Breast Cancer

Machine Learning

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Goals

- ❖ **Train a machine learning model (i.e CNN with transfer learning) on the CBIS-DDSM dataset**
- ❖ **Evaluate model performance using:**
  - ➤ **Accuracy**
  - ➤ **Precision**
  - ➤ **Recall**
  - ➤ **F1-score**
  - ➤ **auc**
- ❖ **Compare different model architectures and hyperparameters**
- ❖ **Document results, analyze findings, and discuss limitations**

Motivation

- ❖ **Breast cancer is one of the most prevalent cancers worldwide and a leading cause of cancer-related deaths among women.**
- ❖ **Early detection can significantly improve survival rates**
- ❖ **Current technology includes some limitations such as**
  - ❖ **reliance on handcrafted features**
  - ❖ **limited generalization across datasets**
  - ❖ **sensitivity to image noise and variability**

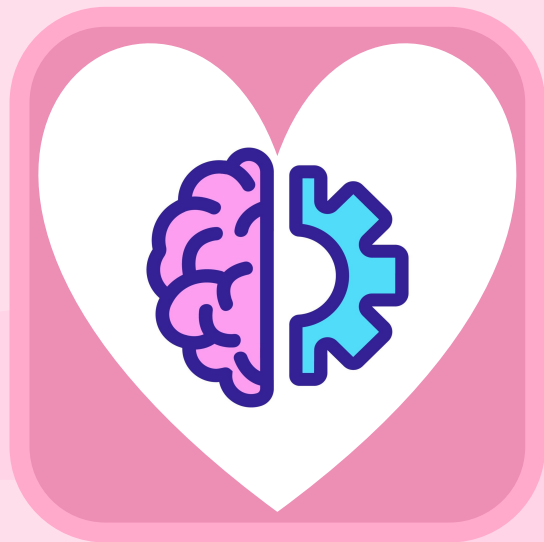# Approach (Key Features)

Feature 1: Preprocessing Pipeline

❖ **Input raw CBIS–DDSM images**

❖ **Automatic:**

➤ **Resizing**

➤ **Normalization**

➤ **Augmentation**

❖ **Consistent, reproducible preprocessing**
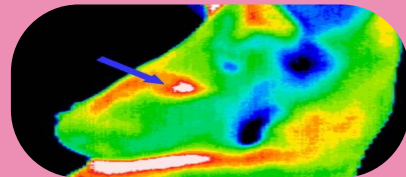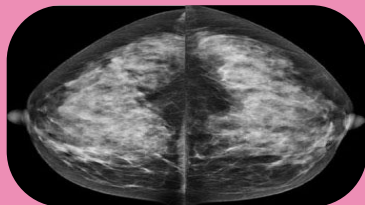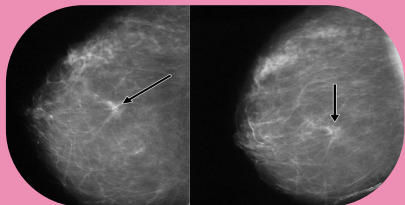
Approach (Key Features) Cont.

Feature 2: CNN-Based Classification

❖ **CNN Models (e.g. ResNet, EfficientNet)**

❖ **Transfer Learning**

❖ **Output:**

➢ **Benign / Malignant label**

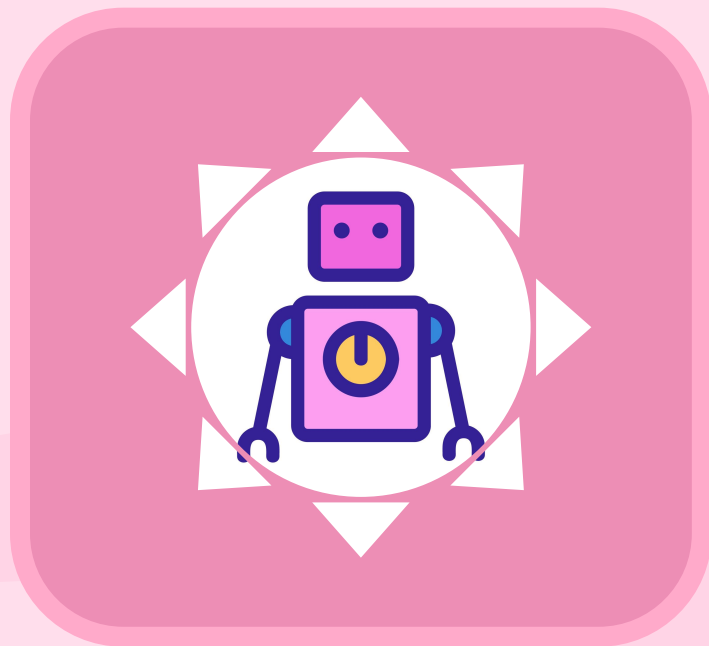➢ **Confidence score**

Approach (Key Features) Cont.

Feature 3: Evaluation & Visualization

❖ **Metrics:**
- ➢ **Accuracy**
- ➢ **Precision**
- ➢ **Recall**
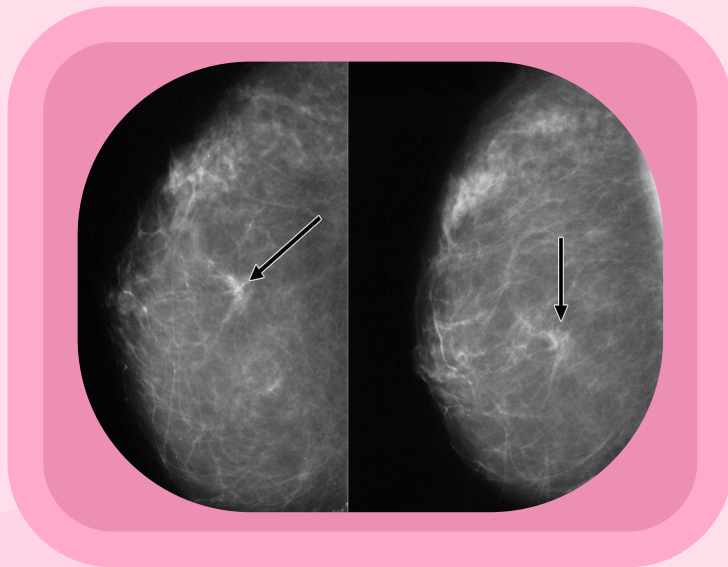- ➢ **F1-score**
- ➢ **AUC**

❖ **Visualizations:**
- ➢ **Confusion Matrix**
- ➢ **ROC Curve**

Functionality

❖ **Upload mammogram images**

❖ **Train & evaluate models**

❖ **Compare architectures**

❖ **View metrics and visual results**

❖ **Inspect misclassified cases**

Algorithms & Tools

❖ **Algorithms**
  ➤ **Convolutional Neural Networks**
  ➤ **Transfer Learning**
  ➤ **Binary Classification**
❖ **Tools**
  ➤ **Python**
  ➤ **PyTorch or TensorFlow**
  ➤ **Scikit-learn**
  ➤ **Matplotlib**

❖ **Dataset**
  ➤ **CBIS-DDSM mammogram image dataset**

Technical Challenges

- ❖ **Limited Experience with Medical Image Data**
- ❖ **CNN Training & Tuning**
- ❖ **Model Evaluation & Interpretation**
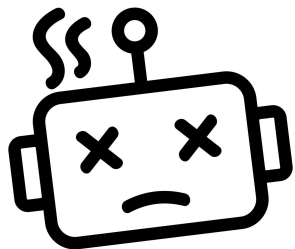
Milestone 1 (Planning & Setup)

- ❖ **Compare and select technical tools**
- ❖ **Develop small demos**
- ❖ **Resolve initial technical challenges**
- ❖ **Create Necessary documents**

Milestone 2 (Core Implementation)

❖ **Implement and test full preprocessing pipeline**
❖ **Implement and train an initial CNN model**
❖ **Implement transfer learning using a pre trained architecture**
❖ **Evaluate and compare initial mode**

Milestone 3 (Refinement & Analysis)

❖ **Implement additional CNN architectures**

❖ **Fine-tune parameters and augmentation strategies**

❖ **Performa detailed evaluation using visuals**

❖ **Create a diagram which showcases each milestone and its results**

Task Matrix

Task	Kahlel	Woroma	Tara
Compare & Select Technical Tools	Data	Models	Visualization
"Hello World" Demos	Preprocessing	CNN Training	Metrics
Resolve Technical Challenges	Dataset	Architecture	Evaluation
Requirements Document	50%	25%	25%
Design Document	25%	25%	50%
Test Plan	25%	50%	25%

Thank you

Questions?