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A Comparative Analysis of CNN Models for Breast Cancer Detection

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Abstract: *Breast cancer remains a critical global health issue, with early detection playing a pivotal role in improving survival rates and treatment effectiveness. Deep learning, particularly Convolutional Neural Networks (CNNs), has emerged as a powerful tool in medical image analysis, offering promising results in disease classification. This paper focuses on the application of transfer learning to classify breast cancer using histopathological and mammogram images. Three widely adopted CNN architectures—ResNet-50, VGG16, and InceptionV3—were utilized to differentiate between benign and malignant breast tissue. The study involved training and evaluating these models on a structured breast cancer dataset, leveraging pre-trained networks for optimized feature extraction and classification accuracy. Among the tested architectures, InceptionV3 demonstrated superior performance, achieving a 92% accuracy rate in binary classification. This result underscores the model's ability to identify malignant cases with high precision and reliability, making it a strong candidate for assisting in diagnostic workflows. However, challenges such as dataset bias, variability in imaging quality, and model generalization remain critical concerns. Addressing these issues through techniques like advanced data augmentation, hyperparameter tuning, and integration of multi-modal imaging could further enhance model robustness[1]. Future work will focus on expanding datasets to improve model generalization and exploring hybrid architectures that combine multiple CNN frameworks*

Keywords: breast cancer, deep learning, CNN, ResNet-50, VGG16, InceptionV3, histopathological images, transfer learning, medical image classification, clinical integration, model robustness