AUTOMATED ASSESSMENT OF BREAST POSITIONING QUALITY IN TOMOSYNTHESIS SCREENING USING AN AI-BASED EVALUATION SYSTEM

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Background

Breast cancer is one of the most common malignant tumors in women worldwide and its incidence is increasing year by year. Mammography, as an important tool for breast cancer screening, can detect breast lesions at an early stage, which is of great significance in the prevention and treatment of breast cancer.

Mammography is widely used in clinical practice because of its ease of operation, low radiation dose, and high diagnostic accuracy. However, there are some challenges associated with mammography, such as fluctuations in image quality and the influence of radiologist subjectivity.

The image quality of mammography has a direct impact on lesion detection and diagnostic accuracy. Therefore, the control and evaluation of mammography image quality is of paramount importance.

Introduction

Importance of Mammography Technicians

Mammography technicians play a crucial role in ensuring high-quality breast images. However, their performance can vary due to experience, skills, and judgment.

AI-Based Systems for Assistance

AI-based systems can assist mammography technicians by providing real-time feedback on breast positioning and image quality control.

This study aimed to evaluate the performance improvement of mammography technicians using an artificial intelligence (AI)-based system for breast positioning and image quality control.

Methods

01

- 2396 mammograms after AI system implementation were included.
- The AI system analyzes images and provides feedback to adjust positioning and optimize quality.

02

- Radiographers and an AI system assessed the breast positioning and image quality.
- Images were evaluated by radiologist on 4-point scale.

03

Image Quality Criteria:

- Appearance of the nipple
- Breast rotation
- Pectoral muscle
- Inframammary fold
- Pectoral nipple line
- Shoulder overlap shadow
- Abdominal skin
- Contralateral breast
- Foreign body

04

Data Analysis:

Images of same view(CC &LMO) before and after technical repeat were evaluated with the standards of Mammography Quality Standards Act (MQSA) on a four-point-scale (1 = poor, 4 = excellent). Incidence of inadequate positioning were recorded and compared.

Results

Image Scores

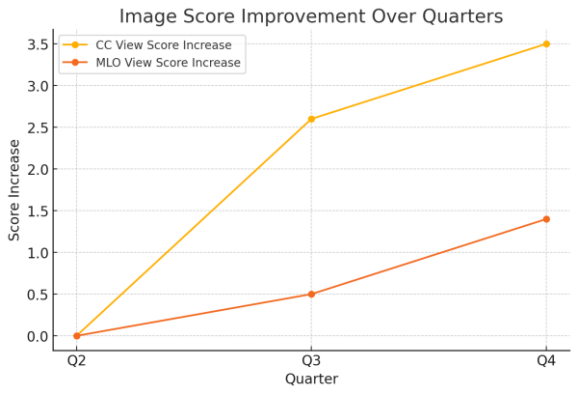
- The average score increased by 2.6 points in the third quarter (compared to the second quarter, $P<0.001$).
- The average score increased by 3.5 points in the fourth quarter (compared to the second quarter, $P<0.001$).
- CC View scores were on average 2.1 points higher than MLO Views ($P<0.001$)."

Adequate Images

- CC Views: Improved by 10% from the second to the third quarter and by 15% from the third to the fourth quarter.
- MLO Views: Improved by 8% from the second to the third quarter and by 12% from the third to the fourth quarter.

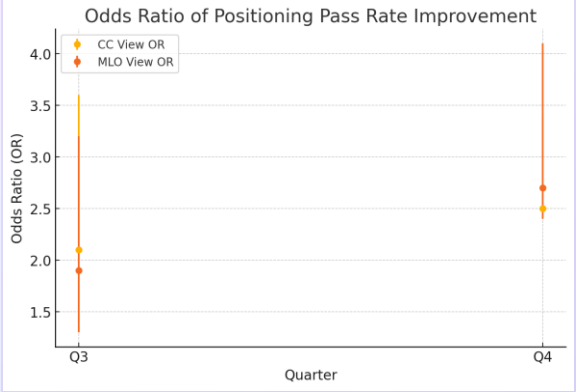
Results

Image Scores



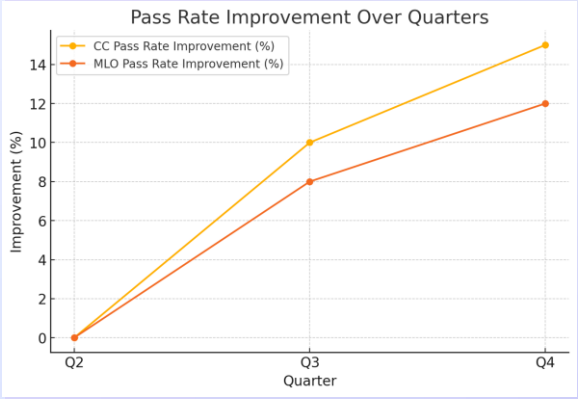
Illustrates the increase in scores for CC and MLO views, highlighting the improvement brought about by the AI-based quality control system.

High Quality Images



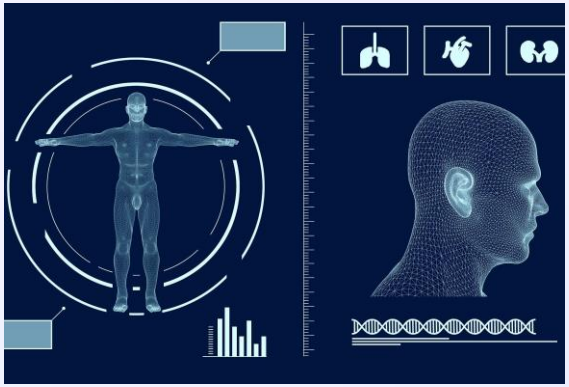
Displays the odds ratios and confidence intervals for CC and MLO views in the third and fourth quarters.

Adequate Positioning



Shows the percentage increase in pass rates for CC and MLO views across different quarters.

Discussion - Benefits of AI System



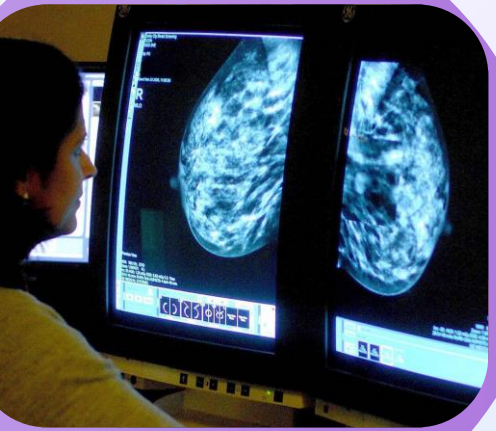
Improving Performance and Efficiency

The use of an automated breast positioning and image quality control system can reduce the likelihood of inadequate positioning and increase the overall image quality of mammography. It can significantly improve the performance of technicians and assess images faster than radiologists, potentially reducing time and cost.

Enhancing Quality Control

The AI system's ability to provide real-time feedback can enhance the quality control process in breast cancer screening. By improving technician performance and image quality, it contributes to more accurate and efficient screening.

Benefits and value of AI in image quality assessment



Efficiency and accuracy

The AI system can quickly and accurately assess the image quality of mammograms, reducing the time and labor required for manual assessment and improving work efficiency

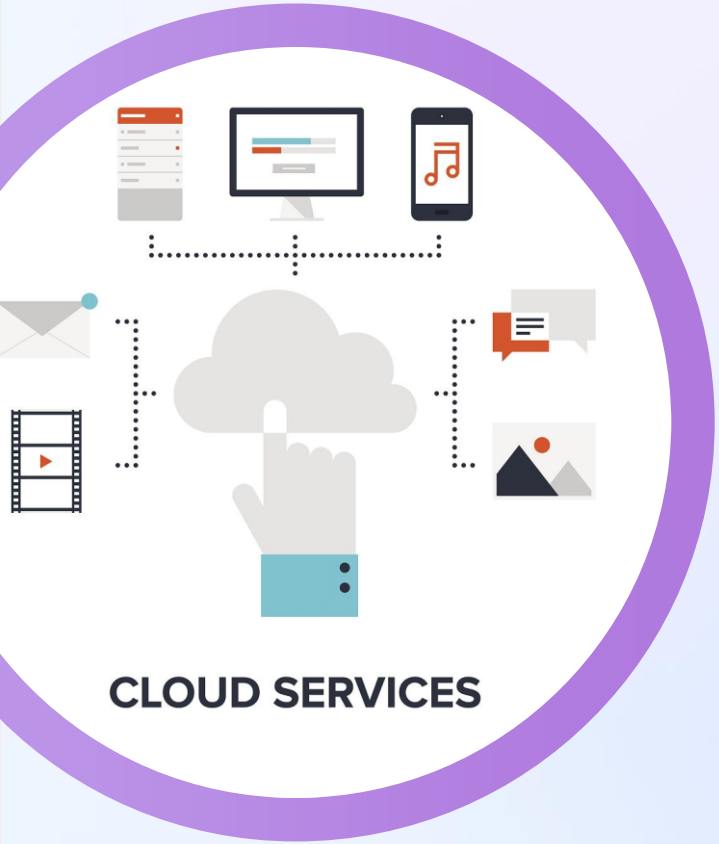
Subjectivity

The AI system can assess the image quality based on preset algorithms and rules without interference from human factors, providing more objective assessment results.

Reproducibility

The AI system can evaluate a large number of images and the results are very reproducible, which is favorable for clinical research and quality control.The AI system has a wide range of applications in mammography quality control and can be applied in the following areas.

Benefits and value of AI in resource-limited areas



01

Improving resource efficiency

The AI system allows for rapid and accurate assessment of mammography image quality, reducing the need for human resources and increasing the efficiency of resource utilization.

02

Reducing healthcare costs

AI systems can reduce healthcare costs by increasing efficiency and quality while reducing labor costs

03

Promoting equity in healthcare

AI systems can bridge the gap in healthcare services brought about by the lack of human resources and provide quality healthcare services to more patients.

Limitations

Considerations for Implementation

It is important to acknowledge limitations in AI-based systems, such as the need for continuous updates and validation. The integration of these systems into existing workflows may require careful planning and training.

Future Directions

Expanding AI Applications

The success of AI in breast positioning and image quality control opens up possibilities for further advancements in AI applications in mammography. Future research may explore AI's potential in other aspects of breast cancer screening.