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ABNORMALITY DETECTION IN MAMMOGRAPHY USING DEEP CONVOLUTIONAL NEURAL NETWORK (CNN)

Pengcheng Xi, Chang Shu, Rafik Goubran

chiara.tumminelli@edu.unito.it

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Presented by: Chiara Tumminelli, 884228



SCAN ME

Overview

Breast Cancer & Mammography

➤ Breast Cancer

- Most prevalent cancer among women
- Prevention strategies can reduce risk
- Early detection is critical for improving survival rates

➤ Mammography

- Primary screening modality utilizing X-rays
- Includes both screening and diagnostic approaches
- Effectively detects calcifications and masses

Challenges & Solutions

➤ Challenges in Mammography

- Low contrast in mammographic images
- Loss of detail due to image compression
- High computational demands for image processing

➤ CADe & CNN

- CADe aids in abnormality detection
- CNNs enhance classification accuracy
- Reducing false positives and improving localization



CNN for Abnormality Detection

Patch Training

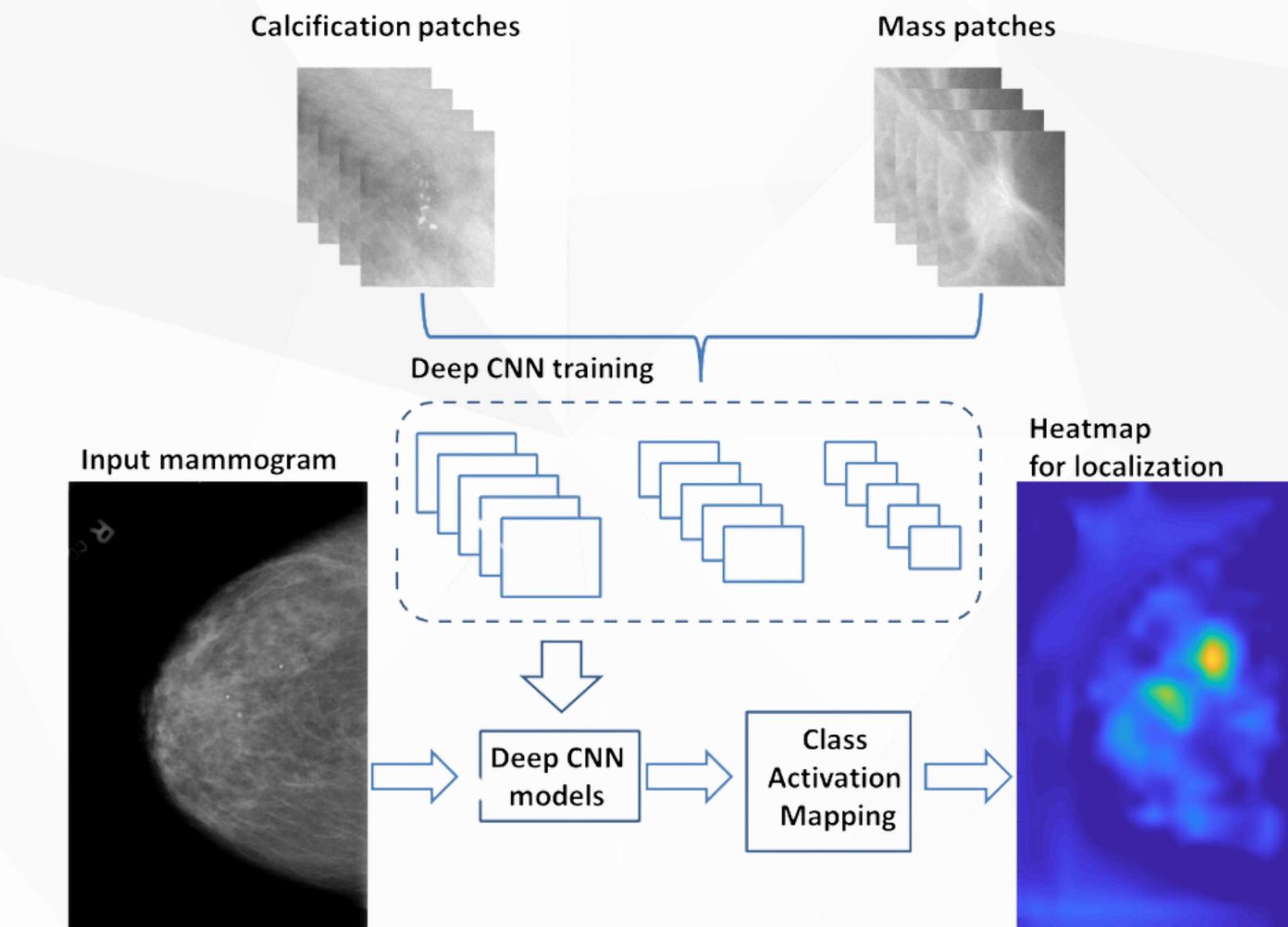
Training the CNN on image patches containing abnormalities like calcifications and masses

Transfer Learning

Adapting a pre-trained neural network on another dataset to improve training on mammography data

Heatmap Localization

Creating a heatmap to visualize and localize abnormalities in the full mammogram image



Data Selection



Mammographic Image Analysis Society (MIAS)

- 161 patients, 208 normal, 63 benign, 51 malignant cases.
- Radiologist markings for suspicious regions.
- Small-sized dataset.



Digital Database for Screening Mammography (DDSM)

- 2,500 studies with mammographic images.
- Detailed annotations for suspicious regions.
- Includes patient and image data.

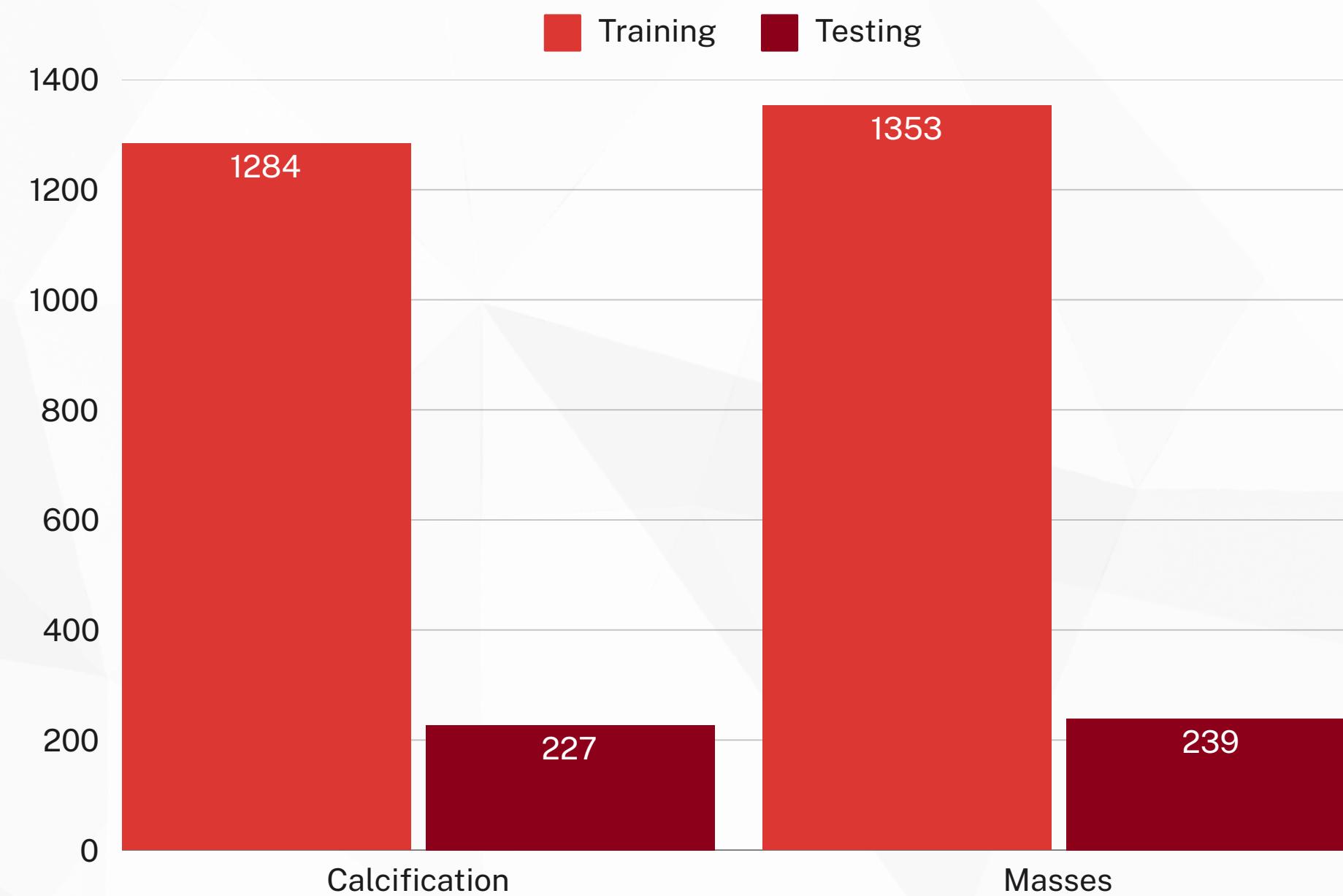


Curated Breast Imaging Subset of DDSM (CBIS-DDSM)

- Updated and standardized version of DDSM.
- Calcification and mass cases with annotations.
- Split 85/15 for training and testing.



CBIS-DDSM Breakdown



Breakdown

Calc. Overall: 1.511 patches

Mass Overall: 1.592 patches

Total Patches
3.103

Data Augmentation



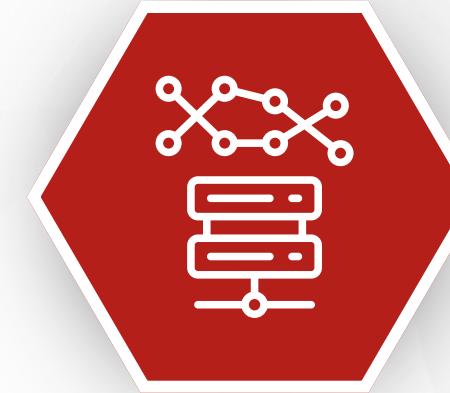
Purpose

- Mitigate overfitting.
- Enhance model robustness.



Methods

- Random rotations (0° to 360°).
- Random X/Y reflections.



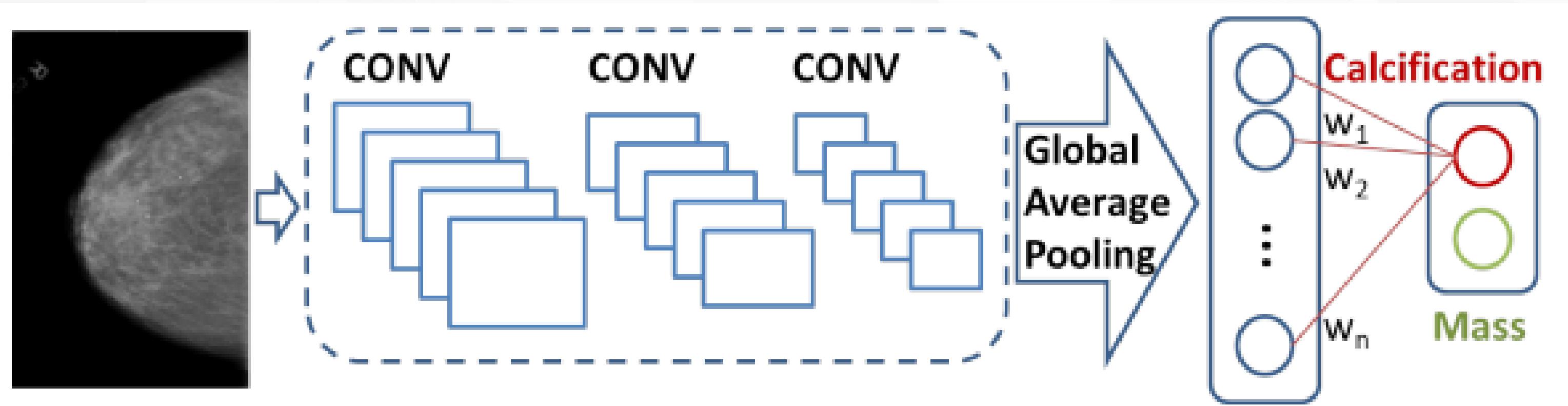
Rationale

- Increase data variability.
- Enhance generalization.

Architectures of Deep CNN

Model	Calcification	Mass	Overall
AlexNet	88.81%	93.64%	91.23%
VGGNet	92.42%	92.64%	92.53%
GoogLeNet	87.14%	95.06%	91.10%
ResNet	90.22%	93.39%	91.80%

Class Activation Maps



$$CAM = \sum_{i=1}^n w_i f_i$$

CONCLUSIONS

The study showed that CNNs can identify calcifications and masses in mammograms by training on cropped images and using Class Activation Mapping (CAM) for detecting abnormalities in full images.

Research Advantage

This research may help radiologists by reducing workload and enhancing diagnostic efficiency.

Research Drawback

CAM highlights areas but doesn't explain them, making it hard for doctors to trust the model.

Future Improvements

Distinction between benign and malignant anomalies and expansion to other medical fields.

Consideration

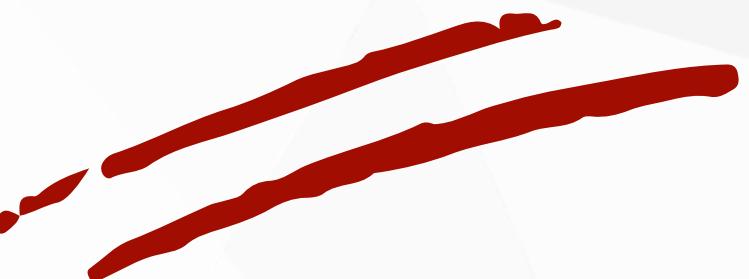
What are the ethical and legal implications of using artificial intelligence in medical diagnosis?



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BIG THANKS

Do you have any questions?



Reach out to me!
chiara.tumminelli@edu.unito.it

