
Advancing Breast Cancer Detection in MRI with AI



Breast cancer remains a significant threat, particularly among high-risk women who benefit from supplemental screening methods such as magnetic resonance imaging (MRI). However, even with advanced imaging, certain malignancies are not detected until they have progressed. Recent advancements in artificial intelligence (AI) offer new possibilities for identifying early signs of breast cancer in MRIs, potentially allowing diagnosis up to a year before radiologists would traditionally detect them. Implementing AI, particularly deep learning techniques, could be transformative in medical imaging, enhancing accuracy and providing radiologists with valuable insights to improve detection in high-risk populations.

AI-Driven Early Detection: Model and Methodology

The study evaluated a convolutional neural network (CNN) trained on extensive breast MRI datasets and refined with a retrospective dataset from 910 high-risk women, featuring over 3,000 scans. The model aims to identify both direct cancer indicators, like localised lesions, and broader features, such as background parenchymal enhancement, a potential breast cancer risk predictor. Using cross-validation, the model provided a probability score for cancer likelihood in future screenings.

A key challenge in cancer screening is the low prevalence of detectable malignancies in high-risk groups. To address this, the model was fine-tuned for high sensitivity while managing false positives through focal loss functions. It assigned risk probabilities to each 2D MRI slice, supporting radiologists in identifying cases for closer review. The model's promising performance could allow for earlier cancer detection, potentially identifying cancers up to a year before clinical diagnosis for high-risk individuals.

Evaluation of Performance Metrics: Sensitivity, Specificity and Accuracy

To assess the AI model's clinical viability, key benchmarks included sensitivity, specificity and the area under the ROC curve (AUC), which was found to be 0.72—indicating a respectable accuracy in predicting malignancies. Notably, the model achieved a sensitivity rate of 30% for cancers missed during initial radiologist reviews, effectively flagging cases that traditional screenings might overlook. This supports the incorporation of AI as a helpful tool in screening, allowing targeted reviews of high-risk cases.

The model's localisation capabilities were significant, guiding radiologists to specific MRI regions where abnormal growths were likely, which were confirmed in over half of flagged cases. This feature reorganises the review process by focusing on higher-risk areas, particularly beneficial for subtle cancer indications. By prioritising high-risk cases, the model enhances both the sensitivity and efficiency of breast cancer screening, serving as a valuable resource in high-demand healthcare settings.

Practical Considerations: Balancing Sensitivity and Clinical Efficiency

AI-assisted detection improves early cancer identification, but practical clinical integration is critical. The study highlighted the importance of balancing high sensitivity with a manageable patient recall rate. The model showed a high false discovery rate (FDR) of about 96% at a 30% sensitivity threshold, leading to potential unnecessary follow-ups. The proposed solution is a 10% re-evaluation rate based on AI risk predictions, allowing radiologists to focus on the top 10% of flagged cases. This strategy aligns with clinical capacity, achieving a positive predictive value (PPV) of around 6%. By concentrating on the most urgent cases, the approach enhances early detection while reducing the workload and maintaining efficiency in high-volume screening environments.

The integration of AI in MRI-based breast cancer screening significantly enhances early detection, particularly for high-risk women. The AI model improves sensitivity and localisation, aiding radiologists in identifying malignancies earlier and more accurately. While its high false discovery rate

calls for careful threshold selection, the suggested 10% re-evaluation rate offers a clinically feasible balance. This approach helps radiologists detect subtle cancer indicators that standard screenings might miss, facilitating early intervention crucial for better patient outcomes. As imaging datasets expand and AI technology progresses, its role in screening programmes will likely grow, equipping radiologists with tools to enhance diagnostics and improve breast cancer survival rates.

AI in MRI breast cancer screening is transformative, offering a proactive approach toward early detection and supporting radiologists with data-driven insights for enhanced accuracy. This advancement signifies a shift toward more effective cancer detection strategies.

Source: [Academic Radiology](#)

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