Automatic Assessment of the Quality of Patient Positioning in Mammography Using an Artificial Intelligent System
Early screening and diagnosis of breast cancer: Mammography

1. Detection of tumor
2. Detection of calcification
3. Noninvasive method
4. Determination of benign and malignant
Quality control in mammography

Qualified images are important basis for doctors to make accurate diagnosis. Unqualified image images will lead to wrong diagnosis.

Quality control problem: incomplete gland
Diagnostic risk: missed detection

Quality control problem: skin overlapping
Diagnostic risk: covering the lesion

Quality control problem: shoulder overlapping
Diagnostic risk: covering the lesion

Quality control problem: inadequate pectoralis major muscle
Diagnostic risk: missed detection of malignant lymph nodes
Automatic patient positioning real time evaluation in mammography using an artificial intelligent system

Features:
- Feature recognition
- Feature extraction
- Data preprocessing

Detection:
- Overall detection and evaluation
- Partial detection and evaluation

Issues:
- Incomplete gland
- Incomplete pectoralis major muscle
- Over or insufficient exposure
- Skin fold
- Nipple not in the contour line
- Shoulder overlap shadow
- Contralateral breast
- Abdominal skin
- Foreign body
Real time quality control in 2 seconds
Nine types of abnormalities detection during mammography

- Incomplete gland
- Incomplete pectoralis major muscle
- Over or insufficient exposure
- Skin fold
- Nipple not in the contour line
- Shoulder overlap
- Contralateral breast
- Abdominal skin
- Foreign body
- Acquisition alert

No abnormality

LMLO
Performance of mammography quality control system

Training data set
30000+ case

Validation accuracy
95.8%

Validation ROC curve

- Incomplete gland, area=0.903
- Incomplete pectoralis muscle, area=0.937
- Over or insufficient exposure, area=0.982
With the help of systematic review and evaluation of the changes in the quality of photography during four quarters, image quality of mammography can be improved by using this management system.
Image quality improvement after using artificial intelligent based quality control system

<table>
<thead>
<tr>
<th>Image quality score</th>
<th>A grade</th>
<th>B grade</th>
<th>C grade</th>
<th>invalid</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Quality control system</td>
<td>86.7%</td>
<td>10.7%</td>
<td>2.6%</td>
<td>0</td>
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<tr>
<td>With quality control system</td>
<td>91.4%</td>
<td>7.2%</td>
<td>1.4%</td>
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</table>

<table>
<thead>
<tr>
<th>Diagnostic value</th>
<th>sensitivity</th>
<th>specificity</th>
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<tbody>
<tr>
<td>No Quality control system</td>
<td>85.22%</td>
<td>89.51%</td>
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<tr>
<td>With quality control system</td>
<td>86.21%</td>
<td>90.67%</td>
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</table>
Artificial Intelligent based real time quality control and manage system

Provide real-time quality control results for technicians
- Ensure the effectiveness of photography
- Reduce waste

Provide qualified images for doctors
- Reduce the risk of misdiagnosis
- Reduce recall rate

Provide efficient management tools for managers
- Standardized management of images and data