Emory Health AI Bias Datathon '23

EMBED Dataset - Mammogram

Medical Imaging Bias Detectives

Team Members

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Motivation

- Black women are **41% more likely** to die from breast cancer than White women, despite being less likely to be diagnosed with it.*

- **EMory BrEast imaging Dataset (EMBED)** dataset exploration revealed:
  - Black women have **5% more** breast biopsies than white women (40% vs 35%) but…….
  - The incidence rate of breast cancer is **essentially the same** (5.7% in black women and 6.2% in white women) patients

- Reducing **false positive** diagnostic mammograms can ***reduce*** patient suffering and preserve health care resources

*https://www.cancer.org/research/acs-research-news/facts-and-figures-african-american-black-people-2022-2024

Motivation: EMBED Stats

- % of diagnostic mammography findings

Diagnostic	Black	White
BI-RADS 1&2	60.6%	65.8%
BI-RADS 4&5	39.4%	34.2%

- % positive breast cancer on diagnostic mammogram BI-RAD 4&5

Diagnostic	Black	White
Non-cancer	69.6%	55.6%
Cancer	30.4%	44.4%

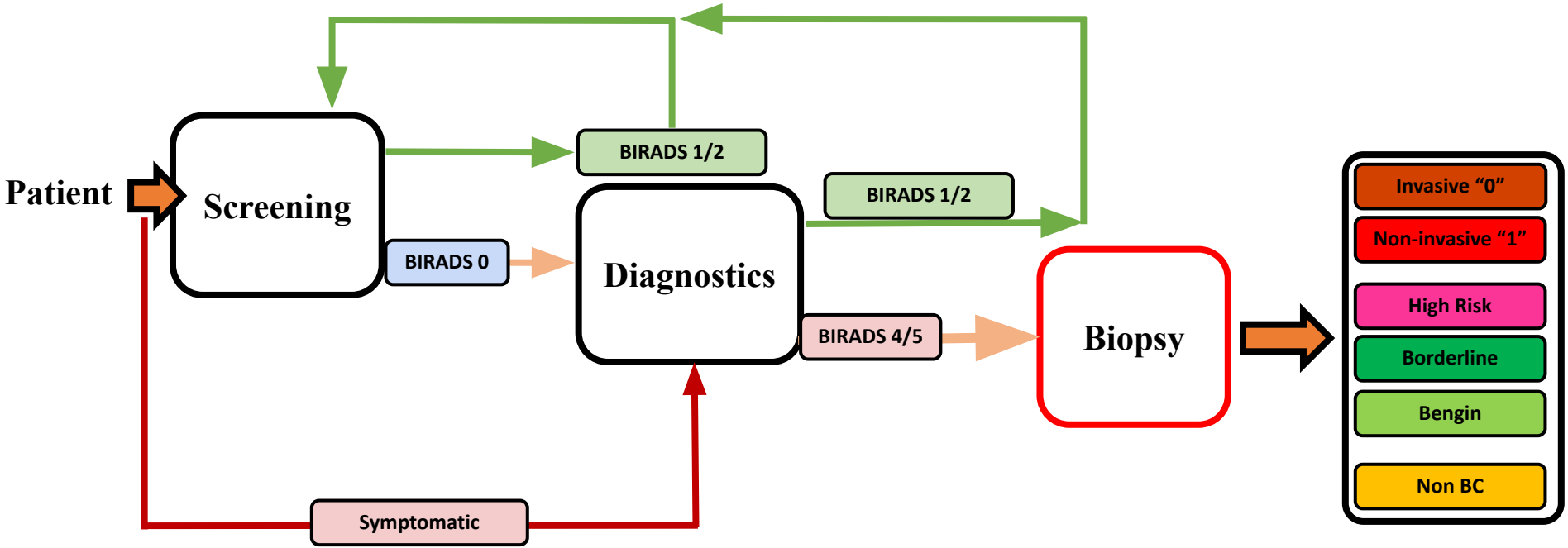
- Incidence of breast cancer

Black	White
5.7%	6.2%

Research Question

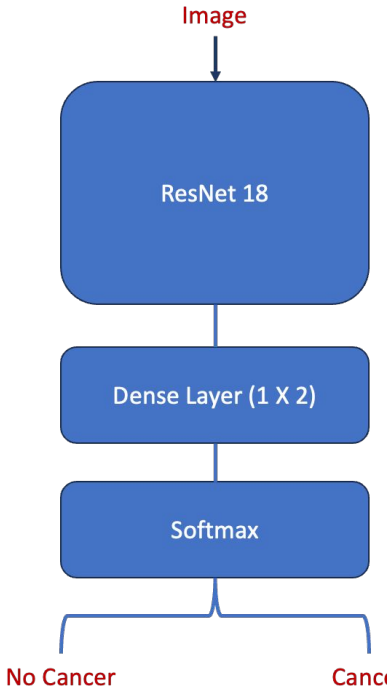
Using breast mammograms, can we develop an AI system to reduce biased breast biopsies?

Workflow


Patient
Screening
BIRADS 1/2
BIRADS 0
Diagnostics
BIRADS 1/2
BIRADS 4/5
Biopsy
Symptomatic
Invasive "0"
Non-invasive "1"
High Risk
Borderline
Bengin
Non BC

Model Training and Preliminary Results

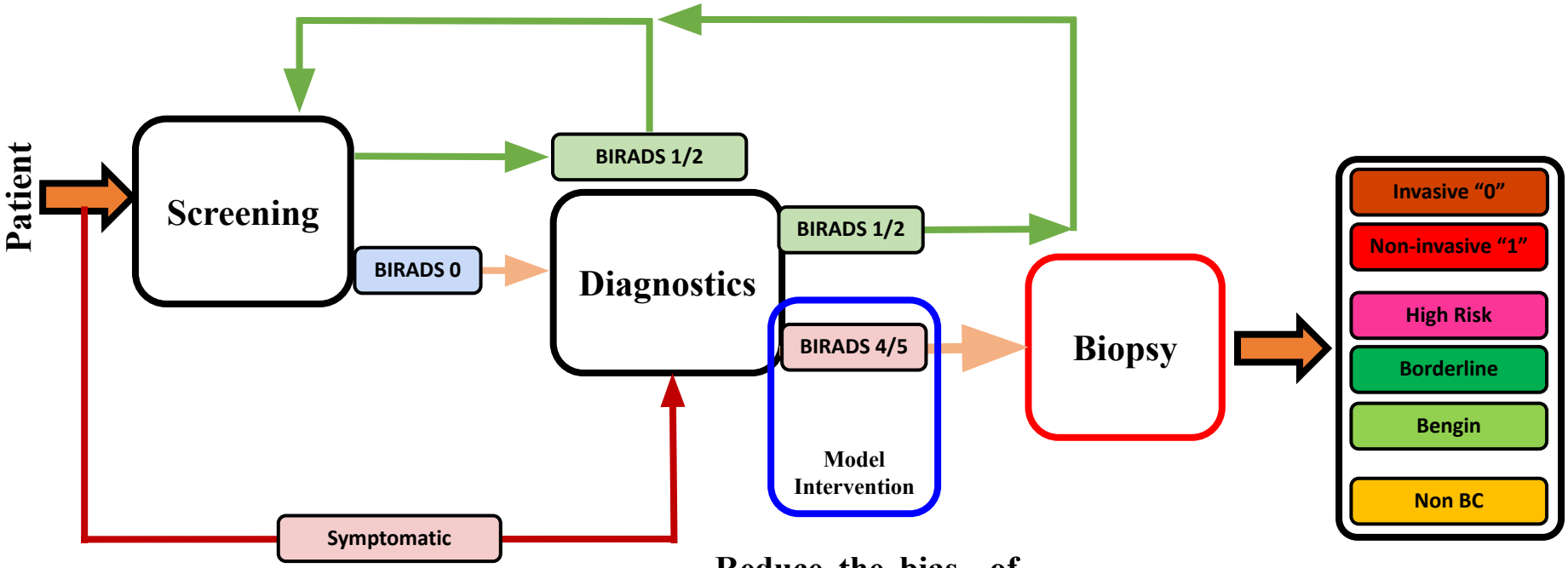
- Since we want to reduce unnecessary biopsies we trained a ResNet18 model on patients that underwent diagnostic imaging and had a BIRADS 4/5 that went on to biopsy.
- The labels were binarized from pathological findings
  - 0 and 1 (invasive and non-invasive breast cancer)
  - 2, 3, 4 (non-cancer)
- N_Training + N_Validation = 28788 (80%)
- N_Test = 7197 (20%)
- Accuracy on training data: 91%
- Accuracy on validation data: 86%
- Accuracy on test data: 75%, AUC: 0.65



Where is the Bias?

- Prevalence of BC aggressiveness and death rate in ***black women*** higher than ***white women***
  - radiologists are more likely to recommend biopsy (***~5% more despite close incidents of cancer***)
- Breast tissue density differs between ***black*** from ***white women***
- Benign breast disease etiology and prevalence differs between ***white*** and ***black*** women
  - therefore mammogram interpretation **more difficult**
- **Is there some other hidden bias in the EMBED dataset?**

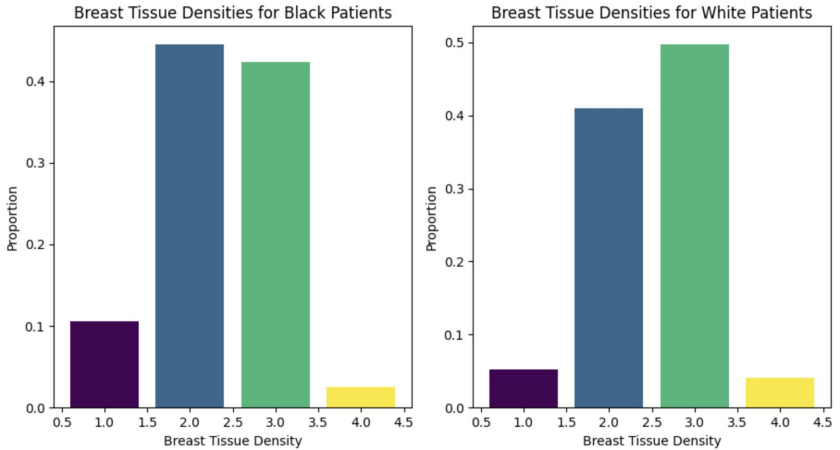
Summary



Reduce the bias of unnecessary biopsy

Future Work

- **Improve model** to maintain sensitivity of cancer detection while reducing biopsy rate
- **Cohort Stratification** based on:
  - Age
  - BMI
  - Pathology of negative biopsies
  - Special views
  - Breast density, etc.



Breast tissue density for Black and White Patients from our EMBED dataset cohort

Thank You & Questions