IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

# Dr Breast Cancer Detector: Breast Cancer Detection Using Deep Learning

Ardra A P, Nandana C, Ramshina B M, Narmada Sanjeev MK,

Prof.Dhanya V(Guide)

Department of Computer Science

College of Engineering Vadakara

APJ Abdul Kalam Technological University(KTU),Kerala,India

**Abstract**

This work employs deep learning, in this case,the InceptionV3 model with transfer learning, to perform automatic breast cancer detection and stage classification from histopathological images. The system classifies cancer stages using a softmax probability score, with thresholds establishing Stage One to Stage Four, and lower scores determining Stage Zero (no cancer detected). A mobile app supports uploading of images for real-time predictions, whereas a web interface supports doctors to examine cases, prescribe medication, and conduct real-time consultations. Developed with TensorFlow and Keras, the system features structured preprocessing, data augmentation, and performance assessment to maximize accuracy. Through less dependence on human interpretation, it facilitates earlier intervention and better diagnostics. Future developments will center on increasing datasets, incorporating more deep learning models, and performing clinical validations to increase accuracy and usability

**Keywords:** Convolutional Neural Network,histopathology image, softmax probability score

## I. INTRODUCTION

Breast cancer is among the most common cancers globally, both in women and men, and early diagnosis is key to proper treatment. It arises as a result of the unrestricted development of abnormal cells within breast tissue, which result in tumor growth that may be benign or malignant. Though symptoms such as lumps, changes in shape, and unusual discharge can signal cancer, most early-stage instances of cancer do not present any obvious signs, which is why it is crucial to undergo regular screenings like mammograms. With highly advanced medical imaging and AI-based methods,diagnostic accuracy has improved quite dramatically,and histopathological imaging is critical in detecting cancerous cells. Convolutional neural networks (CNNs) and deep learning models such as InceptionV3 have proved to be top performers in image analysis of medical images and the identification of malignant and benign tissue.

The current study utilizes the InceptionV3 deep learning model, transfer learned and fine-tuned from expert-annotated histopathological datasets for increased classification performance. A logistic regression model is also integrated to predict cancer risk from breast density, offering an interpretable complement to deep learning prediction. By incorporating AI-driven classification, this technology helps medical practitioners in timely and accurate diagnosis of breast cancer to enhance patient outcomes. Future developments will involve the incorporation of explainable AI methods as well as the integration of other clinical data sources to further augment diagnostic accuracy and usability for real-world medical practice.

## II. LITERATURE REVIEW

Huong Hoang Luong et al[1]. presents a Hybrid Mammogram Classification and Detection Pipeline (HMCaD) intended to improve the detection and classification of breast cancer. The pipeline uses EfficientNetB3 for classifying images from mammographies into classes like benign, malignant, and normal, whereas YOLOv8 is used to precisely localise the anomalous areas in the images. The paper puts great stress on sophisticated data augmentation techniques, such as methods such as seam carving and mosaic, in order to increase the diversity of the dataset and enhance the robustness of the model. Furthermore, transfer learning and fine-tuning are included to maximize the performance of pre-trained mod-els.

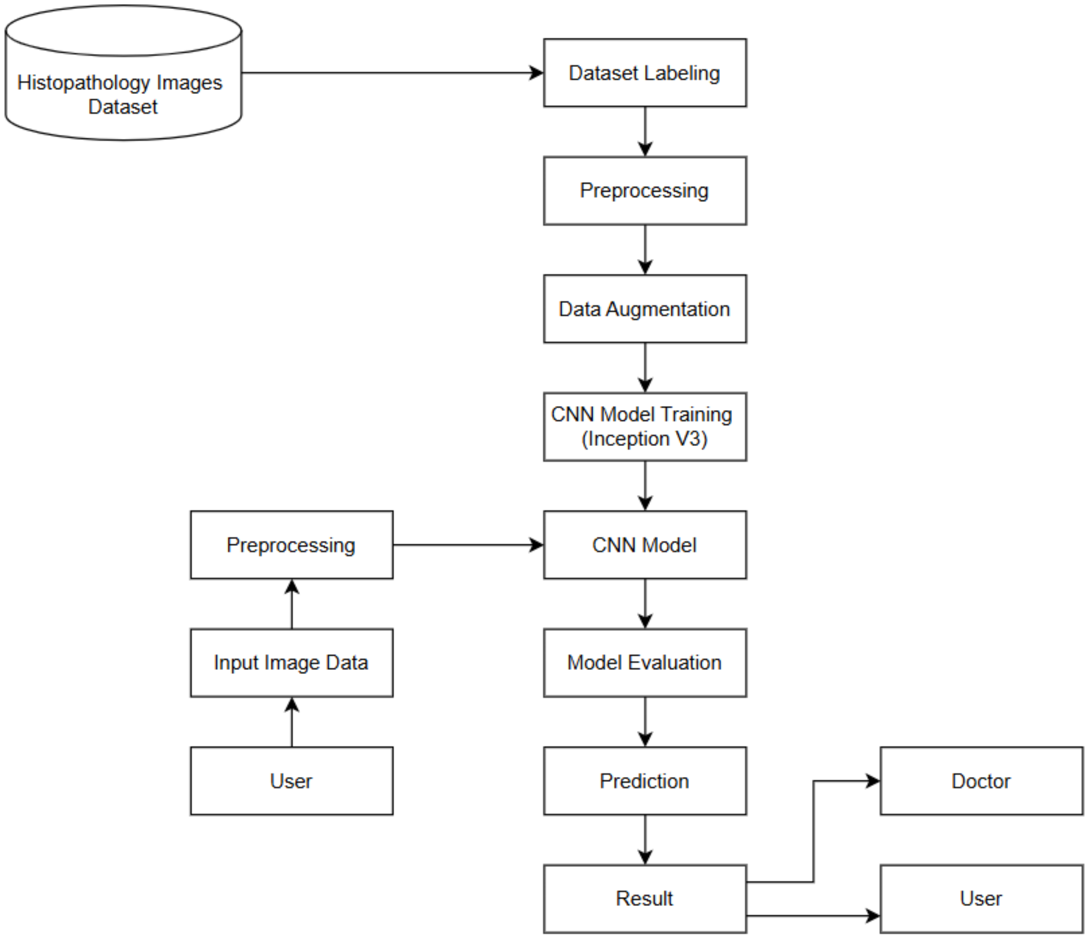
The research by Zahra Jafari et al.[2] entitled "Breast Cancer Detection in Mammography Images: A CNN-Based Approach with Feature Selection" proves the capability of pre-trained CNN models like ResNet50 and AlexNet for feature extraction, and then machine learning classifiers such as SVM and Random Forest, with an accuracy of 96%. Based on this, our project utilizes CNNs for auto-mated feature extraction and applies machine learning techniques to identify breast cancer and forecast related risks, aiming to establish a trustworthy and effective diagnostic device.

Wang, Xiaomei, et al.[3] present in their study a hybrid deep learning architecture that integrates CNN and GRU architectures to improve breast cancer detection, with a specific focus targeted towards invasive ductal carcinoma (IDC) by histopathology images. By overcoming manual detection challenges and the limitations of conventional deep learning methods, the model gets enhanced accuracy and resilience. Features are key components such as CNN for extracting features and GRU for sequential data patterns, with the model implemented on the PCam Kaggle dataset. Guided by this method, our project utilizes CNN-based feature extraction techniques in breast cancer image analysis and uses them in an adapted framework for risk forecasting and diagnostic uses.

The article by Nazir, Muhammad, et al.[4] has a hybrid model of Convolutional Neural Networks (CNN) and Inception-V4 for the classification of breast cancer from mammo-gram images. The method employs methods like CLAHE for image enhancement,data augmentation, and optimization of the hyperparameters to improve the performance of the model, with an accuracy of 99.2%. The model utilizes CNN for extracting features and Inception-V4 for complex classification, validated using the CBIS-DDSM dataset. Our project integrates CNN-based feature extraction methods to enhance classification accuracy and robustness in detecting breast cancer.

## III. SYSTEM ARCHITECTURE

The proposed system leverages deep learning, particularly the InceptionV3 model, to automate breast cancer detection from histopathological images. The process starts with a labeled dataset containing annotated images categorized as benign or malignant. Preprocessing techniques, such as nor-malization and resizing, enhance image quality, while data implemented in Python, manages user authentication, ride coordination, payments, and real-time notifications.augmentation methods like rotation, flipping, and zooming improve model generalization. The InceptionV3 model is fine-tuned using transfer learning with ImageNet-pretrained weights, enabling it to extract essential features for accurate classification. Once trained, the model undergoes evaluation based on performance metrics such as accuracy, precision, and recall to ensure its effectiveness in real-world scenarios.During inference, users upload histopathology images via a mobile or web platform, where preprocessing is applied before feeding them into the trained model. The prediction module determines whether the image is benign or malignant, providing users with an instant diagnosis. Additionally, the system facilitates interaction with medical professionals, allowing users to seek expert opinions for further analysis. Doctors can review patient data, offer prescriptions, and assist in clinical decision-making through the platform. This AI-driven approach enhances diagnostic precision, supports early-stage cancer classification, and streamlines the consultation process, improving accessibility to timely medical intervention.




Architecture

## IV .DATA FLOW

The Dr Breast Cancer system supports communication between administrators, physicians, and users to promote an effective healthcare process. It starts with the Admin, who is in charge of adding physicians and managing them, controlling users, and handling schedules. Admins are also in charge of monitoring appointments, checking feedback, and guaranteeing system stability. Their job is crucial in ensuring the platform remains well-organized and that doctors and patients have a seamless experience.Users are required to sign up and log in in order to utilize the features of the system. They can thereafter edit their profiles, view doctor availability, book

appointments, and use the breast cancer prediction tool by inputting applicable health information. The system provides results that can be discussed with the assigned doctors by the users. Users can also view prescriptions, view test results, and provide feedback regarding their consultation.

# V .METHODOLOGY

## A.Dataset Preparation

1) Input Data:: The used dataset is the histopathology images dataset. Sourced from authentic medical archives, these images have been annotated by expert pathologists to ensure accurate classification. The dataset may contain both raw and pre-processed images, varying in resolution and quality, necessitating appropriate preprocessing before being used for model training. Given the intricate nature of histopathology images,preprocessing steps such as normalization, augmentation, and noise reduction are crucial to enhance the dataset's usability and improve the accuracy of cancer detection models.

## B. Model Design

1) Feature Mapping Layer::This layer plays a crucial role in extracting significant spatial features from the input histopathological images. The convolutional layers make use of a number of filters (kernels) to filter the input picture and identify critical visual elements like edges, textures, and shapes. Filters travel around the image, calculating values along overlap- ing areas to construct feature maps representing signifi- cant patterns. Filter size selection, e.g., 3×3 or 5×5, based on the precision level needed—smaller ones capture wider structures while larger ones abstract broader patterns. Multiple filters are applied together, and the model learns a wide variety of features, improving classi- fication accuracy.

2) Pooling Layer::MaxPooling is a prevalent method employed within Convolutional Neural Networks (CNNs) to minimize the spatial dimensions of feature maps while maintaining the most vital information. A pooling filter, often 2×2 or 3×3,traverses over the feature map with a specified stride, which tends to be 2. Within every region covered by the filter, only the maximum value is chosen. For instance, within a 2×2 region, the maximum value among the four values is kept,basically summarizing most significant features while keeping computational complexity minimal. This facilitates the model in concentrating on necessary details while lessening the threat of overfitting.

## C. Training and Evaluation

1) Model Architecture:: his study employs InceptionV3 for breast cancer stage classification, leveraging its ability to extract complex patterns through its multi-branch design. The model efficiently processes image features at different scales, capturing intricate details essential for accurate classification. Its deep architecture ensures robust feature learning, enhancing the model's ability to distinguish between various stages of cancer progression.

2) Transfer Learning:: To optimize performance, the model utilizes transfer learning by leveraging pre-trained weights from InceptionV3. Since these weights were originally trained on extensive datasets like ImageNet, they provide a strong foundation for feature extraction. Fine-tuning the model on histopathological image data helps improve classification accuracy while reducing training time, making the approach highly efficient for medical image analysis.

3) Batch Normalization and Dropout:: Batch Normalization is applied to stabilize the learning process by normalizing activations within each layer, reducing internal covariate shifts.This technique speeds up convergence and allows for higher learning rates, leading to more efficient training. Additionally,Dropout is implemented to prevent overfitting by randomly deactivating a fraction of neurons during training, ensuring the model generalizes well to new data.

### D. Prediction

Prediction The classification step is a key step in which the model decides the final result based on the features learned during training. As the input image traverses the layers of a Convolutional Neural Network (CNN), the model provides a softmax probability score, which is the probability of the image being benign or malignant. If malignancy is predicted by the model, the score is utilized to determine the cancer stage. A score between 0.50 and 0.65 indicates Stage One, 0.65 to 0.75 signifies Stage Two, 0.75 to 0.85 represents Stage Three, and any score above 0.85 indicates Stage Four, whereas lower scores represent Stage Zero (no cancer found). This rating method enables accurate and reliable classification.

## VI. RESULTS

Our cancer prediction model is meant to scan histopathological images and correctly establish the stages of breast cancer.With the application of a Convolutional Neural Network(CNN), the model processes the input images and provides a softmax probability score to determine whether the tissue is benign or malignant. If the tissue is cancerous, the system classifies the stage of cancer according to probability values: Stage One (0.50–0.65), Stage Two (0.65–0.75), Stage Three (0.75–0.85), and Stage Four (over 0.85), and scores less than these values represent Stage Zero (no cancer). With 86% accuracy, the model makes reliable predictions. For a better user experience, we created an easy-to-use application where users can upload medical images for real-time analysis.The app also has a chat option, allowing users to consult physicians and get prescriptions, providing timely medical care and enhancing patient care.

| **Score Range** | **Cancer Stages** |
|---|---|
| 0.50 ≤ score < 0.65 | Stage One |
| 0.65 ≤ score < 0.75 | Stage Two |
| 0.75 ≤ score < 0.85 | Stage Three |
| Score ≥ 0.85 | Stage Four |
| Otherwise | Stage Zero (No Cancer) |

Cancer stage classification based on probability scores.

## VII. FUTURE SCOPE

The project holds great promise for future development in cancer diagnosis and detection. Broadening the histopathology image dataset with more varieties of high-quality samples can make the model's accuracy greater than its present 86%. The future can hold cutting-edge deep learning algorithms, including transformer-based models, to further hone feature extraction and classification. Deploying this system in actual clinical environments would help physicians make faster and more accurate diagnoses. Moreover, integrating the application with telemedicine capabilities would allow patients to see experts remotely and obtain AI-powered advice for customized treatment solutions. As medical AI continues to evolve, the system could be configured to diagnose many diseases, providing a useful tool in contemporary healthcare.

## VIII. CONCLUSION

The project holds great promise for future development in cancer diagnosis and detection. Broadening the histopathology image dataset with more varieties of high-quality samples can make the model's accuracy greater than its present 86%.The future can hold cutting-edge deep learning algorithms, including transformer-based models, to further hone feature extraction and classification. Deploying this system in actual clinical environments would help physicians make faster and more accurate diagnoses. Moreover, integrating the application with telemedicine capabilities would allow patients to see experts remotely and obtain AI-powered advice for customized treatment solutions. As medical AI continues to evolve, the system could be configured to diagnose many diseases, providing a useful tool in contemporary healthcare

## REFERENCES

[1] Hoang Luong, Huong, Hai Thanh Nguyen, and Nguyen Thai-Nghe.”*Detection and classification of breast cancer in mammographic images with fine-tuned convolutional neural networks.*” Journal of Information and Telecommunication (2024): 1-28

[2] Jafari, Zahra, and Ebrahim Karami. ”*Breast cancer detection in mammography images: A CNN-based approach with feature selection.*” Information 14, no. 7 (2023): 410.

[3] Wang, Xiaomei, Ijaz Ahmad, Danish Javeed, Syeda Armana Zaidi, Fahad M. Alotaibi, Mohamed E. Ghoneim, Yousef Ibrahim Daradkeh, Junaid Asghar, and Elsayed Tag Eldin. ”*Intelligent hybrid deep learning model for breast cancer detection.*” Electronics 11, no. 17 (2022): 2767

[4] Nazir, Muhammad Saquib, Usman Ghani Khan, Aqsa Mohiyuddin, Mana Saleh Al Reshan, Asadullah Shaikh, Muhammad Rizwan, and Monika Davidekova. ”*A Novel CNN-Inception-V4-Based Hybrid Approach for Classification of Breast Cancer in Mammogram Images.*” Wireless Communications and Mobile Computing 2022, no. 1 (2022): 5089078.

[5] Laghmati, Sara, Soufiane Hamida, Khadija Hicham, Bouchaib Cherradi,and Amal Tmiri. ”An improved breast cancer disease prediction system using ML and PCA.” Multimedia Tools and Applications 83, no. 11(2024): 33785-33821.

[6] Dar, Rayees Ahmad, Muzafar Rasool, and Assif Assad. ”*Breast cancer detection using deep learning: Datasets, methods, and challenges ahead.*” Computers in biology and medicine 149 (2022): 106073. Medical Journal.

[7] Reshma, V. K., Nancy Arya, Sayed Sayeed Ahmad, Ihab Wattar, Sreenivas Mekala, Shubham Joshi, and Daniel Krah. ”*[Retracted] Detection of Breast Cancer Using Histopathological Image Classification Dataset with Deep Learning Techniques.*” BioMed Research International 2022, no. 1(2022): 8363850. 3