Radio-opaque artefacts in digital mammography: automatic detection and analysis of downstream effects

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INTRODUCTION

(a) Circular marker (b) Triangular marker (c) Breast implant (d) Support devices (e) Spot compression

- AI is transforming breast cancer screening, but artifacts in mammograms (e.g., skin markers, implants) may introduce biases.
- Most studies focus on global imaging changes; the effect of local artifacts remains understudied.
- This work investigates how radiopaque artifacts impact AI-based mammography models.

METHOD

Artefact Dataset Construction

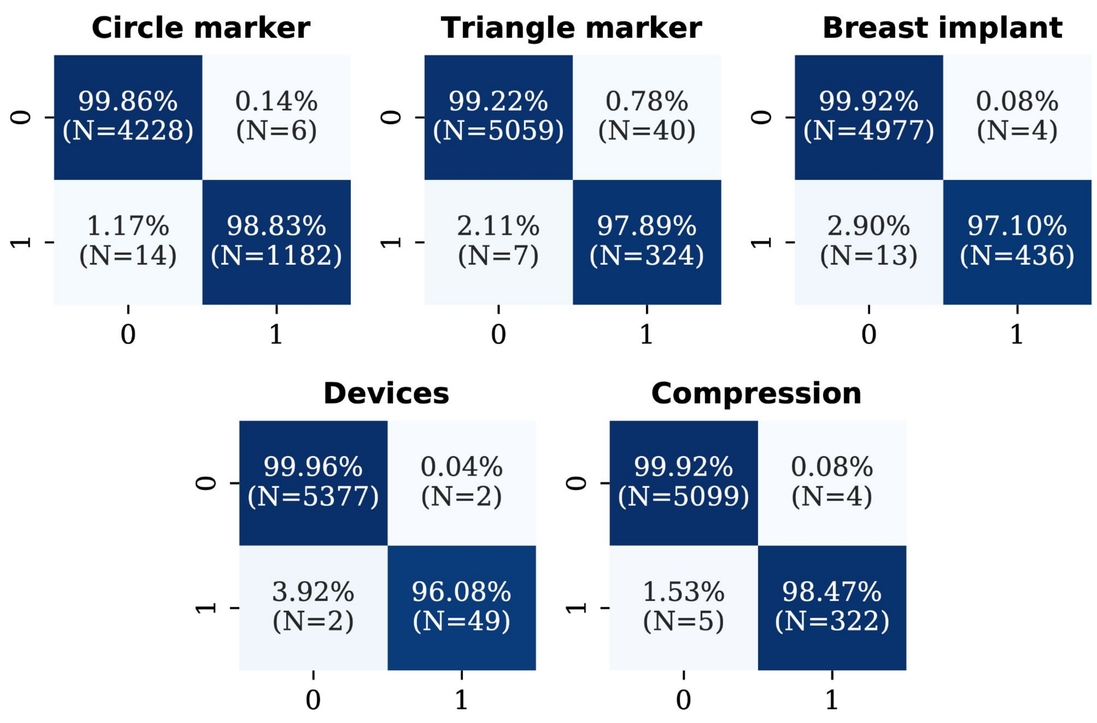
Used EMBED dataset (398,458 mammograms).
Manually annotated 22,012 images for 5 artifact types.

Artefact	Images with Artefact
Circles	4,905 (22%)
Triangles	1,186 (5%)
Implants	1,815 (8%)
Devices	286 (1%)
Spot compressions	1,250 (6%)
Total	22,012

Statistics of annotated dataset.

Artefact Detection Model

Multi-label ResNet-50 classifier.
Separate classification heads for each artifact.
Achieved 99.3% ROC-AUC in artifact detection.



Downstream Tasks

Breast Cancer Screening: Normal vs. non-negative cases.
Breast Density Assessment: 4-class density prediction.
Models trained using ResNet-18.

RESULTS

Artefact Distribution in EMBED Dataset

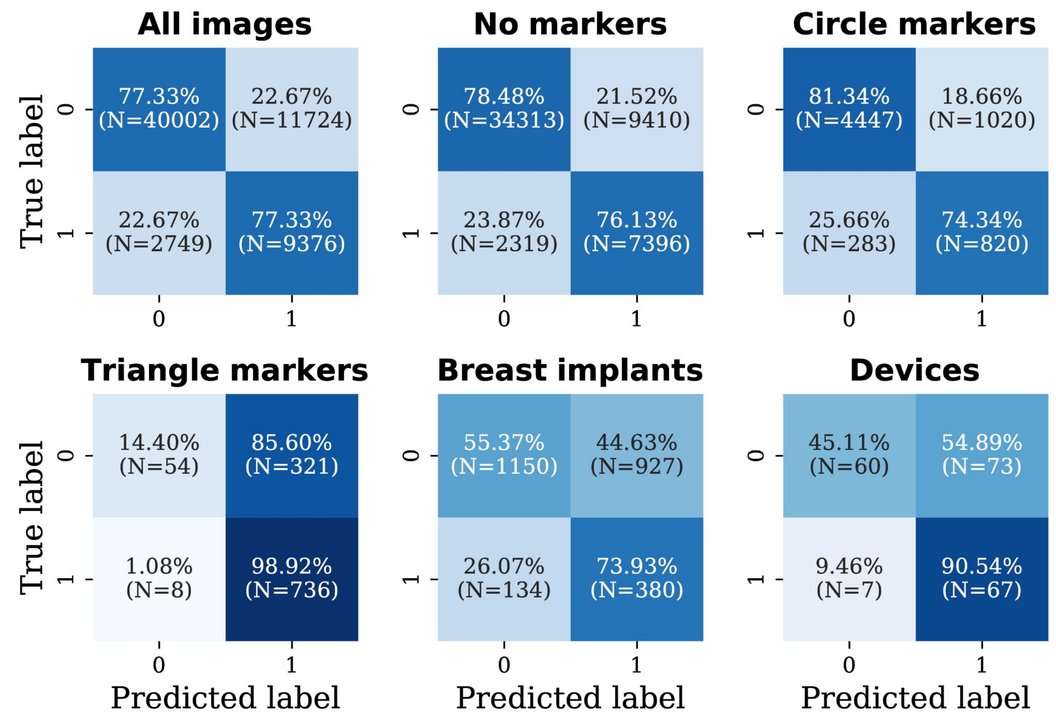
22% of mammograms contain artifacts.
Certain artifacts (triangular markers, compression) correlate with non-negative cancer findings.

Artefact	Normal Images	Non-negative Images
No Artefacts	251,805 (84%)	57,699 (59.5%)
Circles	31,698 (10%)	7,148 (7%)
Triangles	3,769 (1%)	7,477 (8%)
Implants	8,973 (3%)	2,111 (2%)
Devices	775 (0.3%)	309 (0.3%)
Spot compressions	6,734 (2%)	27,370 (28.2%)
Total	301,416	97,042

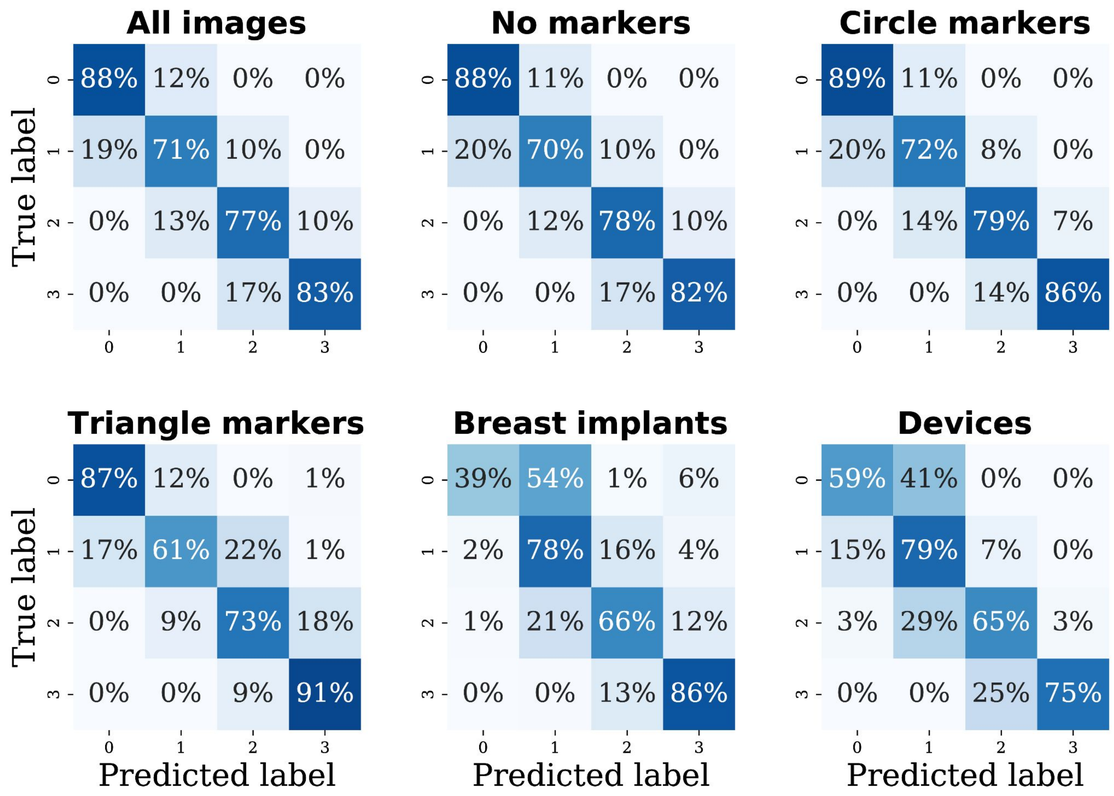
Distribution of artifacts in normal vs. non-negative cases.

Effects on Downstream Tasks

Artifacts degrade classification accuracy.
Breast cancer model misclassified images with artifacts.
Accuracy of breast density classification drop for images with implants/devices.



Confusion matrices for breast cancer screening, per marker subgroup



Confusion matrices for breast density classification, per marker subgroup

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