

COVID-19 ICU Admissions



Agenda

Problem Overview

Data Trends

Predictive Modeling

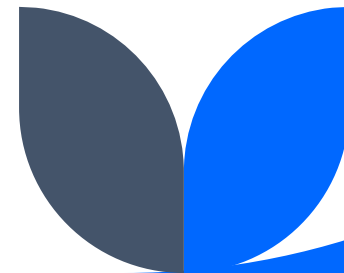
Model Justification





Problem Overview

Predicting COVID-19 ICU
Admissions



Tasks At Hand

- 1. Predict **admission** to ICU of confirmed COVID-19 Cases
 - Is it feasible to predict which patients will need ICU support? Why?
 - The goal is to provide tertiary & quaternary hospitals with the most accurate answer so ICU resources can be arranged or patient transfer can be scheduled.
- 2. Predict **NOT admission** to the ICU of confirmed COVID-19 cases
 - Is it feasible to predict which patients will NOT need ICU support? Why?
 - To provide local & temporary hospitals a good enough answer so frontline physicians can safely discharge and remotely follow up with these patients.



Trends in the Data

- Dataset from Hospital Sao Paulo and Brasilia
- All anonymized
- All scaled between -1 and 1
- Breakdown of Data:
 - Patient Demographic Info (3)
 - Patient Previous Grouped Diseases (6)
 - Blood results (36)*
 - Vital Signs (6)*

** Each of these is expanded to show minimum, maximum, mean, median, difference, and relative difference calculations.*

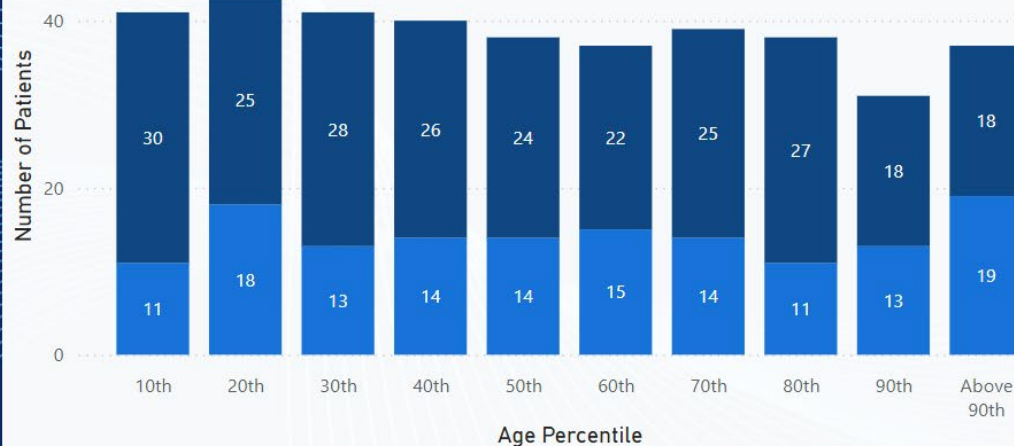
Patient Demographics

«
≡ Filters

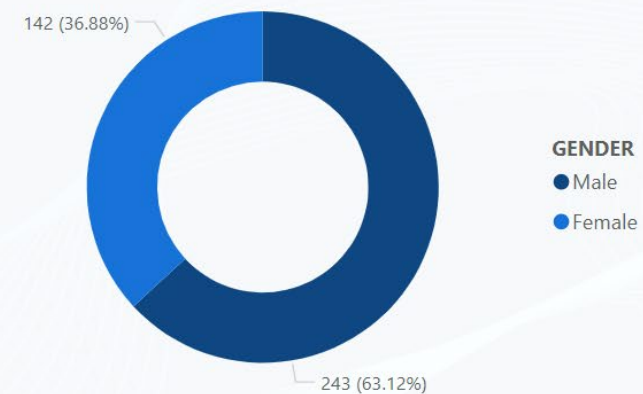
Unique Patient IDs

385

Number of Patients by Age Percentile and Gender



Patient IDs by Gender



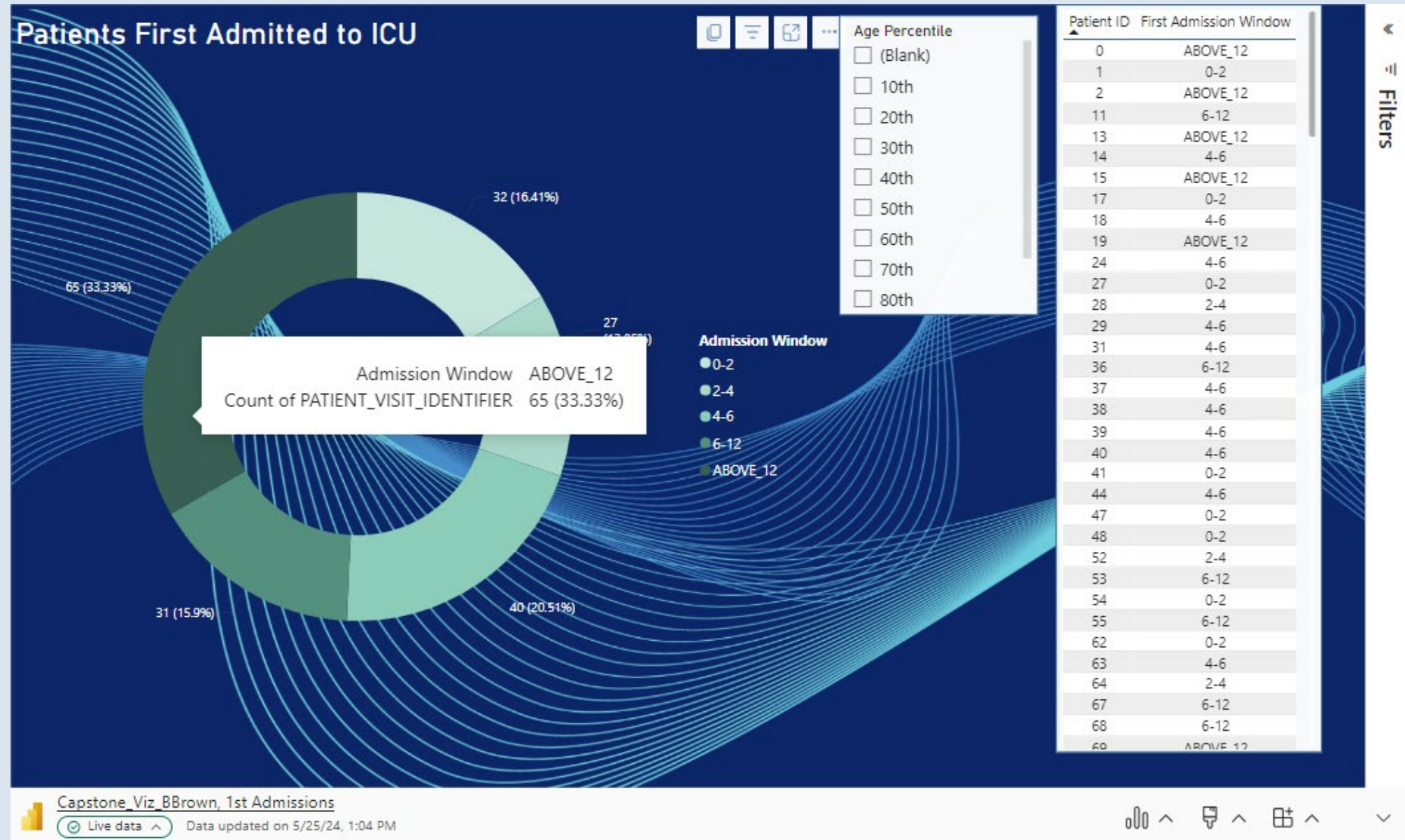
ICU
☐ Admitted
☐ Not Admitted

WINDOW
☐ 0-2
☐ 2-4
☐ 4-6
☐ 6-12
☐ ABOVE_12

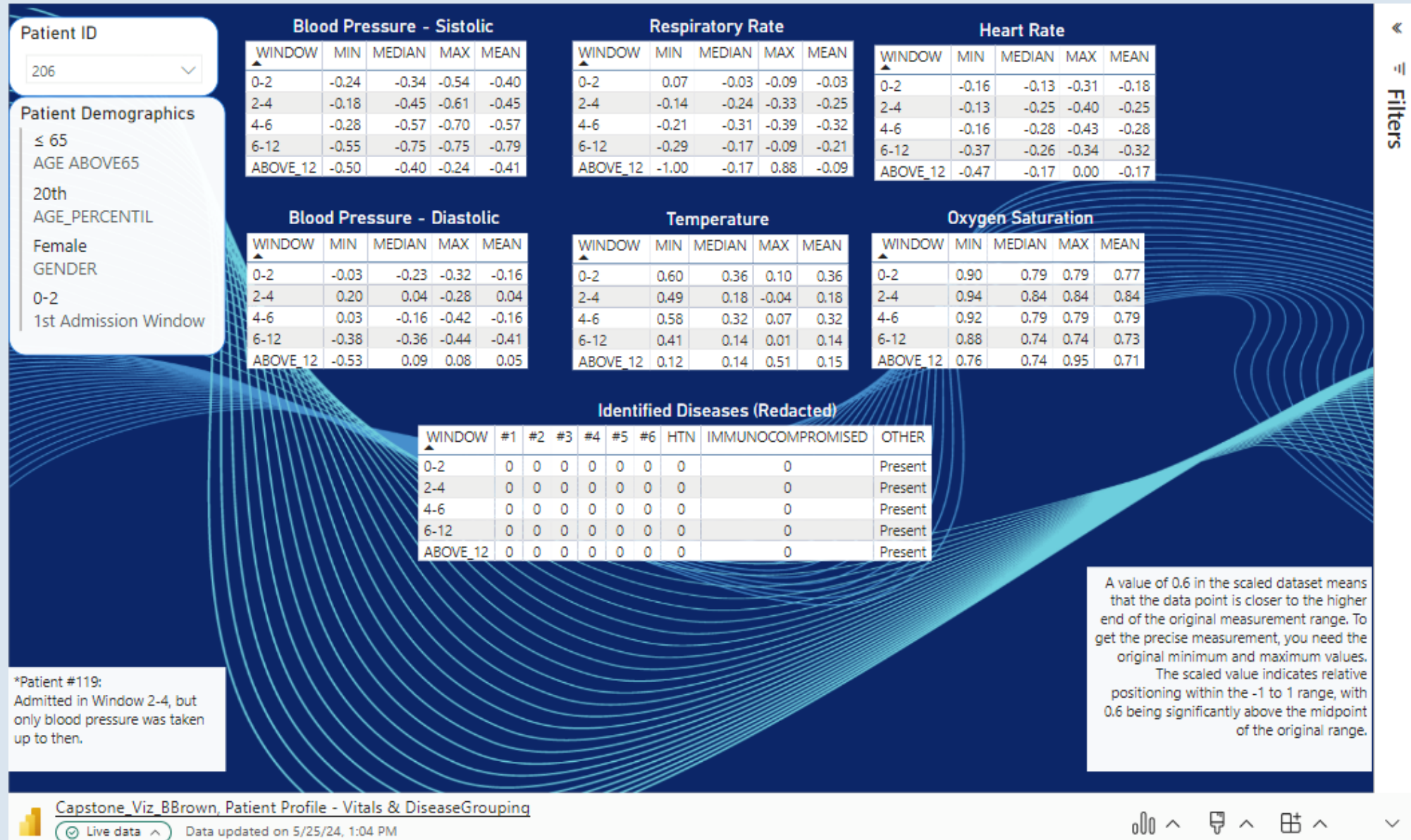
AGE_ABOVE65
☐ > 65
☐ ≤ 65



First ICU Admissions



Explore a Patient Profile

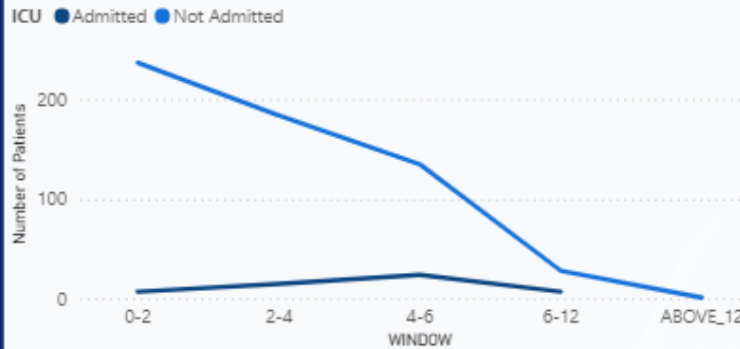


No Vitals or Bloodwork Taken

No Vitals

Patient ID	Age	Age Percentile	Gender	ICU	Window
27	> 65	60th	Female	Admitted	0-2
117	> 65	60th	Female	Admitted	2-4
117	> 65	60th	Female	Admitted	4-6
179	> 65	60th	Female	Admitted	4-6
117	> 65	60th	Female	Admitted	6-12
130	> 65	60th	Female	Not Admitted	0-2
190	> 65	60th	Female	Not Admitted	0-2
224	> 65	60th	Female	Not Admitted	0-2
244	> 65	60th	Female	Not Admitted	0-2
321	> 65	60th	Female	Not Admitted	0-2
123	> 65	60th	Female	Not Admitted	2-4

Distribution of Patients with No Vitals by Window



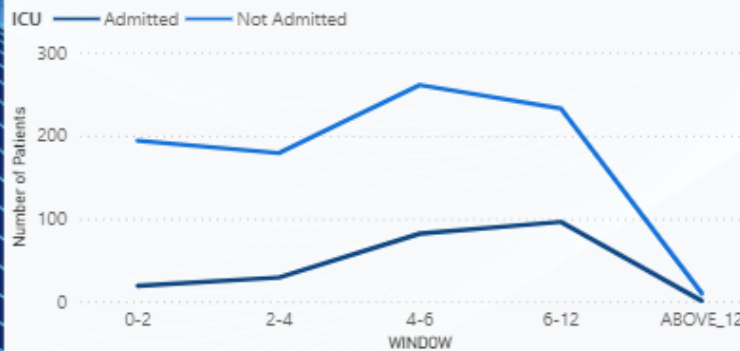
ICU
☐ Admitted
☐ Not Admitted

"It is reasonable to assume that a patient who does not have a measurement recorded in a time window is clinically stable, potentially presenting vital signs and blood labs similar to neighboring windows. Therefore, one may fill the missing values using the next or previous entry."

No Bloodwork

Patient ID	Age	Age Percentile	Gender	ICU	Window
0	> 65	60th	Male	Not Admitted	0-2
0	> 65	60th	Male	Not Admitted	2-4
0	> 65	60th	Male	Not Admitted	6-12
1	> 65	90th	Female	Admitted	0-2
1	> 65	90th	Female	Admitted	4-6
2	≤ 65	10th	Male	Not Admitted	2-4
2	≤ 65	10th	Male	Not Admitted	4-6
2	≤ 65	10th	Male	Not Admitted	6-12
3	≤ 65	40th	Female	Not Admitted	0-2
3	≤ 65	40th	Female	Not Admitted	2-4
3	≤ 65	40th	Female	Not Admitted	4-6

Distribution of Patients with No Bloodwork by Window



ICU
☐ Admitted
☐ Not Admitted





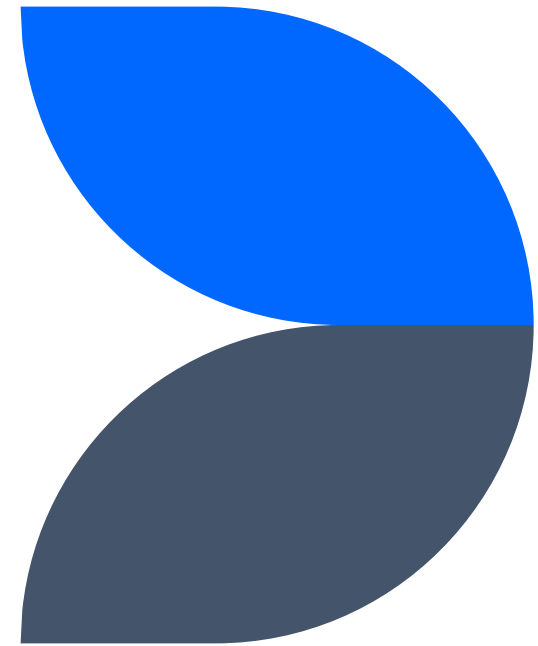
Predictive Models

(Let's get to the gist of the techy stuff)



Capstone_Covid19_BBrown.ipynb

This is the code behind building
the machine learning models
(double-click to open)



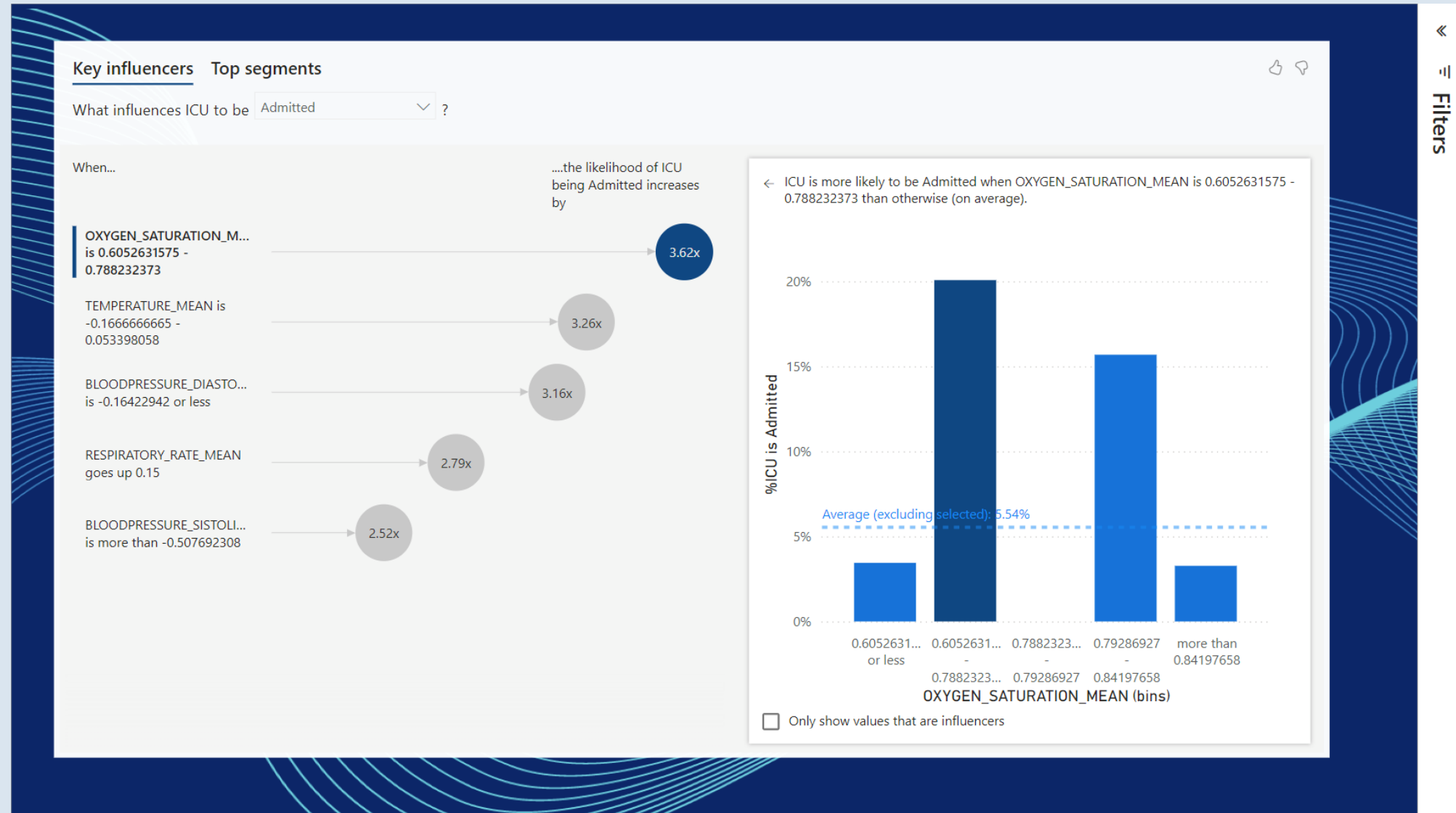


Model Evaluation

Model	Accuracy
Logistic Regression	97.2%
Decision Tree Classifier	94.1%
Random Forest	96.5%
Support Vector Machines	86.8%
Naïve Bayes	94.1%



Key Influencers



Final Takeaways

Why use this model?

- Strong precision, recall, and f1-scores = high predictive capabilities
- Can provide data points as markers for likelihood of ICU admittance (or non-admittance)
- Load & analyze data specific to your city/region/hospital
- Keep up with changes in patient vital signs





Thank you