Reducing Bias in HealthCare for Diabetic Patients

Kristen Lo - BrainStation Data Science Capstone

TODAY'S AGENDA

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The Problem

2
The Data

3
The Analysis

6
Future Plans

5
Current Status

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The Models

THE PROBLEM

- There are **5.7 Million Canadians** living with **Diabetes Mellitus** in 2022 (1)
- Diabetic patients have **complex medical needs**, especially in the ER (2)
- The prevalence of diabetes is **2.1 times** higher among adults living in the lowest-income group (3)

(1)Diabetes Canada (2)Grant, R et al. (3) Gov of Canada

THE DATA

What does it look like?

After filtering for **only patients with diabetes**, there were **110K rows and 487 columns**

What changes were made?

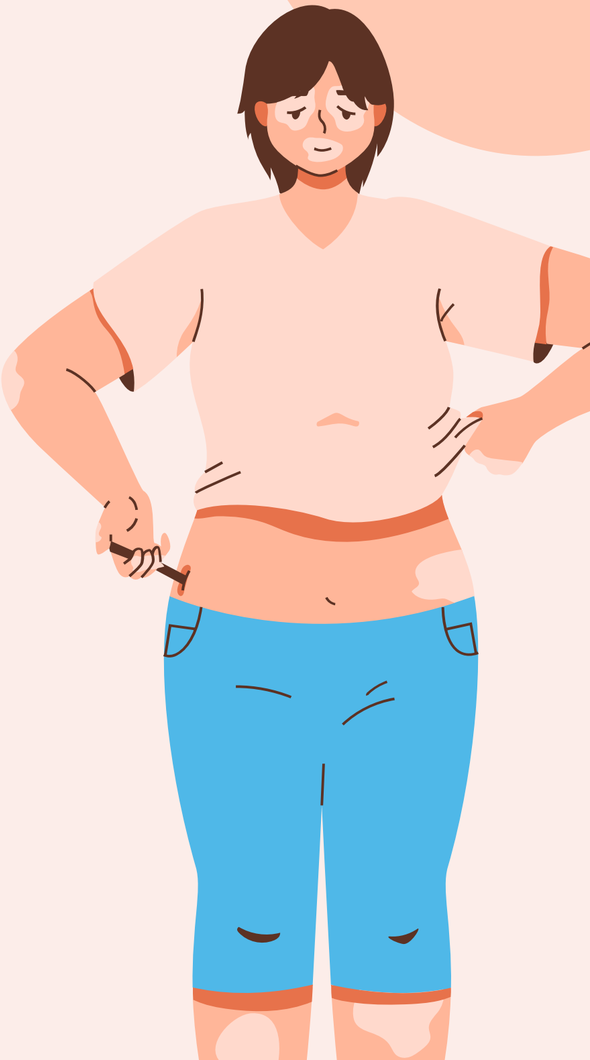
Changing all **numeric columns** to **categorical columns.**

Dummying the columns

Feature Engineering/Elimination

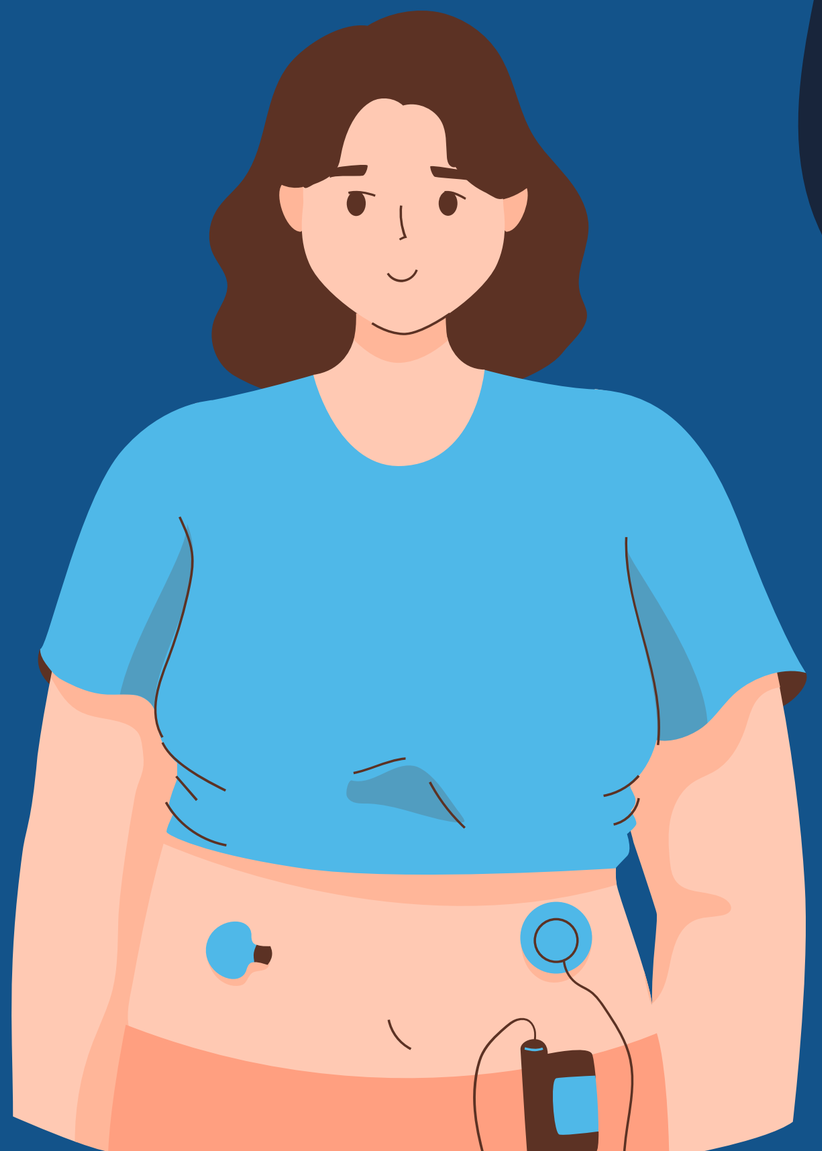
Motivation

To aid in the **pre-processing** of data for **modeling**



THE ANALYSIS

- The **majority** of patients are **over 40**
- About **76%** of the patients have **hypertension**
- About **53%** of the patients have **hyperlipidemia (high cholesterol)**



MODEL METRICS

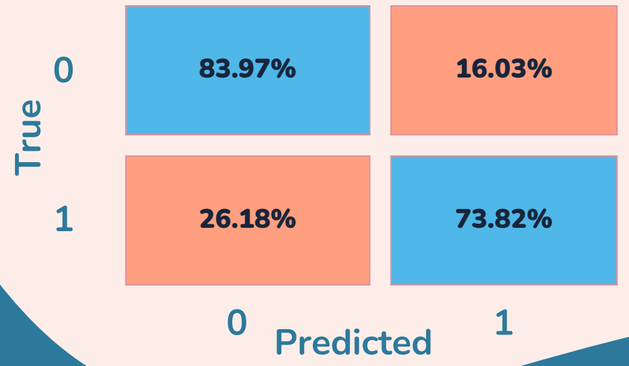
- Train Accuracy
- Test Accuracy
- 5 Fold Cross Validation (CV)
- Mean CV Accuracy
- Classification Report
  - Precision, Recall, F-1 Score
- Confusion Matrix
- ROC - AUC Curve

Logistic Regression

Base

Train Accuracy: **0.792**
Test Accuracy: **0.793**
Mean CV Accuracy: **0.789**

CLASSIFICATION REPORT	PRECISION	RECALL	F-1 SCORE
0	0.79	0.84	0.81
1	0.80	0.74	0.77



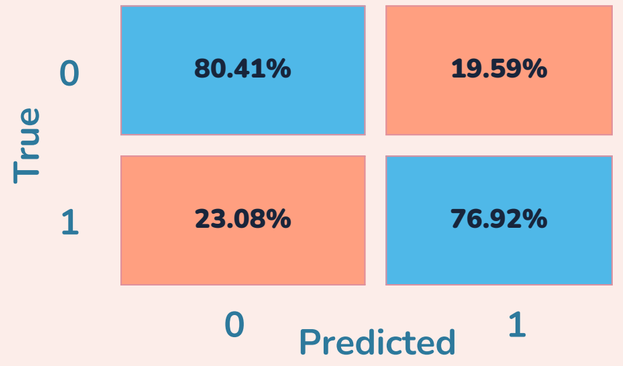
ROC AUC: **0.87**

Optimized

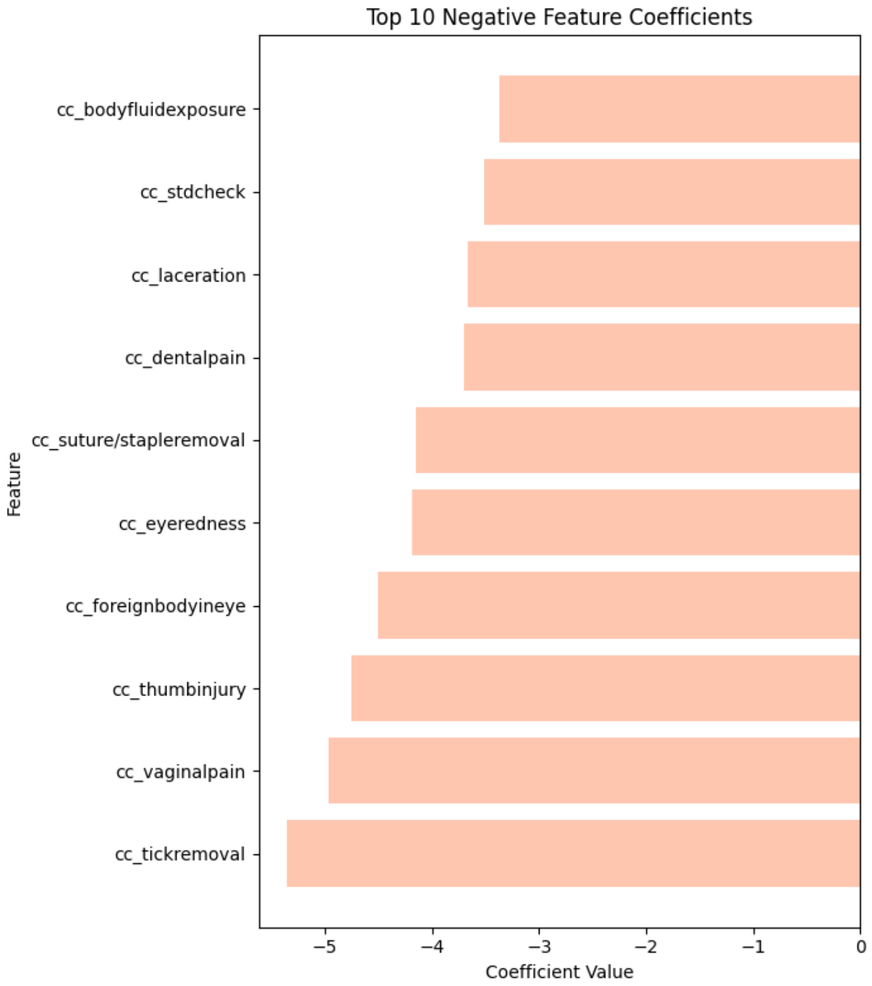
Train Accuracy: **0.787**
Test Accuracy: **0.788**
Mean CV Accuracy: **0.789**

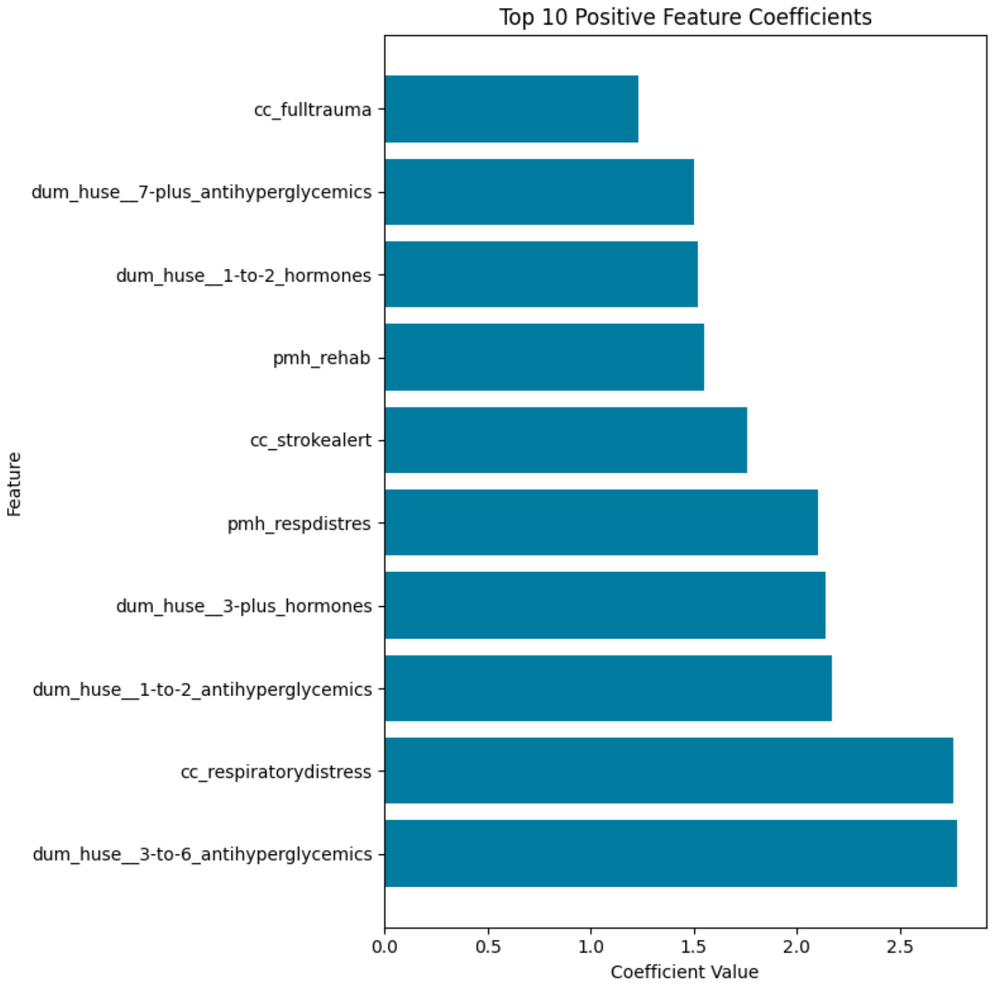
PRECISION	RECALL	F-1 SCORE	CLASSIFICATION REPORT
0.80	0.80	0.80	0
0.77	0.77	0.77	1

ROC AUC: **0.87**



Feature Importance



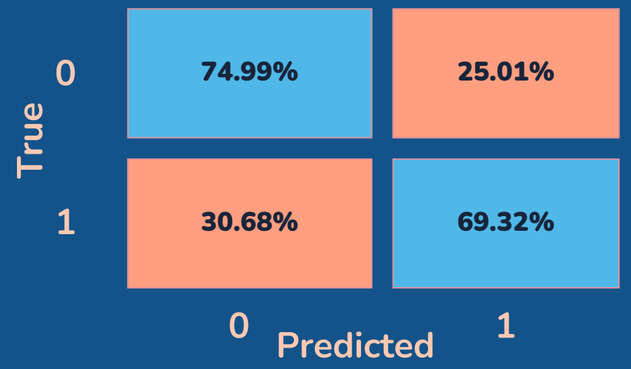


DECISION TREE

Base

Train Accuracy: **0.995**
Test Accuracy: **0.724**
Mean CV Accuracy: **0.700**

CLASSIFICATION REPORT	PRECISION	RECALL	F-1 SCORE
0	0.74	0.75	0.74
1	0.70	0.69	0.70



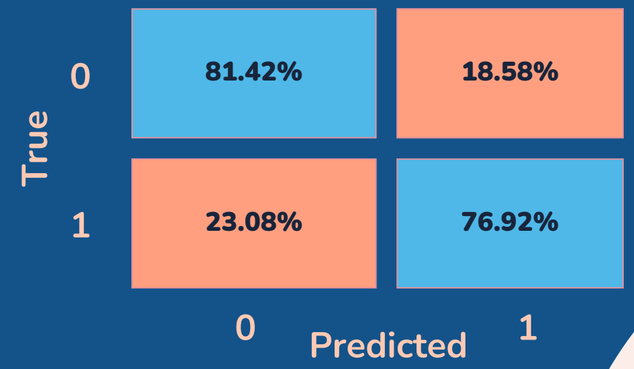
ROC AUC: **0.72**

Optimized

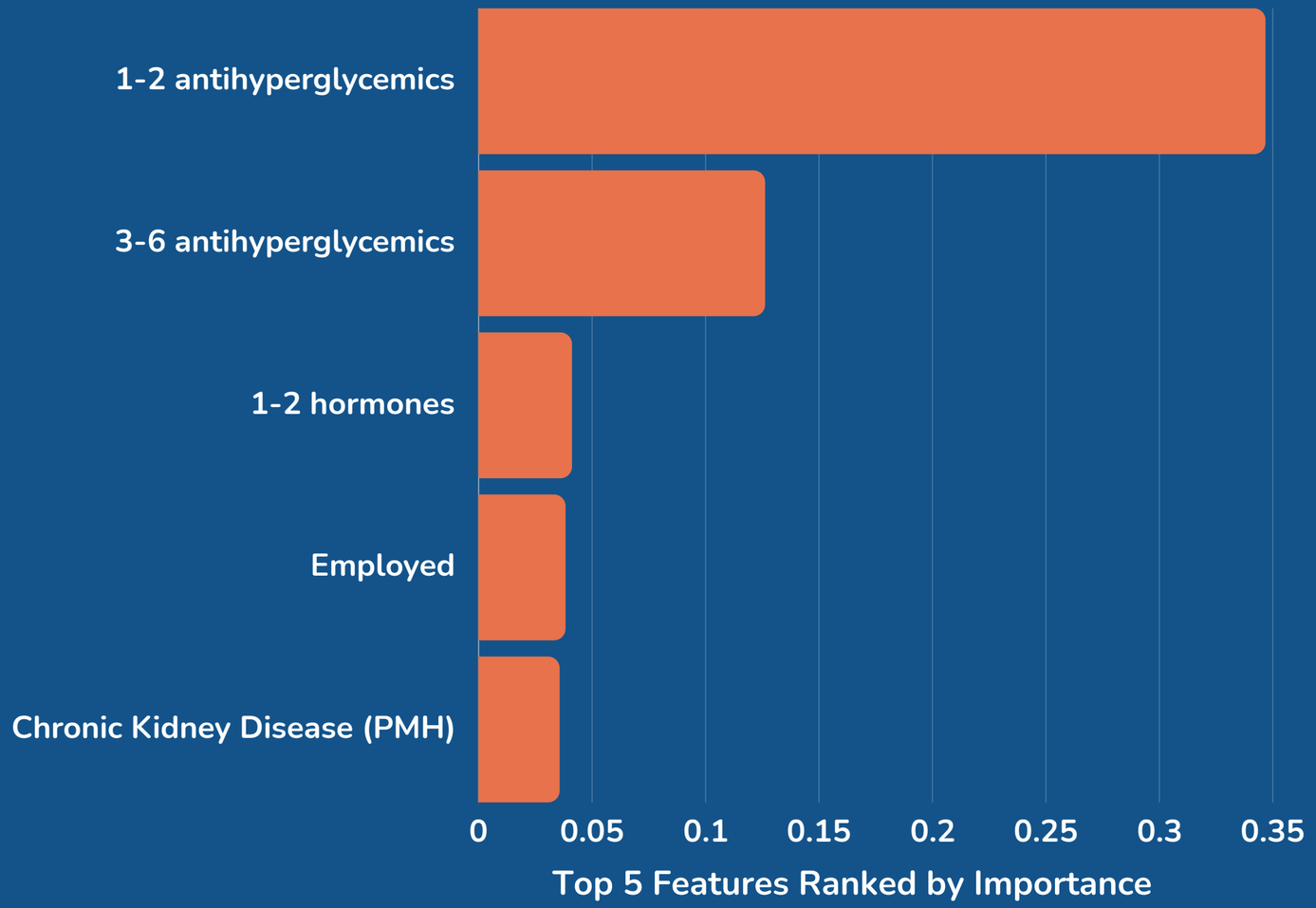
Train Accuracy: **0.8000**
Test Accuracy: **0.762**
Mean CV Accuracy: **0.747**

PRECISION	RECALL	F-1 SCORE	CLASSIFICATION REPORT
0.76	0.81	0.79	0
0.76	0.70	0.73	1

ROC AUC: **0.80**



DECISION TREE



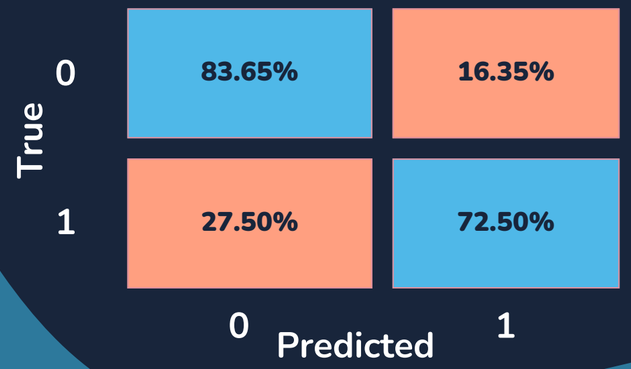
Random Forest

Base

Train Accuracy: **0.995**
Test Accuracy: **0.785**
Mean CV Accuracy: **0.776**

CLASSIFICATION REPORT	PRECISION	RECALL	F-1 SCORE
0	0.78	0.84	0.81
1	0.79	0.72	0.76

ROC AUC: **0.86**

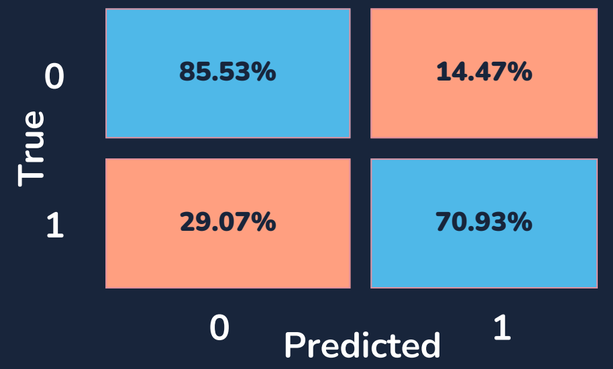


Optimized

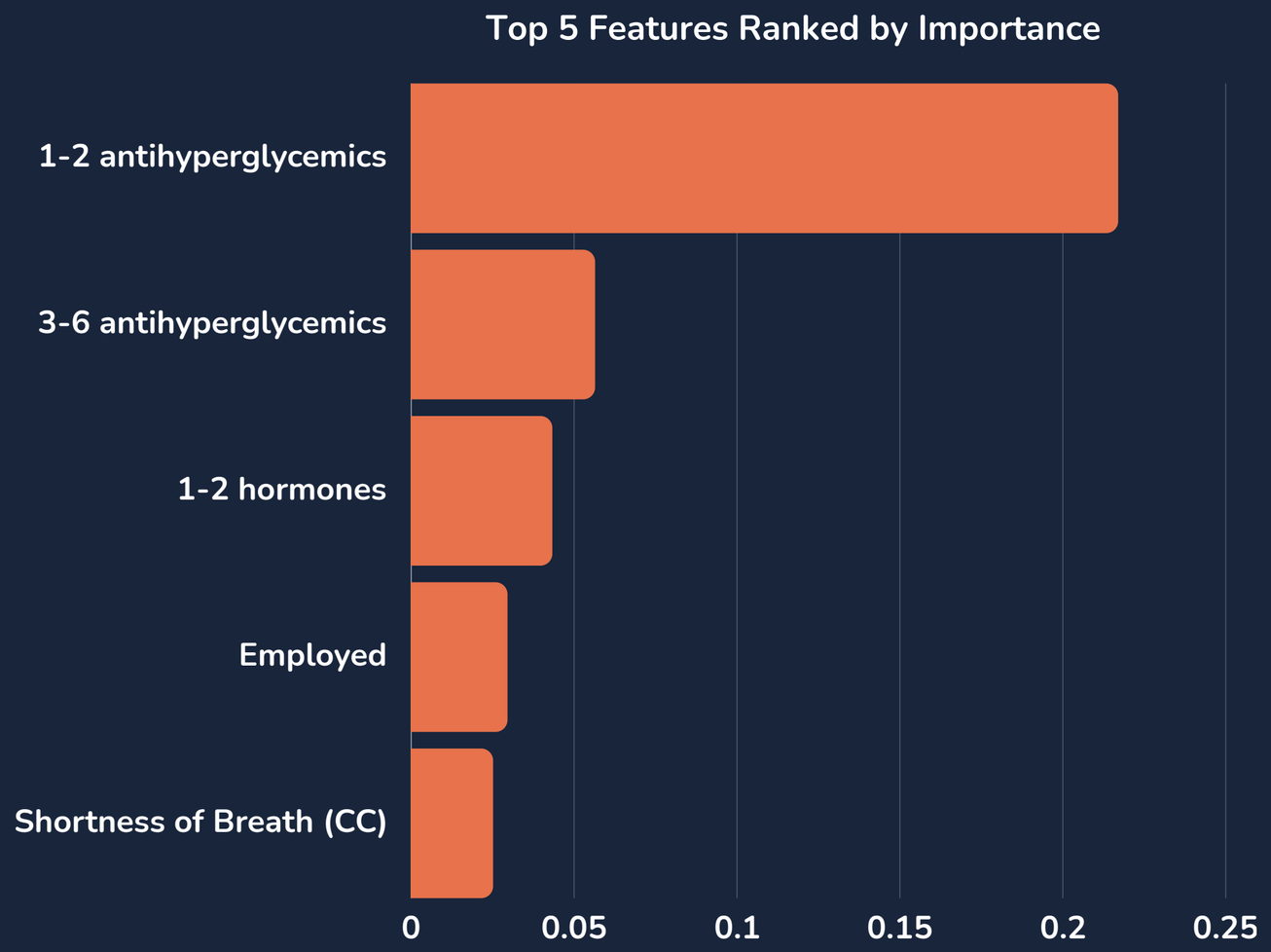
Train Accuracy: **0.849**
Test Accuracy: **0.779**
Mean CV Accuracy: **0787**

PRECISION	RECALL	F-1 SCORE	CLASSIFICATION REPORT
0.77	0.86	0.81	0
0.81	0.70	0.75	1

ROC AUC: **0.87**



Random Forest



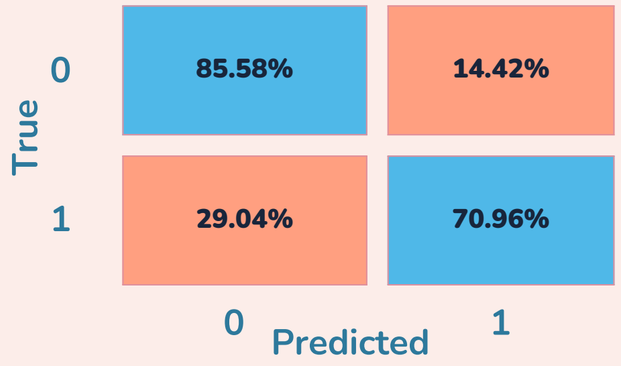
XGBOOST

Base

Train Accuracy: **0.812**
Test Accuracy: **0.788**
Mean CV Accuracy: **0.789**

CLASSIFICATION REPORT	PRECISION	RECALL	F-1 SCORE
0	0.77	0.86	0.81
1	0.81	0.71	0.76

ROC AUC: **0.88**

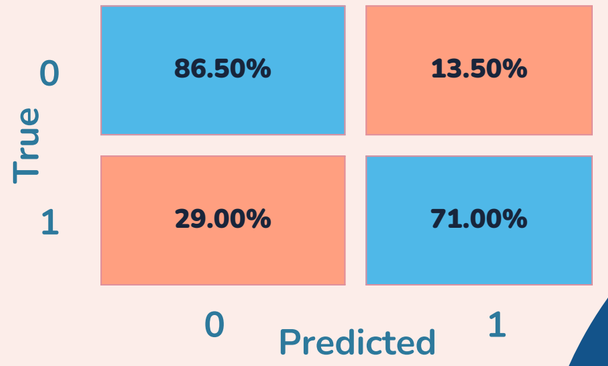


Optimized

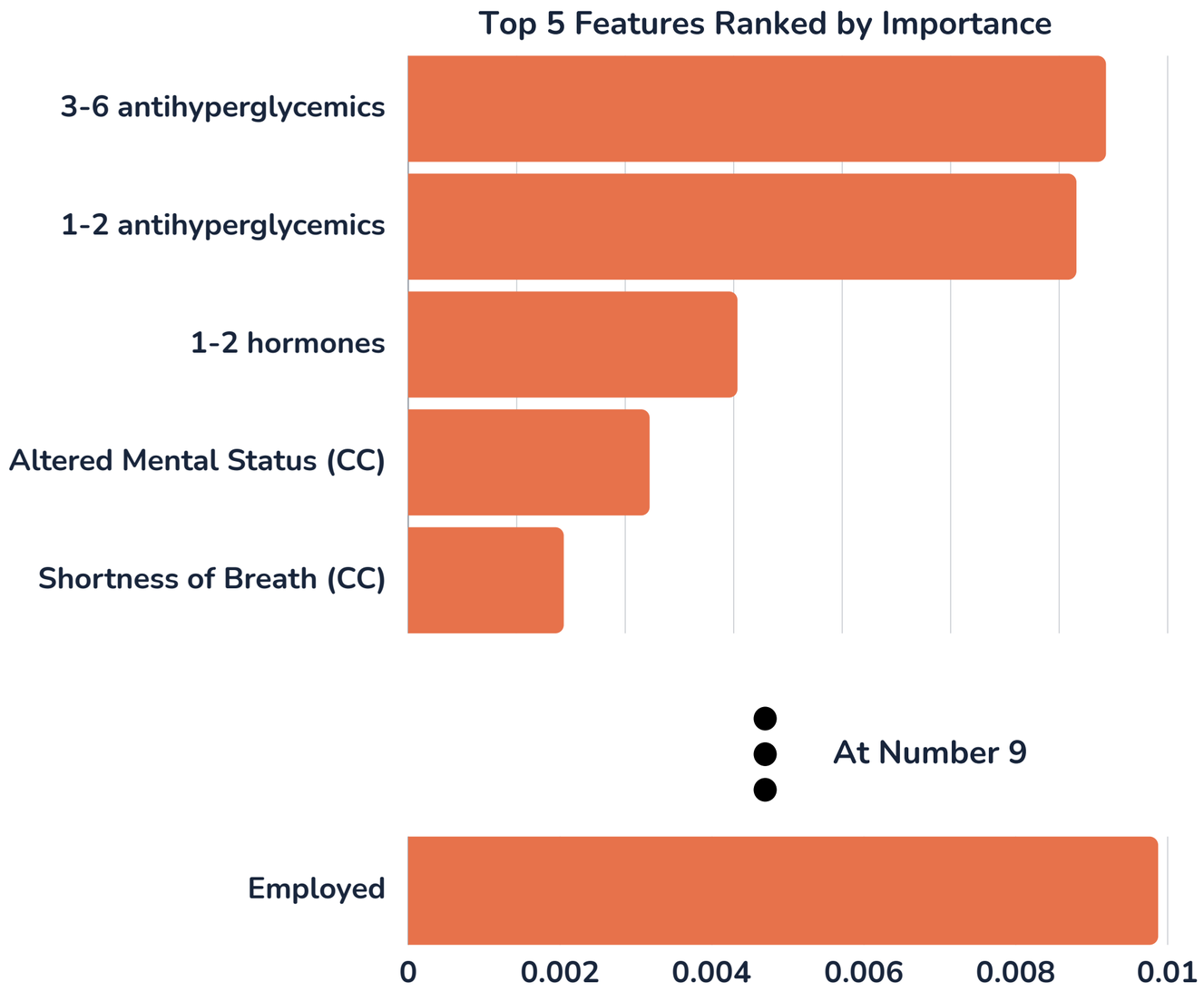
Train Accuracy: **0.817**
Test Accuracy: **0.795**
Mean CV Accuracy: **0.789**

PRECISION	RECALL	F-1 SCORE	CLASSIFICATION REPORT
0.78	0.87	0.82	0
0.81	0.71	0.76	1

ROC AUC: **0.88**

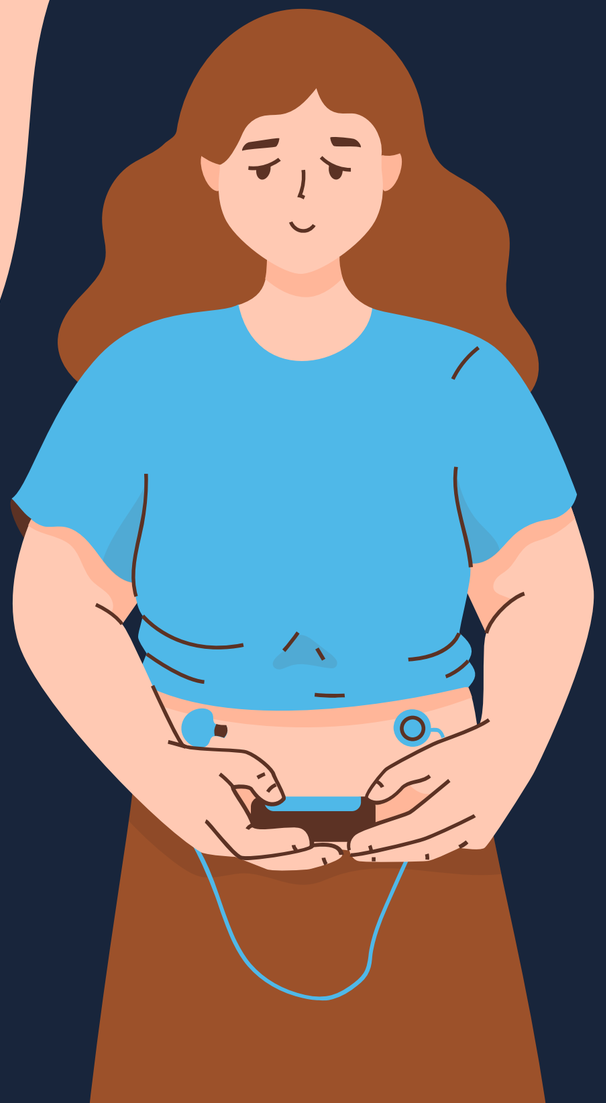


XGBOOST


Top 5 Features Ranked by Importance
3-6 antihyperglycemics
1-2 antihyperglycemics
1-2 hormones
Altered Mental Status (CC)
Shortness of Breath (CC)
At Number 9
Employed
0
0.002
0.004
0.006
0.008
0.01

CURRENT STATUS

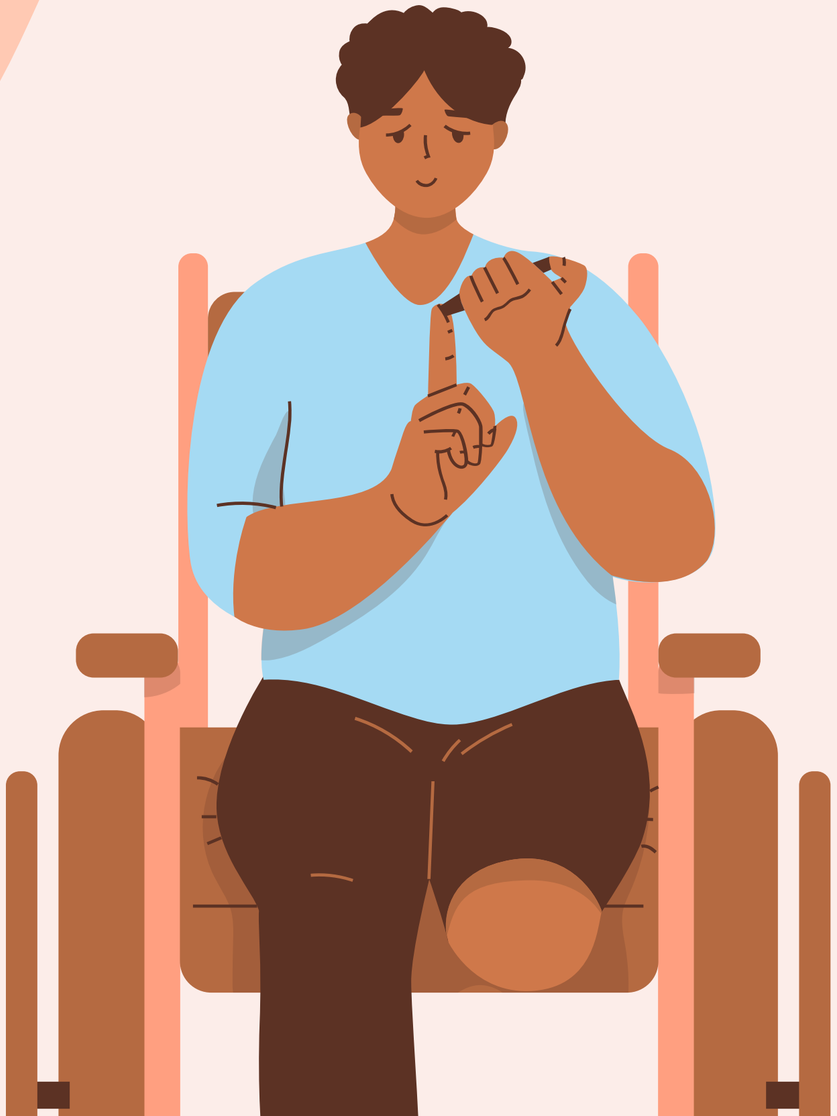
- Increasing **Explainability**



ML IN PRODUCTION

- Use **top 2 models** to push to **production**

- Utilize **Streamlit** to create a **web app** to **interact** with the **models**



BUT WHERE DOES BIAS/HEALTH DISPARITY FIT IN?

FUTURE PLANS:

- More research into **IBM's AIF360 Toolkit**
- Find a way to **successfully implement** it into **model pre-processing**
- Assess **model performance** and compare to **baseline**

THANK YOU!
SO LONG
AND
THANKS FOR
ALL THE FISH!