

Title: One Model Multiple Insights: CNNs for Medical Image Classification

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Abstract: Breast cancer diagnosis from ultrasound imaging poses a significant challenge due to the difficulty of simultaneously distinguishing between normal, benign, and malignant tissues within a unified framework. Existing approaches often prioritize binary classification, overlooking the clinical necessity for comprehensive multi-class differentiation. In this work, we propose an end-to-end convolutional neural network (CNN) architecture that directly addresses this gap. Leveraging a modified ResNet-18 backbone with domain-specific adaptations, our model integrates feature extraction and multi-class decision-making into a single efficient pipeline. Trained on the BUSI dataset, the proposed framework achieves 92.31% accuracy in multi-class classification, outperforming state-of-the-art methods by a significant margin. Through extensive ablation studies, we demonstrate the robustness and scalability of our approach, highlighting its clinical relevance for early detection and effective management of breast cancer. This work sets a new benchmark for ultrasound-based breast cancer diagnostics, offering a reliable and interpretable framework for real-world deployment.

Keywords: Breast cancer diagnosis, Ultrasound imaging, Multi-class classification, Convolutional Neural Network (CNN)

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