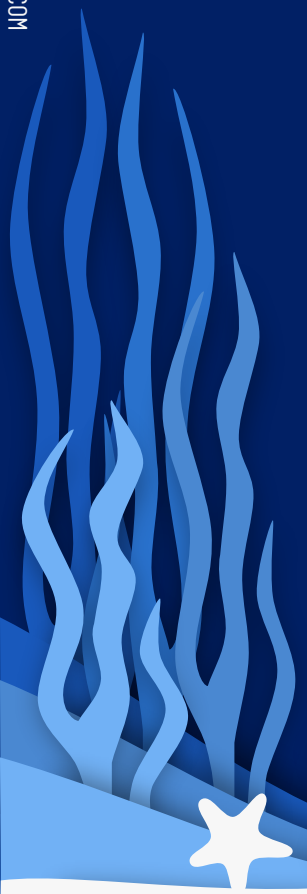
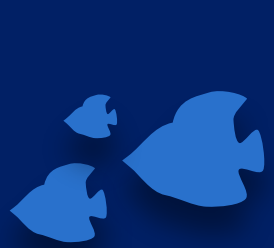
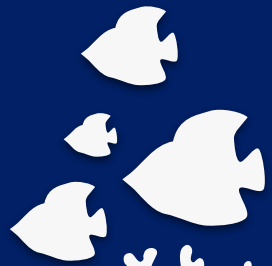
6.8301 Final Presentation

HEARTBEATS IN THE DEEP

Darcy Kim | MIT







♥ HEART FAILURE ♥

Ejection fraction (EF) is a key metric for the diagnosis and treatment of heart failure

EF: Amount of blood heart pumps each beat

Reduced: no squeeze | Preserved: no relax

EF using echocardiography is expensive and variable

***Chest X-rays*: quick, inexpensive, need less expertise, but human eye cannot estimate EF.**

Deep Learning Models can [0]

[0] Williams W. et al. “Classifying Chest X-rays with Pulmonary Edema into HFrEF vs HFpEF.”

PROBLEMS

Data Limitations

Image Data Size

Computational Resources

Clinical models need frequent updates

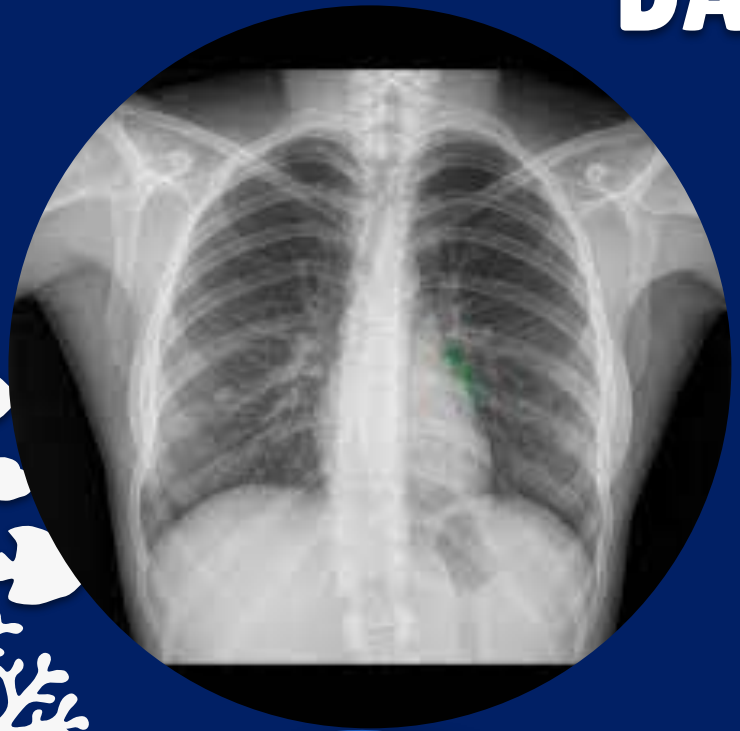
Bias and Representation

Previous model performs significantly better on White Patients than Black Patients

1. Representation: Structural oppression prevents access to Healthcare

2. Short cut features

DATA



- MIMIC IV, MIMIC CXR [1]
  - insurance, race, sex
  - labels: icd codes
  - 2967 patients; 23007 images
- EHR from the Beth Israel Deaconess Medical Center
- 2011- 2016

[1] Johnson A. et al. “MIMIC-CXR, a de-identified publicly available database of chest radiographs with free-text reports.”

General → Specific

Super Contrastive Learning [2]

- Normal vs Abnormal
- Image Embeddings
- 821 544 Chest X-Rays
- India and the United States

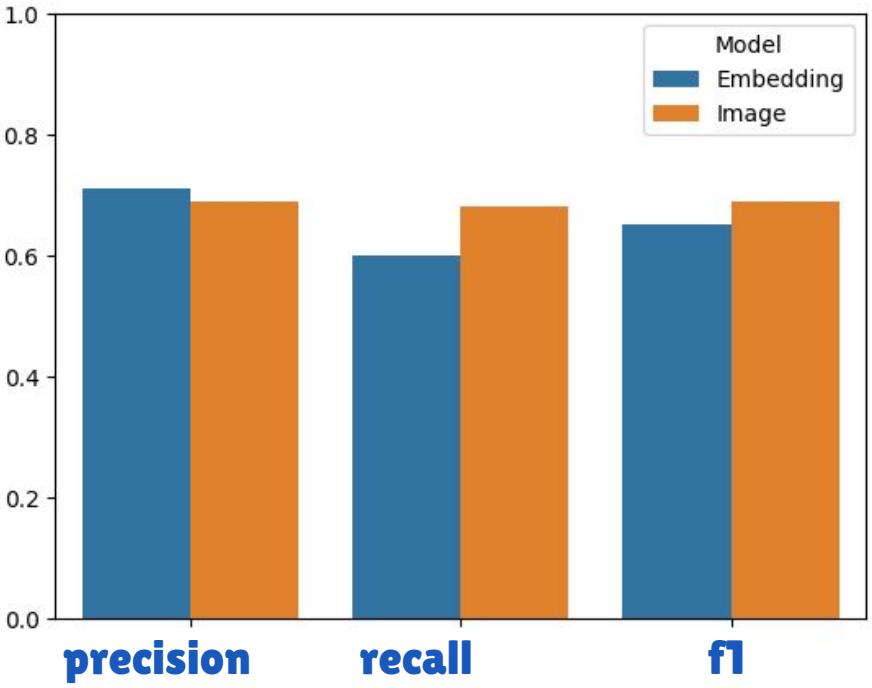
FREEZE

FINE TUNE

- Binary Classification
  - Reduced vs Preserved
- Dense, Dropout, Batch Normalization
- Short cut features

[2] Sellergren, Andrew B et al. “Simplified Transfer Learning for Chest Radiography Models Using Less Data.”

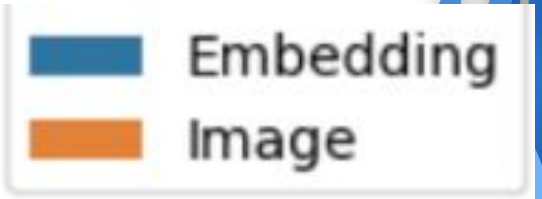
RESULTS



Precision: TP / Pred. P

Recall: TP / Actual P

f1: Balance of both



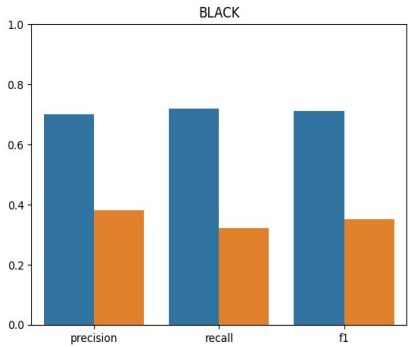
Race is a construct

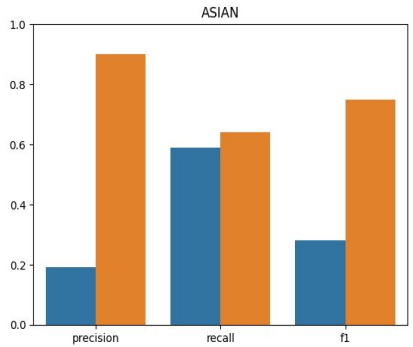
BLACK

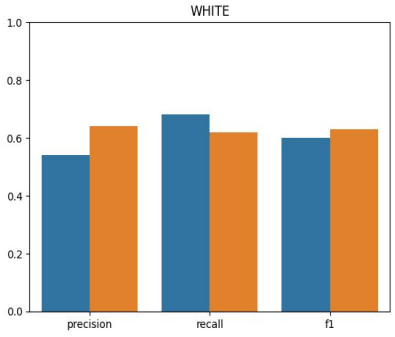
ASIAN

WHITE

Reduced EF





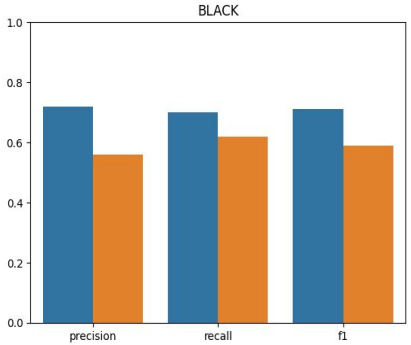


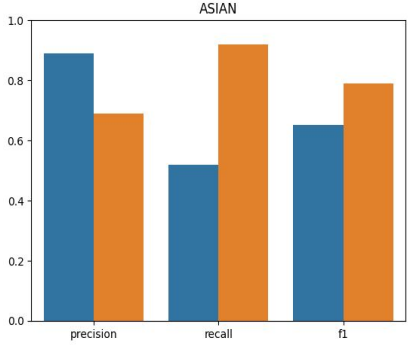
prec **recall** **f1**

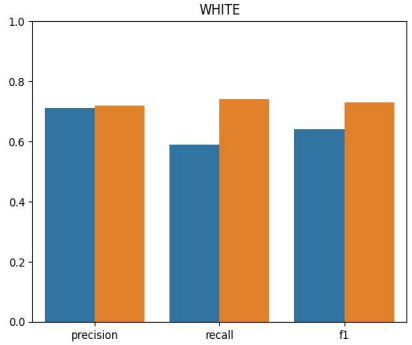
prec **recall** **f1**

prec **recall** **f1**

Preserved EF

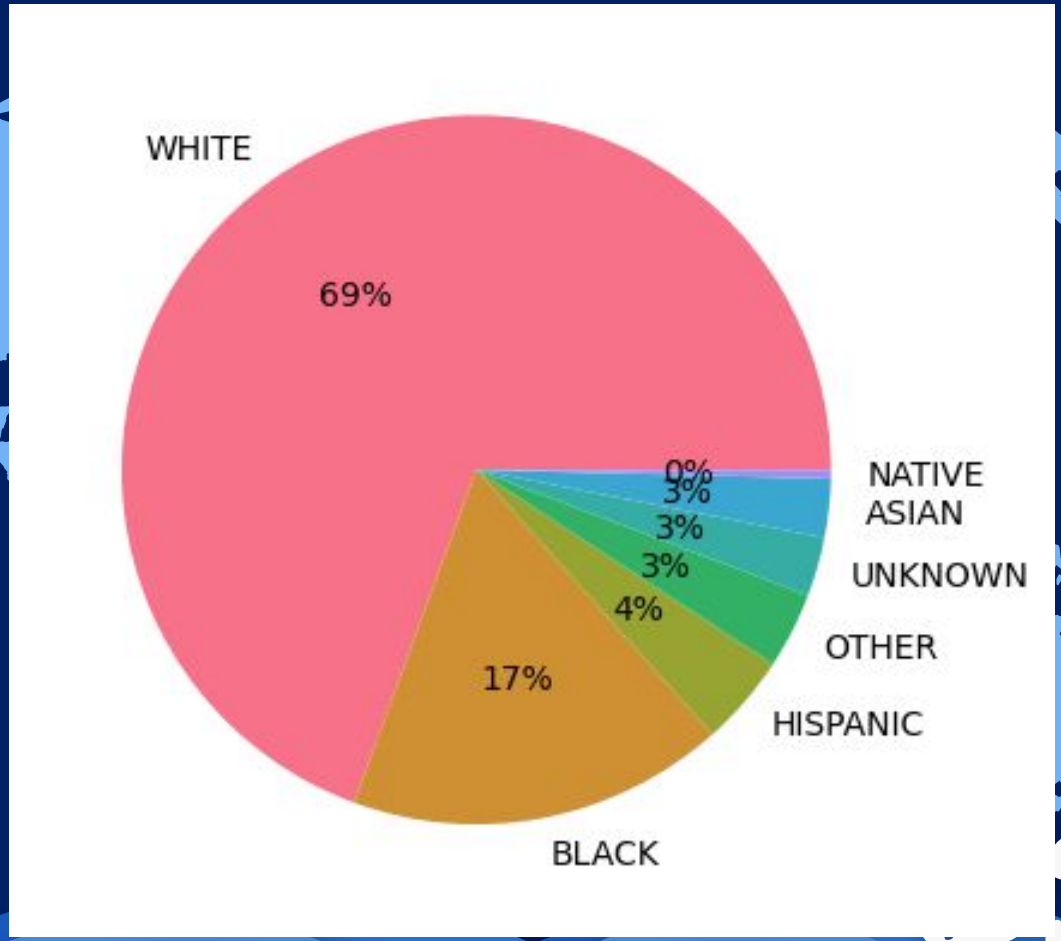


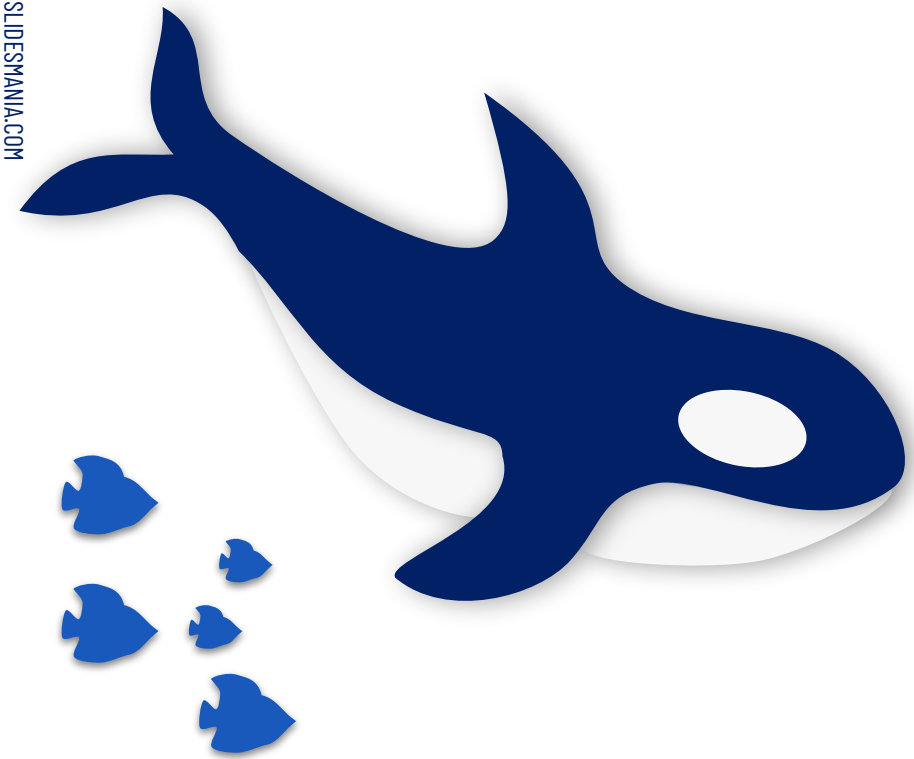




Embedding

Image





HOPE IS PASSION FOR THE POSSIBLE