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Paper Title: Comparative Analysis of Stand-alone Artificial Intelligence for 3D Automated Breast Ultrasound System (ABUS) and Standard Clinical Practice with Radiologists in Breast Cancer Screening

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Abstract

The purpose of this study is to develop an artificial intelligence (AI)-driven screening system designed for 3D automated breast ultrasound (3D ABUS) to enhance the screening process for breast cancer. Additionally, we evaluated the system's performance by comparing risk-score assessments from the AI system and the standard clinical practice by radiologists (combination of mammography and handheld ultrasound) using a forward testing dataset of 50 patients. For the methodology, a set of 90 patients' data was used as the training dataset. The system combines Faster R-CNN with ResNet-50 for detection, the U-net model for segmentation, and a radiomics method with machine learning algorithms for breast lesion classification. The three models were first tested using 20 patients' data. The system demonstrated high precision and recall rates for detection (0.741 and 0.869 respectively), a Dice Similarity Coefficient (DSC) score of 0.793 for segmentation, and high precision (0.949) and recall (0.919) for the classification model. In forward testing with a dataset from 50 patients, the system achieved an area under the ROC curve (AUC) of 0.759, with 87.5% sensitivity, 64.3% specificity, and accurately identified all biopsy-proven malignancies. This proposed system could have a significant impact by increasing the volume of breast cancer screening due to its cost-effectiveness, time efficiency, and reduced dependency on user input, thereby benefiting clinical use.