23]	"Predicting chemotherapeutic response for far-advanced gastric cancer by radiomics with DL semi-automatic segmentation"	DL, Radiomics, Semi-automatic segmentation	Accuracy: 0.76, Precision: 0.74, Recall: 0.79, Sensitivity: 0.79	"Prediction of chemotherapeutic response in advanced gastric cancer using radiomics"
Z. Fan et al.[24]	"Development and validation of an artificial neural network model for non-invasive gastric cancer screening and diagnosis"	Artificial Neural Network	Accuracy: 0.89, Precision: 0.87, Recall: 0.91, Sensitivity: N/A	"Non-invasive gastric cancer screening and diagnosis using an artificial neural network"

The literature review shows that there is an increasing interest in using ML methods to analyze gastric cancer. These techniques can help with various aspects of the disease, such as detecting lymph nodes and predicting the outcome of treatment. There are still many opportunities for further research. Although the reviewed studies used different approaches and algorithms, it is important to conduct comparative analyses to identify the most effective method for a given task. Despite the progress that has been made in using ML methods for the analysis of gastric cancer, more research is needed to improve the accuracy and interpretability of these techniques. In the future, studies should also look into the integration of other data sources and the development of models that can be interpretable. This will allow us to improve the treatment and diagnosis of this disease. We have extensively reviewed and analyzed the literature to include the most relevant and up-to-date studies in this field. The paper highlights the significant progress made in utilizing artificial intelligence techniques to improve the accuracy and efficiency of gastric cancer diagnosis through MRI and CT imaging.

3. METHODOLOGY

3.1 Dataset

In a research paper published by Weiming Hu, he describes the "GasHisSDB", a new dataset that provides a comprehensive view of histopathology images for the computer-aided diagnosis of gastric cancer[28]. The dataset is designed to help researchers develop new methods and techniques for the detection and classification of this disease. The collection of histopathology data was carefully curated and annotated to ensure its usefulness and relevance for diagnosing gastric cancer. The images were acquired from surgical or biopsy resection procedures. They provide comprehensive information about the changes in tissue and cellular levels that are associated with the disease. The "GasHisSDB" data can be utilized by researchers to develop and apply computer-aided diagnosis methods for gastric cancer. Through the use of DL models and ML techniques, they can automatically classify and analyze histopathology images.

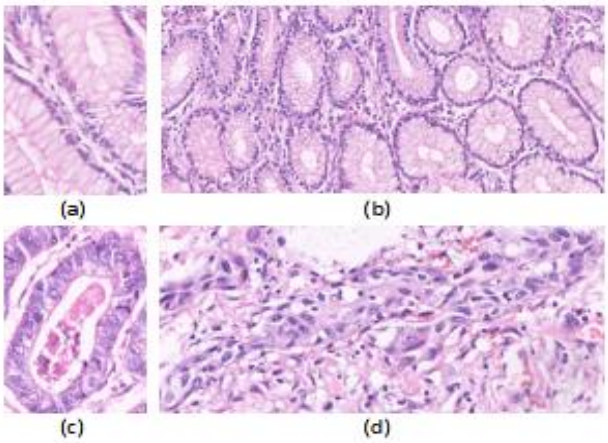

Figure 1: Example of Pathological images: (a)(b) Normal pathological images, (c) Non-invasive abnormal pathological image, (d) Invasive abnormal pathological image

3.2 Preprocessing

To prepare DL models for training and analysis, preprocessing techniques must be performed. This process is carried out in the "GasHisSDB" data set, which is a new image dataset for the diagnosis of gastric cancer. The various steps involved in the preprocessing process ensure that the images are ready for the extraction and training of features. Histopathology images are included in the "GasHisSDB" dataset, which is designed to help

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computer-aided diagnoses of gastric cancer. These are extracted from surgical resection or biopsy specimens, and they provide a detailed analysis of the tissue and cellular changes that are associated with this disease. Before DL models can be trained on these images, various steps are usually performed to improve the data.

The "GasHisSDB" preprocessing process involves various steps such as the resize, grayscale conversion, data augmentation, and rotation. These procedures ensure the quality and compatibility of the data, which is very important for the development of DL models for the detection and classification of gastric cancer.

3.2.1. Resize: Maintaining the aspect ratio while also adjusting the dimensions helps with efficient inference and training. Resize ensures that all the images have the same dimensions, which helps with the consistency of the results. Standardizing the resolution of the images makes it easier for developers to create DL models. Reducing the size of the images while preserving the necessary data can help reduce the computational requirements for training.

3.2.2. Gray Scale Conversion: Grayscale conversion is a process that involves taking out the full color information and replacing it with shades of gray. It is performed in "GasHisSDB" to reduce the data's dimensionality and simplify it for analysis. A grayscale image of a gastric histopathology specimen can capture details such as the structure and texture of the tissue, which are crucial for accurate cancer classification and diagnosis.

3.2.3. RGB-BGR Conversion: The process of converting an image's color channels into BGR or RRGB is commonly used in DL frameworks to perform inference and training. It can be done by changing the order of the channels in the image, for example, from Red to Green to Blue. This ensures that the results are consistent and accurate with the model architecture.

3.2.4. Data Augmentation: Various methods are used to increase the diversity and size of a dataset by implementing transformations. These techniques can help improve the training models' generalization capabilities and robustness.

3.2.4.1 Flip: A flip of an image creates a mirrored image of the original. This technique can be useful in handling asymmetry in images of the gastric histopathology. For instance, if the left portion of the image has a cancerous region, flipping it vertically can create a similar area on the right side. This method helps the model learn how to handle variations in the symmetry of images.

3.2.4.2 Zoom In / Zoom Out: Keeping the aspect ratio intact while reducing the size of the image can be done by either zooming in or out. This augmentation method helps the model deal with variations in the scale, and it makes the magnified images more robust. By zooming in, you can highlight certain tissue regions or cellular structures, while zooming out lets you see the entire tissue environment.

3.24.3. Shift Left / Right: A shift in the image's orientation causes the contents to be shifted to either the right or left side. This method can be used to simulate the alignment or positioning of tissue structures in a gastric histopathology image. It can also help the model learn how to handle different types of tissue alignments.

3.24.4. Rotation 45 Degree: Rotation augmentation is a technique that takes advantage of the angle of 45 degrees to add various features to a tissue image. It helps the model recognize and classify these features at different angles and positions. This method is useful for gastric histopathology as the tissues may have misaligned horizontal or vertical axes.

3.3 Algorithm used

3.3.1. Convolutional Neural Network (CNN): A DL algorithm known as CNN is commonly used in image classification to identify and categorize gastric cancer. It can do so by learning and extracting relevant features from the data. CNNs are capable of learning and identifying specific visual patterns in gastric pathology images, which can aid in the detection of gastric cancer. By utilizing the CNN's hierarchical structure, it can take into account global and local features, allowing them to classify and detect the disease accurately.
CNNs feature various layers, such as pooling, fully connected, and convolutional as shown in *figure 2*. The former performs spatial transformations on the input images and captures the relationships between the different elements. On the other hand, the latter reduces the features' spatial dimensions and makes predictions.

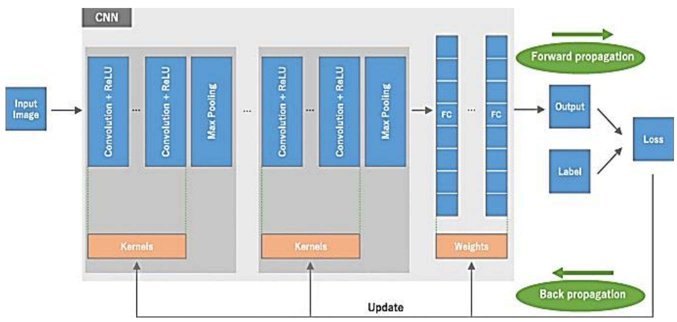

Figure 2: CNN architecture

Mathematically it represents as shown in eq.1

$$y = f(W * x + b)\ldots \quad (1)$$

Where, x = input image feature map, W = learnable convolutional filters, b = bias terms, f = activation function, and y = output feature map.

3.3.2 "AlexNet": "AlexNet" can be used to analyze and classify gastric cancer images by learning the features that differentiate healthy tissues from cancerous ones. By training the model on a large set of images, it can accurately detect and classify the complex structures and visual patterns associated with the disease.

The "AlexNet" framework was featured in 2012 as a winner of the ILSVRC, which highlighted the importance of DL in the

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field of image classification. It is a multi-layer system that can perform hierarchical extraction. The "AlexNet" framework features a variety of convolutional layers that are designed to capture various features as shown in *figure 3*. These layers are then used to perform various functions such as capturing features at different abstraction levels.

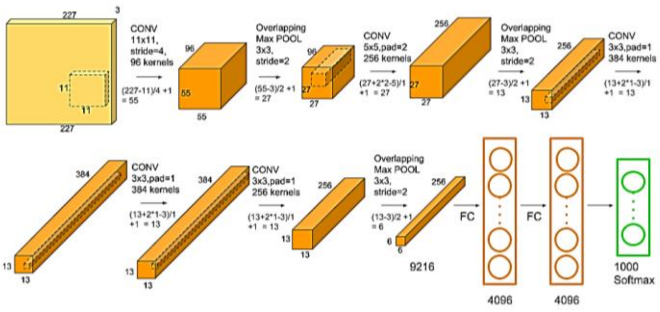

Figure 3: "AlexNet" architecture

Mathematically it represented as *eq.2*

$$z = f(W * x + b)\ldots \quad (2)$$

x = input image feature map, W = learnable convolutional filters, b = bias terms, f = activation function, and z = output feature map.

3.3.3. "MobileNet": The "MobileNet" framework is a lightweight computational resource-efficient DL system for mobile devices and embedded systems. It aims to provide a good balance between accuracy and model size by utilizing depth-wise separable filters. "MobileNet" can be used for the detection of gastric cancer in environments that are resource-constrained, such as edge devices and mobile applications. By utilizing depth-wise separable convolution filters, it can efficiently capture various features of histopathology images. "MobileNet"'s depth-wise separable convolution features two different operations: a pointwise and a depth-wise convolution as shown in *figure 4*.

The former is used to filter the input channels independently, while the latter is used to combine the filtered channels. This factorization helps reduce the number of parameters and allows the system to capture important features of the data.

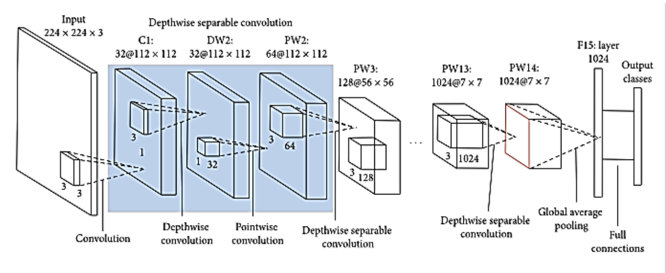

Figure 4: "MobileNet" architecture

4. RESULTS AND OUTPUTS

4.1 Accuracy Result

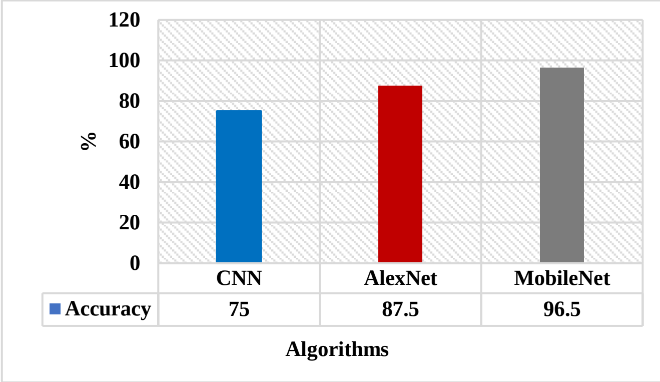

Figure 5: Accuracy graph

4.2 Accuracy Graph

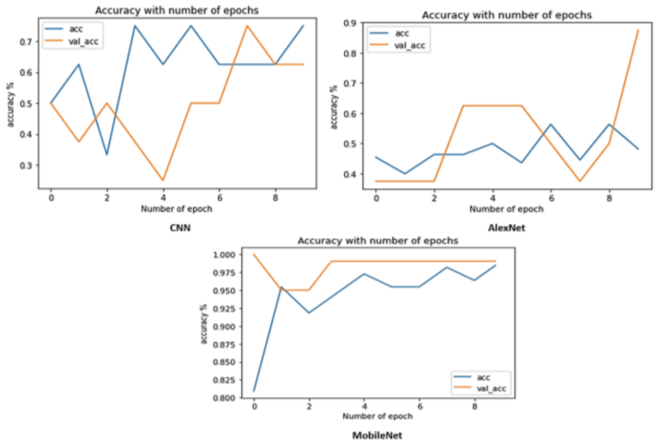

Figure 6: Accuracy with no. of epochs

The accuracy of various models, such as CNN, "MobileNet", and "AlexNet", is a crucial factor in determining their effectiveness and performance in detecting gastric cancer using histological images as shown in *table-1 and figure-5*. The results of the study revealed varying levels of achievement. Although CNN is widely used in image classification, its accuracy in detecting gastric cancer was only 75%. This model's low accuracy suggests that further fine-tuning and optimization are needed to improve its performance. For instance, by adjusting the CNN architecture's hyperparameters, it can learn and extract more relevant details from the histological images. The "AlexNet" model, on the other hand, was able to achieve an accuracy of 87.5% when it came to detecting gastric cancer. Its superior performance in this field is attributed to its deep architecture and ability to capture the various visual patterns in histological images.

The "AlexNet" model's ability to learn complex features through its non-linear activation and hierarchical layers allows it to perform better than CNN. The "MobileNet" model was able to achieve a 96.5% accuracy, which is higher than the "AlexNet" and CNN models. Its lightweight structure and efficient deep convolutions are some of the factors that have contributed to its superior performance in this field. The ability to perform deep structural analysis on histological images allows "MobileNet" to improve its performance in detecting gastric cancer.

The difference in accuracy between the three models can be attributed to their design choices and model architecture. According to the findings, the "MobileNet" model, with its lightweight structure and deep convolutions, was able to perform better than the "AlexNet" model and CNN in this specific task. Its higher accuracy indicates that it can be a reliable and efficient model for analyzing and diagnosing gastric cancer. Furthermore, the size and variety of the dataset, as well as the training process' quality, can affect a model's generalizability and accuracy.

The accuracy levels of the different models in detecting gastric cancer were evaluated based on the images of histological structures. CNN was able to achieve about 75% accuracy, while the "AlexNet" and "MobileNet" models were able to achieve 87.5% and 96.5% accuracy, respectively. The findings of this study indicate that the "MobileNet" model's lightweight structure and deep convolutions were the factors that contributed to its higher accuracy in detecting gastric cancer. In order to improve its accuracy and overall performance in this field, further studies and optimization efforts should be carried out on the models.

5. CONCLUSION AND FUTURE SCOPE

The objective of this study was to analyze the performance of DL models on detecting gastric cancer based on histological images. The models that were evaluated had varying accuracy levels. For instance, CNN had an accuracy of 75%, while "AlexNet" had an accuracy of 87.5% and "MobileNet" had an accuracy of 96.5%. The results of the study indicate that "MobileNet", with its DL architecture and lightweight structure, performed better than the other models when it came to detecting gastric cancer. The findings of the study highlight the importance of having the right design and model architecture in order to achieve an accurate and efficient diagnosis of gastric cancer. The ability of "MobileNet" to capture various features while maintaining its computational efficiency and compact size makes it an ideal candidate for use in the field of computer-aided diagnosis.

The study's future work aims to expand the scope of the investigation and improve the DL models' performance in detecting gastric cancer. Despite the impressive performance of DL models in the classification tasks, they still lack interpretability. This issue can be addressed by developing methods that allow them to visualize and interpret the features of their learning. The incorporation of DL models into a user-friendly interface can help them gain widespread adoption in real-world settings. The evaluation of the models presented in the study revealed that "MobileNet" had the highest accuracy level when it came to performing the task of detecting gastric cancer. The findings of the study indicate that DL models can potentially help healthcare professionals in making an accurate diagnosis of this disease. Further studies are required to analyze the scope of the study's findings and improve the models' interpretability, performance, and integration into clinical applications.

REFERENCES

[1] World Cancer Research Fund (WCRF), "Stomach cancer statistics | WCRF International." 2020, [Online]. Available: https://www.wcrf.org/cancer-trends/stomach-cancer-statistics/.

[2] P. Celard, E. L. Iglesias, J. M. Sorribes-Fdez, R. Romero, A. S. Vieira, and L. Borrajo, A survey on DL applied to medical images: from simple artificial neural networks to generative models, vol. 35, no. 3. Springer London, 2023.

[3] E. Morgan et al., "The current and future incidence and mortality of gastric cancer in 185 countries, 2020–40: A population-based modelling study," eClinicalMedicine, vol. 47, pp. 1–10, 2022.

[4] G. Zhang, J. Pan, and C. Xing, "Computer-aided diagnosis of digestive tract tumor based on DL for medical images," Netw. Model. Anal. Heal. Informatics Bioinforma., vol. 11, no. 1, pp. 1–13, 2022.

[5] H. Abdel-Nabi et al., A comprehensive review of the DL -based tumor analysis approaches in histopathological images: segmentation, classification and multi-learning tasks, vol. 2. Springer US, 2023.

[6] M. Puttagunta and S. Ravi, "Medical image analysis based on DL approach," Multimed. Tools Appl., vol. 80, no. 16, pp. 24365–24398, 2021.

[7] C. Zhou, Y. Wang, M. H. Ji, J. Tong, J. J. Yang, and H. Xia, "Predicting Peritoneal Metastasis of Gastric Cancer Patients Based on Machine Learning," Cancer Control, vol. 27, no. 1, pp. 1–8, 2020.

[8] Q. X. Feng et al., "An Intelligent Clinical Decision Support System for Preoperative Prediction of Lymph Node Metastasis in Gastric Cancer," J. Am. Coll. Radiol., vol. 16, no. 7, pp. 952–960, 2019.

[9] S. Sharanyaa, S. Vijayalakshmi, M. Therasa, U. Kumaran, and R. Deepika, "DCNET: A Novel Implementation of Gastric Cancer Detection System through DL Convolution Networks," 2022 Int. Conf. Adv. Comput. Technol. Appl. ICACTA 2022, pp. 1–5, 2022.

[10] X. Guan, N. Lu, and J. Zhang, "Computed Tomography-Based DL Nomogram Can Accurately Predict Lymph Node Metastasis in Gastric Cancer," Dig. Dis. Sci., no. 0123456789, 2022.

[11] H. Wahab, I. Mehmood, H. Ugail, A. K. Sangaiah, and K. Muhammad, "Machine learning based small bowel video capsule endoscopy analysis: Challenges and opportunities," Futur. Gener. Comput. Syst., vol. 143, pp. 191–214, 2023.

[12] S. Nazir, D. M. Dickson, and M. U. Akram, "Survey of explainable artificial intelligence techniques for biomedical imaging with deep neural networks," Comput. Biol. Med., vol. 156, no. January, p. 106668, 2023.

[13] L. Fan et al., "Machine learning analysis for the noninvasive prediction of lymphovascular invasion in gastric cancer using PET/CT and enhanced CT-based radiomics and clinical variables," Abdom. Radiol., vol. 47, no. 4, pp. 1209–1222, 2022.

[14] J. Li et al., "Dual-energy CT–based DL radiomics can improve lymph node metastasis risk prediction for gastric cancer," Eur. Radiol., vol. 30, no. 4, pp. 2324–2333, 2020.

[15] D. Dong et al., "DL radiomic nomogram can predict the number of lymph node metastasis in locally advanced gastric cancer: an international multicenter study," Ann. Oncol., vol. 31, no. 7, pp. 912–920, 2020.

[16] Z. Zhang and J. Peng, "Journal of Radiation Research and Applied Sciences Clinical nursing and postoperative prediction of gastrointestinal cancer based on CT DL model," J. Radiat. Res. Appl. Sci., vol. 16, no. 2, p. 100561, 2023.

[17] T. Habuza et al., "AI applications in robotics, diagnostic image analysis and precision medicine: Current limitations, future trends, guidelines on CAD systems for medicine," Informatics Med. Unlocked, vol. 24, p. 100596, 2021.

[18] Q. Liu et al., "18F-FDG PET/CT Radiomics for Preoperative Prediction of Lymph Node Metastases and Nodal Staging in Gastric Cancer," Front. Oncol., vol. 11, no. September, pp. 1–12, 2021

[19] D. Hao et al., "Identifying Prognostic Markers From Clinical, Radiomics, and DL Imaging Features for Gastric Cancer Survival Prediction," Front. Oncol., vol. 11, no. February, 2022.

[20] Sneha S. Nair, Dr. V. N. Meena Devi and Dr. Saju Bhasi (2022), Prediction and Classification of CT images for Early Detection of Lung Cancer Using Various Segmentation Models. IJEER 10(4), 1027-1035. DOI: 10.37391/IJEER.100445.

[21] V Sanjay and P Swarnalatha (2022), Deep Learning Techniques for Early Detection of Alzheimer's disease: A Review. IJEER 10(4), 899-905. DOI: 10.37391/IJEER.100425.

[22] Subrat Sarangi, Uddeshya Khanna and Rohit Kumar (2022), Ensemble Deep Convolution Neural Network for Sars-Cov-V2 Detection. IJEER 10(3), 481-486. DOI: 10.37391/IJEER.100313.

[23] T. Jing-Wen et al., "Predicting chemotherapeutic response for far-advanced gastric cancer by radiomics with DL semi-automatic segmentation," J. Cancer, vol. 11, no. 24, pp. 7224–7236, 2020, doi: 10.7150/jca.46704.

[24] Z. Fan, Y. Guo, X. Gu, R. Huang, and W. Miao, "Development and validation of an artificial neural network model for non-invasive gastric cancer screening and diagnosis," Sci. Rep., vol. 12, no. 1, pp. 1–10, 2022, doi: 10.1038/s41598-022-26477-4.