Automatic Detection of Breast Cancer Lumpectomy Margin from Intraoperative Specimen Mammography

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INTRODUCTION

This study aims to develop a deep learning model that improves the detection of positive margins in intraoperative breast lumpectomy specimens on radiographs. We propose a strategy, Forward-Forward Contrastive Learning (FFCL) with both local and global-level contrastive learning to detect positive margins from radiographs.

METHODS

We employed a FFCL-based pretraining strategy with local and global contrastive learning before backpropagation for classification. We collected 100 localized lumpectomy intraoperative radiographs from 2020-2022 at UK and the Markey Cancer Center, annotating them for malignancy, non-malignant tissue, and positive margins. Then extracted 64 × 64 patches from these regions and fed them into a ResNet-18 model pretrained with Focal cross-entropy loss to address dataset imbalance

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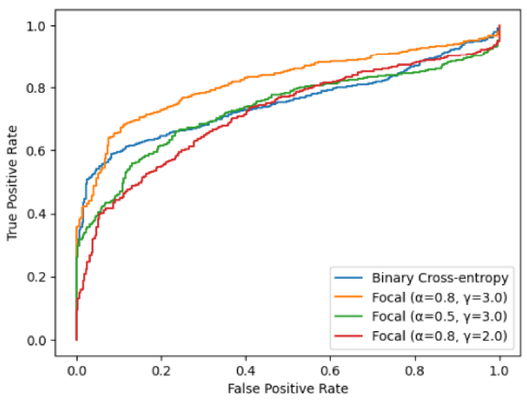
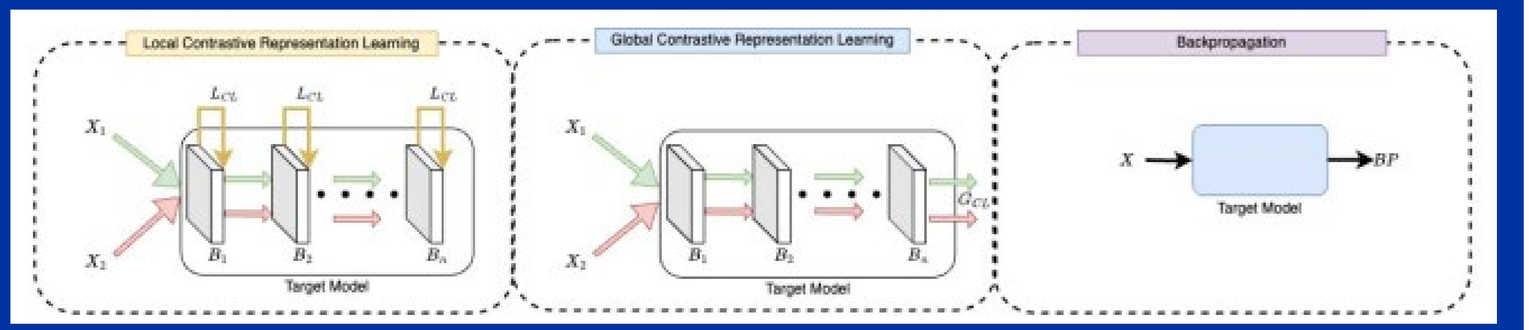
RESULTS

FFCL-based ResNet-18 achieves an accuracy of 0.8070 with an AUC score of 0.8428 at the optimal Focal loss setting compared to 0.7823 with an AUC score of 0.7869.



Visualization of ROC curves comparing the binary cross-entropy and Focal cross-entropy losses (w/ ResNet-18) at different α and γ parameters.

Preliminary results of our FFCL method indicate that a deep learning model can **effectively detect positive margins** in intraoperative radiographs of breast lumpectomy specimens, potentially **reducing re-excision rates and improving patient outcomes.**



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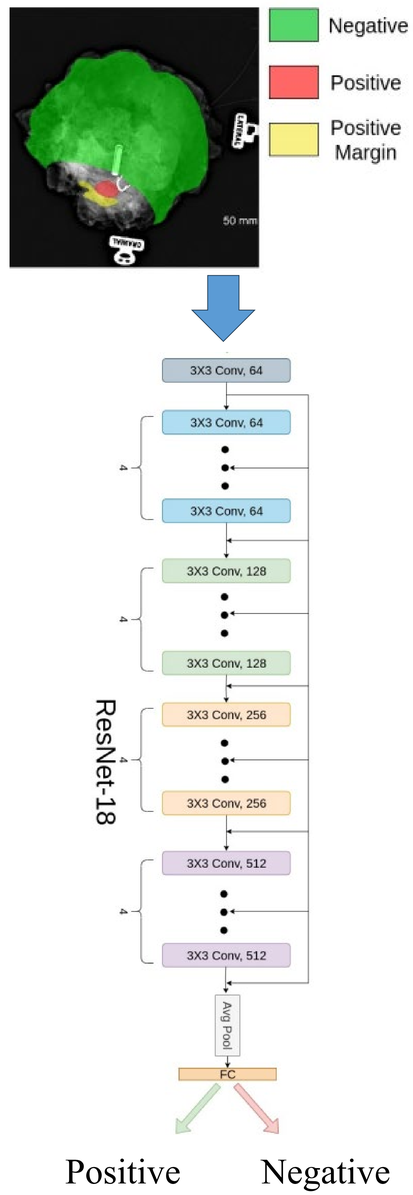
DISCUSSION

Preliminary results suggest a deep learning model can effectively detect positive margins in intraoperative radiographs of breast lumpectomy specimens. Our project aims to automate the labeling of these radiographs using pathology reports across two medical centers with different patient populations and imaging methods.

Extra Tables & Figures

Illustration of breast cancer margin detection using ResNet-18 model



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