Automatic Assessment of the Quality of Patient Positioning in Mammography Using an Artificial Intelligent System
Current status of breast cancer in China

420,000 new cases of breast cancer in China during 2020
Ranking first in female cancer incidence rate

<table>
<thead>
<tr>
<th>New cases of cancer in China during 2020</th>
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<tbody>
<tr>
<td>Breast cancer</td>
<td>19.9%</td>
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<tr>
<td>Lung cancer</td>
<td>13.2%</td>
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<tr>
<td>Colorectal cancer</td>
<td>11.3%</td>
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<td>Thyroid carcinoma</td>
<td>8.0%</td>
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<td>Gastric cancer</td>
<td>7.0%</td>
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<tr>
<td>Cervical carcinoma</td>
<td>5.2%</td>
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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
Challenges from traditional manual quality control

- Not real time
- Not instant countable
- Not uniformed management
Automatic patient positioning real time evaluation in mammography using an artificial intelligent system

Images input

Feature recognition → Feature extraction

Data preprocessing

Feature extraction

Overall detection and evaluation
- incomplete gland
- incomplete pectoralis major muscle
- over or insufficient exposure

Partial detection and evaluation
- skin fold
- nipple not in the contour line
- shoulder overlap shadow
- contralateral breast
- abdominal skin
- foreign body
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

LMLO: No abnormality
Performance of mammography quality control system

Training data set
30000+ case

Validation accuracy
95.8%

Validation ROC curve
Quality control management and analysis system

<table>
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<tr>
<th>Skin fold</th>
<th>Incomplete gland</th>
<th>No abnormality</th>
<th>abdomen skin</th>
<th>Incomplete muscle</th>
<th>Nipple not in line</th>
<th>Shoulder overlap</th>
<th>Contralateral breast</th>
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Data output in file

Respectively analysis

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Respectively analysis
Statistical analysis of image quality for improvement

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.

- A: No abnormality
- B: Incomplete gland
- C: Incomplete muscle
- D: Skin fold
- E: Nipple not in line
- F: Shoulder overlap
- G: Contralateral breast
- H: Abdomen skin
- I: Foreign body
- J: Inappropriate exposure
Artificial Intelligent based real time quality control and manage system

Provider 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