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Detection of Breast Cancer Using Mammogram

Miss. Rekha A. Shidnekoppa*[1], Achyuta D Mundargi[2], Aishwarya Shidling[3], Philomina Kambli[4]

[1]Assistant Professor, Department of Computer Science and Engineering, Tontadarya College of Enginnering, Gadag, Karnataka, India.
[2,3.4]Student Department of Computer Science and Engineering, Tontadarya College of Enginnering, Gadag, Karnataka, India.

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Abstract: This study emphasizes the significance of timely disease detection, specifically breast cancer, given the rising population. Its objective is to develop an automated disease detection system that assists healthcare providers in diagnosis, enabling reliable, efficient, and prompt intervention to mitigate mortality risks. The study evaluates the performance of these approaches using metrics such as accuracy and the Confusion Matrix.
Keywords: Breast Cancer, Machine Learning, Mammograms, Benign, Malignant

INTRODUCTION

Breast cancer, which affects 1 in 8 women, is a major cause of cancer-related mortality worldwide. Mammography remains the primary imaging tool for breast cancer screening, despite its challenges in interpretation. Artificial intelligence (AI) and machine learning hold the potential to revolutionize breast cancer screening through the development of tools that support radiologists in diagnosis, minimizing false positives and false negatives to enhance accuracy**.**

The following factors and observations may be considered in the context of early detection through mammography:

Microcalcifications: Small calcium accumulation in breast tissue may appear on the mammograms and serves as an early sign of breast cancer.

Masses or Tumors: Mammograms have potential to detect masses or tumors in breast tissue. These masses may be benign or malignant, and further evaluation is necessary to determine their nature

Asymmetry: Differences in density or appearance among the left and right breasts may be observed on mammograms, potentially indicating abnormal growth or changes.

Architectural Distortion: Changes in the structure of breast tissue, which may appear distorted on mammograms, could be indicative of underlying abnormalities.

Breast Density: Dense breast tissue can sometimes make it challenging to detect abnormalities on mammograms. Radiologists take into account breast density when interpreting mammographic images.

MATERIALS AND METHODS

Transfer Learning is a machine learning technique that repurposes a trained model for another task. It is commonly used in breast cancer prediction, using a pre-trained convolutional neural network (CNN) as a feature extractor. Fine-tuning involves retraining the last few layers using a smaller dataset of mammograms, allowing the network to customize features from a larger dataset for the specific task of breast cancer prediction.

Advantages of the Proposed System

It is recorded that current studies have obtained the lowest accuracy, while the proposed system has obtained an accuracy of 97%. Finally, it is observed that the proposed has optimal results compared with existing systems.

Algorithms Used

- **Fine-tuning**: more often than not, involves protecting the weights of the pre-trained Convolutional Neural Arrange layers and exclusively preparing the weights of the last layers associated with an unused classifier. To moderate overfitting, the learning rate is regularly decreased

***Corresponding Author:** Miss. Rekha A. Shidnekoppa

compared to pre-training, and fine-tuning ages are utilized less regularly than pre-training.

- **ResNet50:** CNNs have least one convolution layer, in which, in addition to network duplication, a convolution operation is carried out on the input network in order to learn unmistakable low-level and high-level highlights of the picture. Profound CNNs upgrade their learning capabilities by increasing the network's profundity. By the way, expanding the degree of the organization comes about in issues with blurring angles and degradation.

- **VGG16:** A CNN plan known as the VGG16 is composed of a stack of convolutional layers with minor 3x3 channels, max-pooling layers, and completely connected layers at the exceptionally close conclusion. There are 13 convolutional layers in all, the first two of which have 64 channels each, and the last 11 of which have 128 filters**.**

Modules

- Data collection: Data acquisition serves as the cornerstone for enhancing AI models. It represents the initial stage that sets the foundation for the model's effectiveness. The quality and quantity of data collected directly impact the model's performance. Various methods exist for data collection, including web scraping, manual moderation, and other techniques.

- Data set: We are using the Radiological Society of North America (RSNA) Screening Mammography Breast Cancer Detection Dataset. The data set consists of a total of 1214 images. In this data set, we have 637 cancerous samples and 577 noncancerous samples.

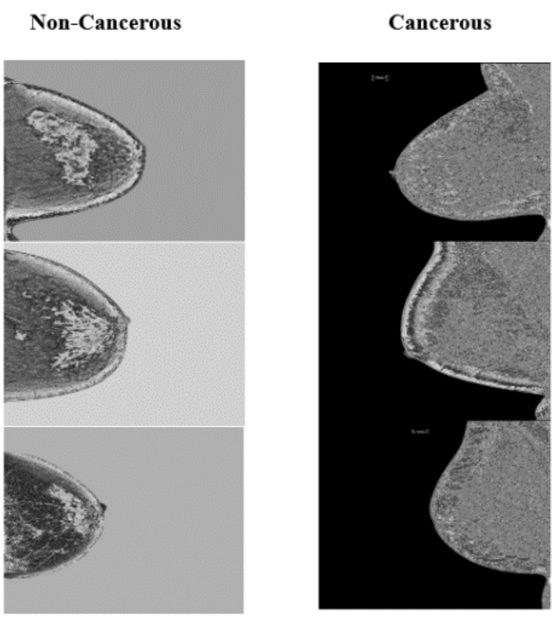

Figure 1: Cancerous and Non-cancerous images

- Cancerous vs Non Cancerous Images: "Cancerous" describes cells or tumors that are malignant, capable of invading nearby tissues, and spreading to other parts of the body. This uncontrolled growth can be life-threatening if left untreated. Conversely, "non-cancerous" or "benign" tumors are unusual cell growths that do not spread and are usually not life-threatening. Although they may still require medical attention depending on their size and location, they generally do not present the same level of risk as cancerous tumors. it is crucial for individuals to undergo thorough medical evaluation and testing to accurately determine the nature of any unusual growths.

- Flowchart:

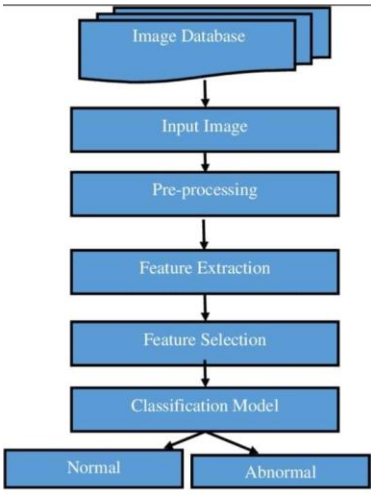

Figure 2: Process of detecting breast cancer

Input data: Input data: A comprehensive dataset comprising various features extracted from mammographic images and patient information used for training machine learning models.

Pre-processing: Data preprocessing involved cleaning and transforming raw mammographic images and clinical data to enhance accuracy and efficiency in detecting breast cancer.

Training dataset: The training dataset for breast cancer detection leverages transfer learning techniques, utilizing pre-trained models to extract relevant features from medical images, enhancing the efficiency and accuracy of classification algorithms.

Feature extraction: Utilizing transfer learning, our project employs pre-trained convolutional neural networks to extract high-level features from mammogram images, enhancing the accuracy of breast cancer detection through efficient knowledge transfer and fine-tuning.

Testing data: Utilized transfer learning techniques to fine-tune pre-trained models for accurate detection of

***Corresponding Author:** Miss. Rekha A. Shidnekoppa

breast cancer in medical imaging data, enhancing classification performance and efficiency.

Classification: An advanced classification system utilizing machine learning algorithms for accurate detection of breast cancer from medical imaging data, aiding in early diagnosis and treatment.

RESULTS

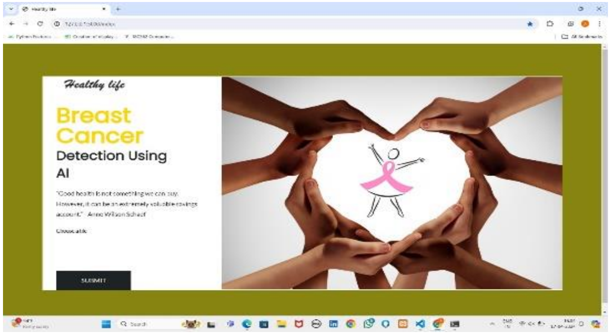

Figure 3: Main website

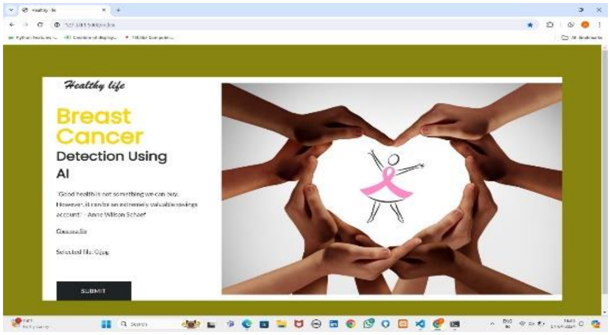

Figure 4: Image Seected

Figure 5: Benign Tumor

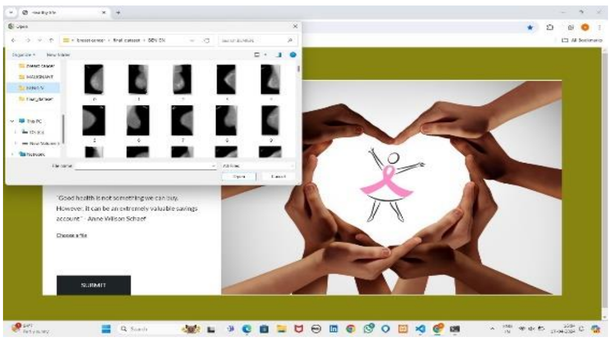

Figure 6: Image Selection

Figure 7: Malignant Tumor

DISCUSSION

Dataset Pre-processing:

1. Re-organize: The primary data is reorganized pertaining to the patient. This is reorganized into images with and without cancer.
2. Resize: The image resolution is lowered from 5000 * 5000 to 500 * 500.
3. Reformat: The mammograms in the raw dataset are in DICOM format. These are converted to PNG format.

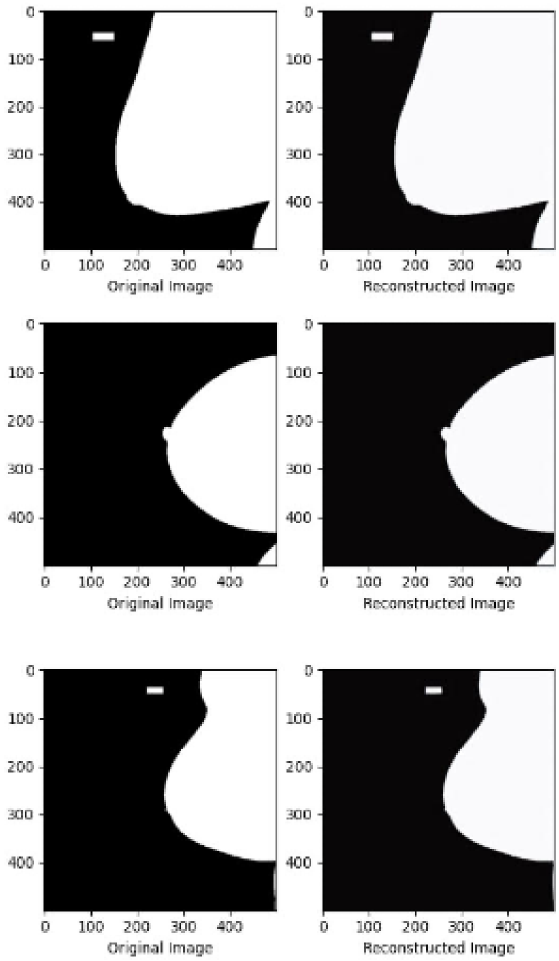

Figure 8: Original vs Reconstructed Images

4. Analysis and prediction: Here, a few of the features are considered, which are:

***Corresponding Author:** Miss. Rekha A. Shidnekoppa

(1) density of breast tissue (2) Masses and tumors (3) Change in Nipple (4) Architectural Distortion.

5. Exactness on the test set: We got an exactness of 0.99794% on the test set.

	precision	recall	f1-score	support
BENIGN	0.99784	0.99784	0.99784	462
MALIGNANT	0.99804	0.99804	0.99804	509
accuracy			0.99794	971
macro avg	0.99794	0.99794	0.99794	971
weighted avg	0.99794	0.99794	0.99794	971

Figure 9: Exactness on the test set

CONCLUSION

In conclusion, the detection of breast cancer through mammograms plays a crucial role in improving patient outcomes and survival rates. By identifying abnormalities at an early stage, medical professionals can implement appropriate treatment plans, reducing the necessity for aggressive therapies and increasing the chances of a successful recovery. Regular mammogram screenings, combined with self-examinations and awareness of risk factors, contribute significantly to the effective prevention and detection of breast cancer.

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***Corresponding Author:** Miss. Rekha A. Shidnekoppa