

A Deep Learning Classifier Using Sliding Patches for Detection of Mammographical Findings

Diego Mellado, Marvin Querales, Julio Sotelo, Eduardo Godoy, Fabian Pardo, Scarlett Lever, Stéren Chabert,
Rodrigo Salas

Doctorado en Ciencias e Ingeniería para la Salud
Universidad de Valparaíso

November 16th, 2023



Acknowledgements

This work was funded by:

- National Agency for Research and Development (ANID) / Scholarship program / *Becas Doctorado Nacional 2022 - 21221429*
- Millennium Science Initiative Program ICN2021_004
- ANID FONDEF IDEA I+D ID20i10332 “*Artificial Intelligence System for Support in Diagnosis and Priorization of Mammographic Exams*”
- ANID FONDECYT Research Grant 1221938



Millennium Institute
for Intelligent
Healthcare Engineering



Breast Cancer Screening

Pathological Findings Detection

Our Proposal

Our study proposes a Deep Learning Classifier trained on cropped segments of mammograms for multi-label classification of pathological findings.
General Inspection of the complete image using local patches.

Dataset

- **Vindr-mammo** Dataset¹
- 5000 digital mammogram examinations containing for each view:
 - BIRADS
 - Breast density
 - Bounding box of each finding present on the image
- 10 classes of pathological findings

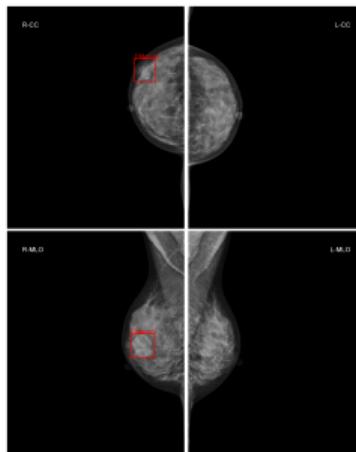


Figure: Example of a mammogram from the Vindr-mammo dataset.

¹Hieu Huy Pham, Hieu Nguyen Trung, and Ha Quy Nguyen. VinDr-Mammo: A Large-Scale Benchmark Dataset for Computer-Aided Detection and Diagnosis in Full-Field Digital Mammography. Version 1.0.0. PhysioNet. DOI: 10.13026/BR2V-7517. URL: <https://physionet.org/content/vindr-mammo/1.0.0/> (visited on 11/08/2022)

Dataset Distribution

Image Processing Pipeline

- Each DICOM Image is normalised to a range of [0, 1]
- Apply CLAHE algorithm² for histogram equalization at 2 different scales
- Fuse the equalized images with the original, channel-wise
- Image is cropped to the bounding box of the breast using Otsu's thresholding.

²S.M. Pizer, R.E. Johnston, J.P. Erickson, et al. "Contrast-Limited Adaptive Histogram Equalization: Speed and Effectiveness". In: *[1990] Proceedings of the First Conference on Visualization in Biomedical Computing. [1990] Proceedings of the First Conference on Visualization in Biomedical Computing*. May 1990, pp. 337–345. doi: 10.1109/VBC.1990.109340. URL: <https://ieeexplore.ieee.org/document/109340> (visited on 10/03/2023)

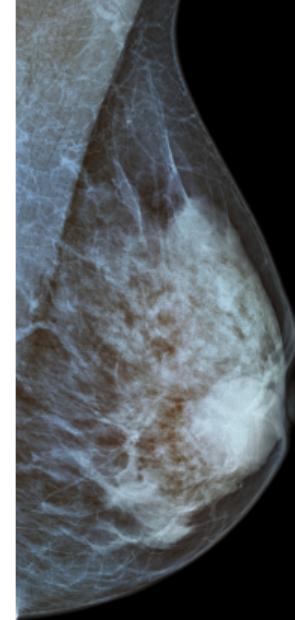
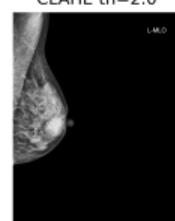
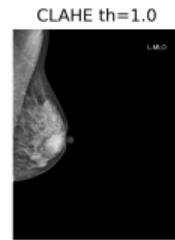
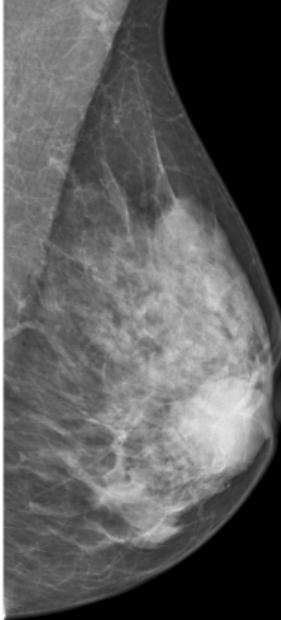
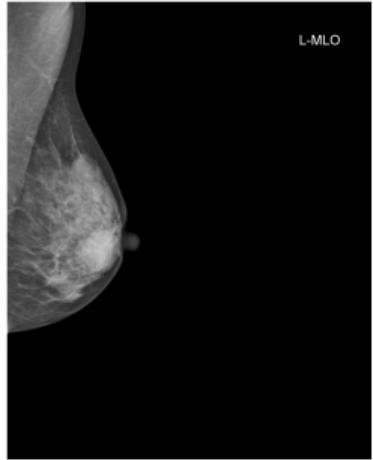


Figure: Image processing pipeline

Evaluation of deep learning architectures

We evaluated the following architectures as a backbone:

- ResNet50
- EfficientNetV2
- DenseNet
- Swin Transformer
- MobileNet
- VGG19

Classifier Layer using 2 layer MLP with 512 hidden units and ReLU activation. Output layer with 10 units and sigmoid activation.

Feature Extraction Model

- We use the backbone of the selected architecture as a feature extractor.
- The output of the backbone is flattened and fed to the classifier.
- The classifier is trained using the cropped images.

Results

Discussion

Future Work