FAIRCARE ANALYTICS

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Problem Statement/Motivation

- Hospital readmissions within 30 days are costly and often preventable. How can we use predictive models to identify high-risk patients?

- If predictive models perform unevenly across racial groups, they risk deepening health disparities.

Desired outcomes/ Stakeholders

- Use predictive modeling to enable early, patient-centered interventions and optimize resource allocation.

→ Supports **clinicians, hospital networks, and patients.**

- Ensure models are fair and equitable, avoiding harm to underserved groups.

→ Matters to **policymakers, advocates, and communities.**

- Improve health system accountability and transparency through interpretable predictions.

→ Engages **health data scientists and public health researchers.**

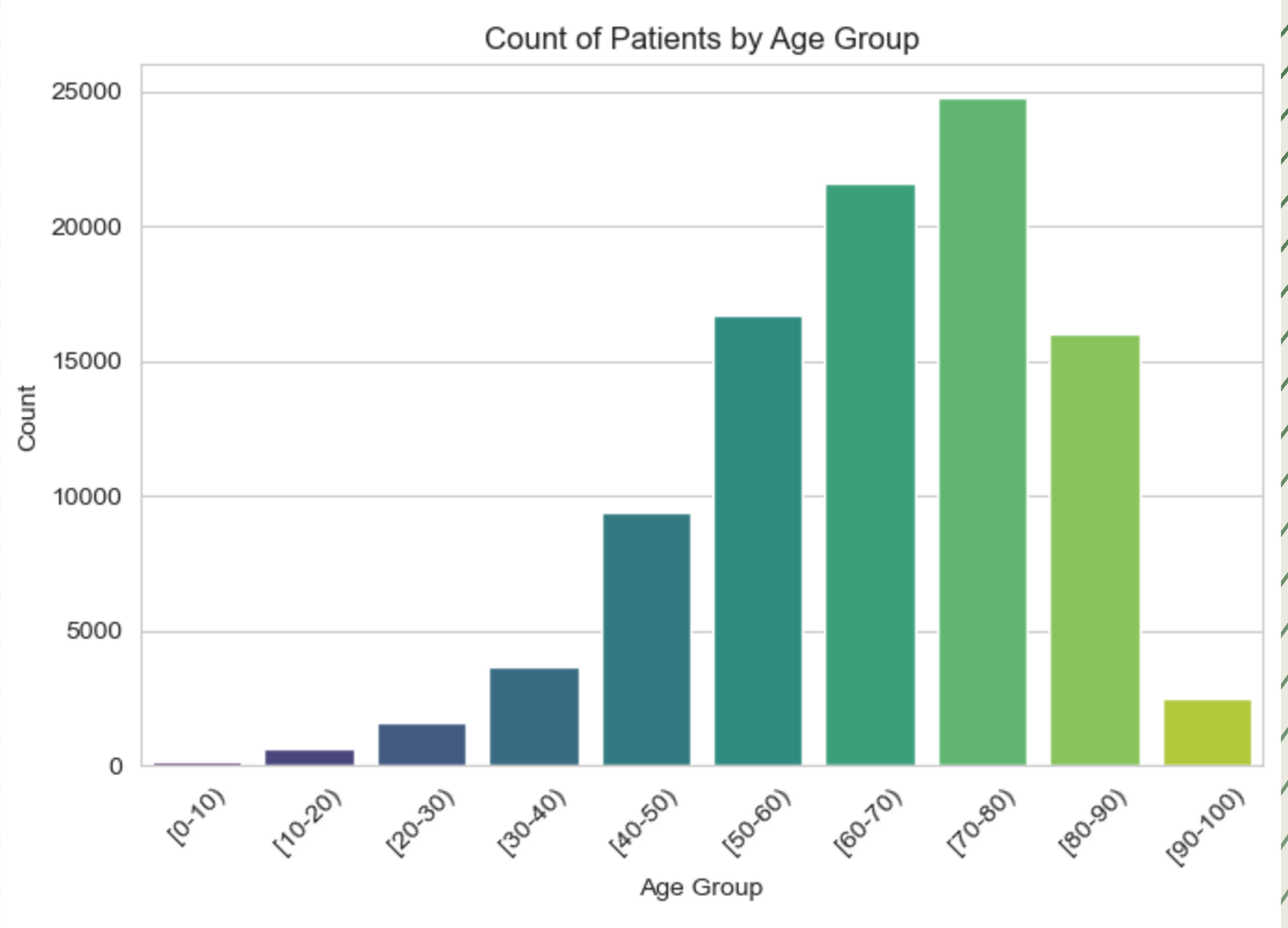
The dataset

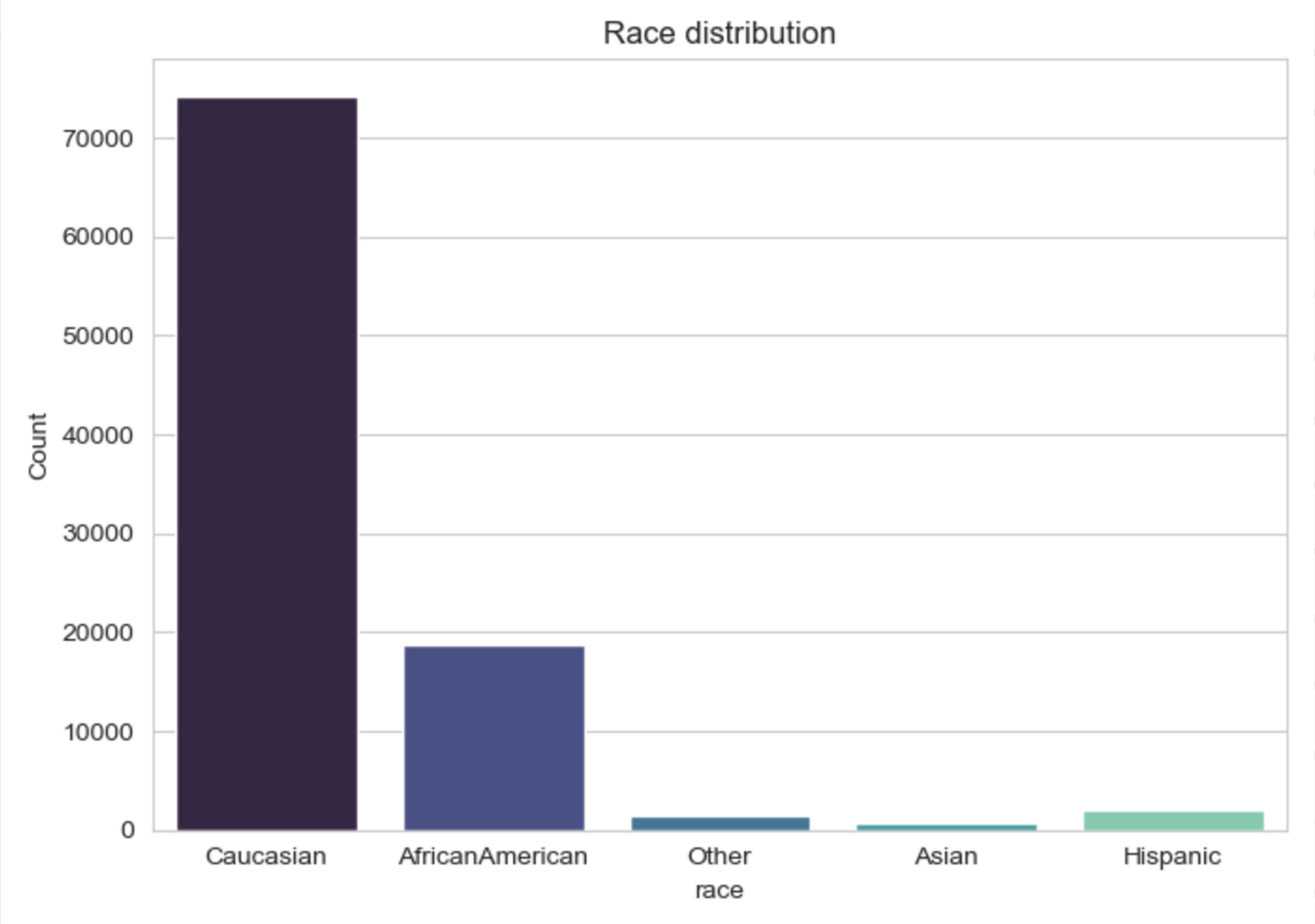
UCI Diabetes 130-US Hospitals Dataset (1999–2008)

- Over 25,000 patient encounters

- Features include:
  - **Demographics**: race, age, gender
  - **Clinical data**: diagnoses, medications, lab procedures
  - **Hospitalization data**: admission type/source, discharge disposition, time in hospital

- High ratio of records to features.



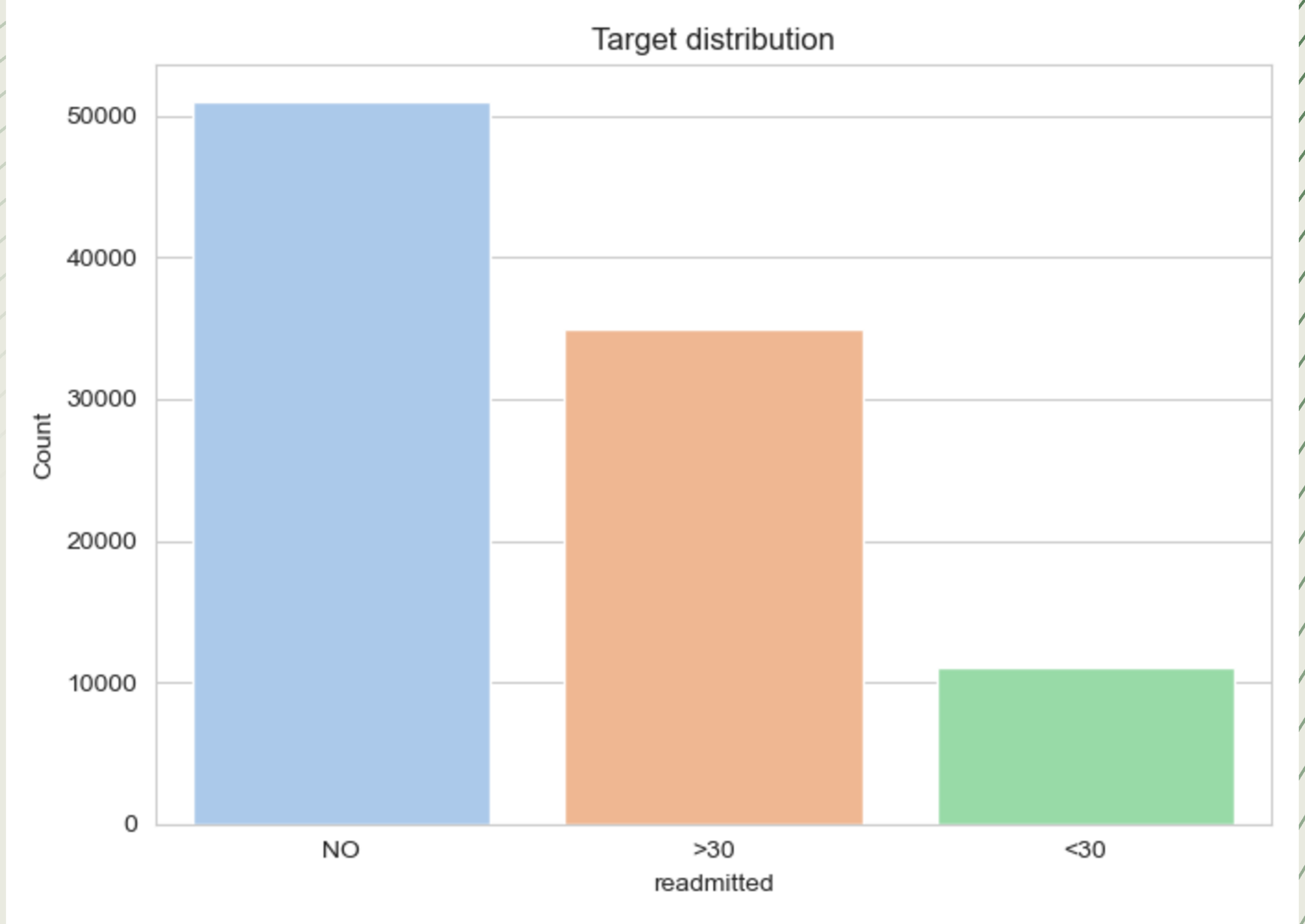


The dataset

UCI Diabetes 130-US Hospitals Dataset (1999–2008)

- Many categorical variables.

- **Target variable: readmitted_binary** is 1 when a patient has a <30 day readmission in the record and 0 otherwise.



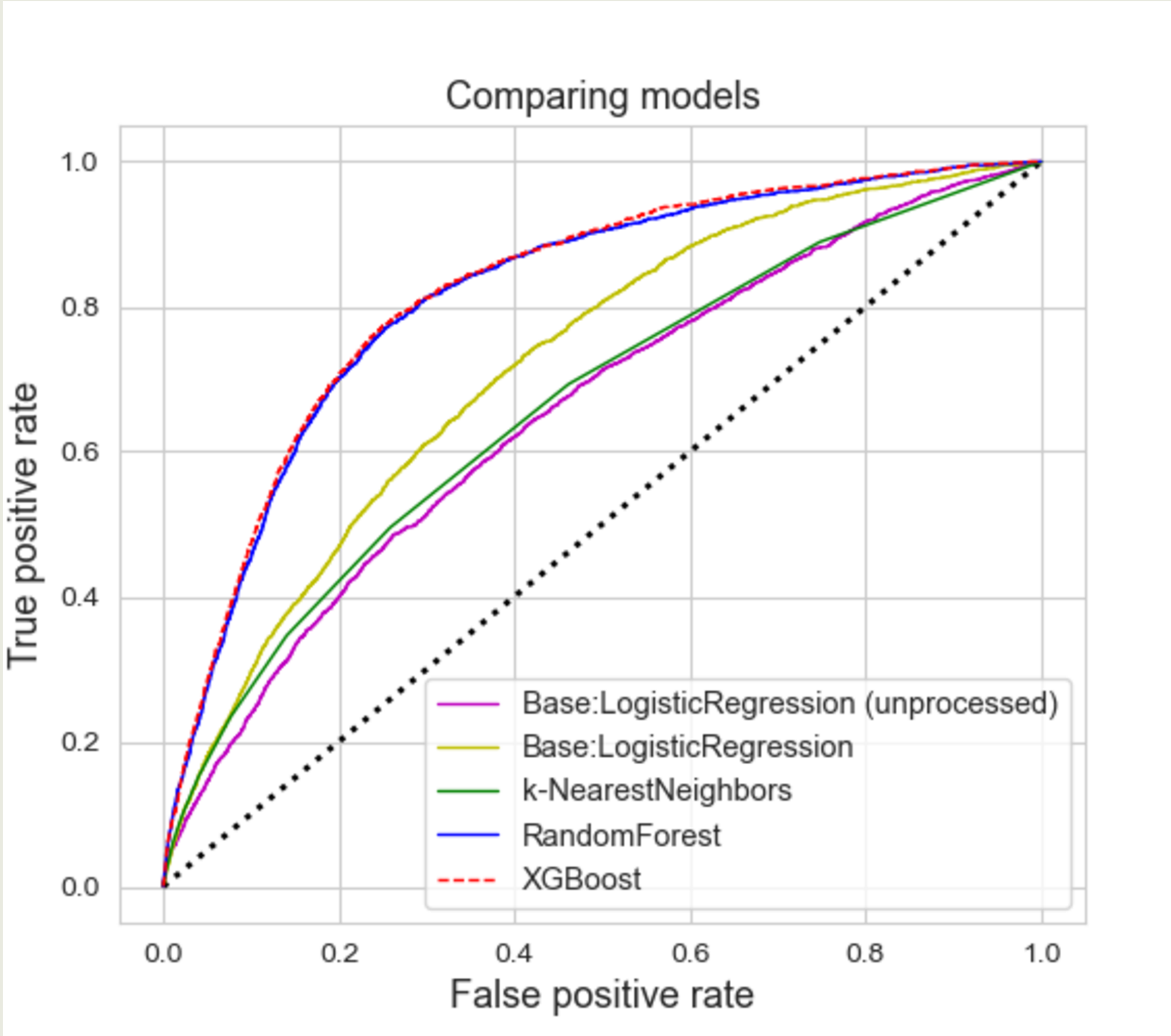
Data processing

- **Integer encodings**
  - drug features (metformin, glimepiride, insulin, etc.)
  - test results (A1Cresult, max_glu_serum)
- **Grouping codes**
  - admission_type_id, discharge_disposition_id, admission_source_id.
  - diag_1, diag_2, diag_3 into groups such as circulatory, digestive, etc.
- **Additional features:** patient histories, high-risk diagnoses.

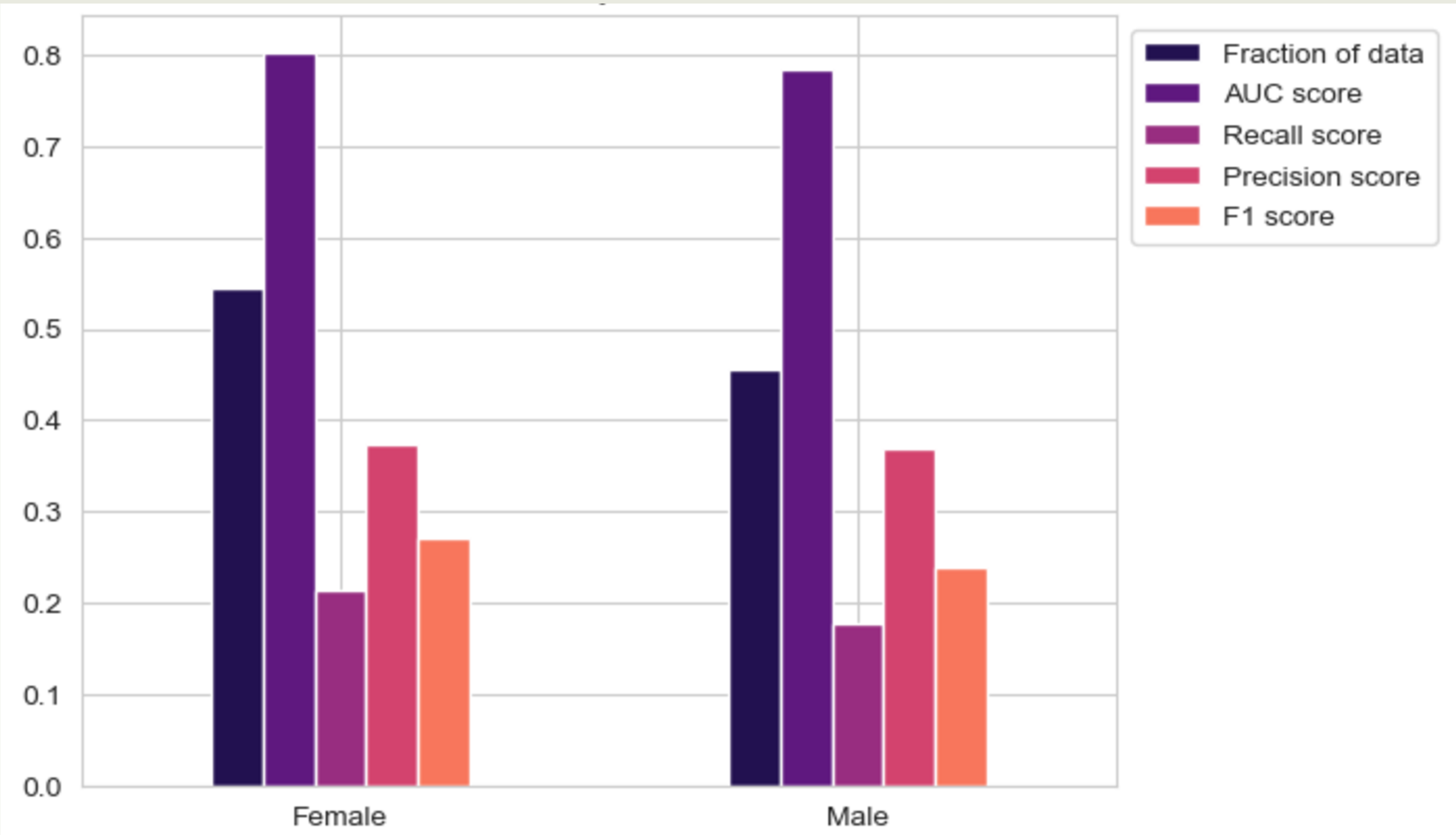
Models

Model	AUC Score	Precision	Recall
Baseline - Linear Regression	0.7193	0 : 0.89 1 : 0.39	0 : 0.99 1 : 0.04
k-Nearest Neighbors	0.6640	0 : 0.89 1 : 0.48	0 : 1.00 1 : 0.02
RandomForest	0.8034	0 : 0.89 1 : 0.50	0 : 0.99 1 : 0.10
Final - XGBoost	0.7937	0 : 0.90 1 : 0.37	0 : 0.96 1 : 0.20

OUR METRICS/OUTCOMES

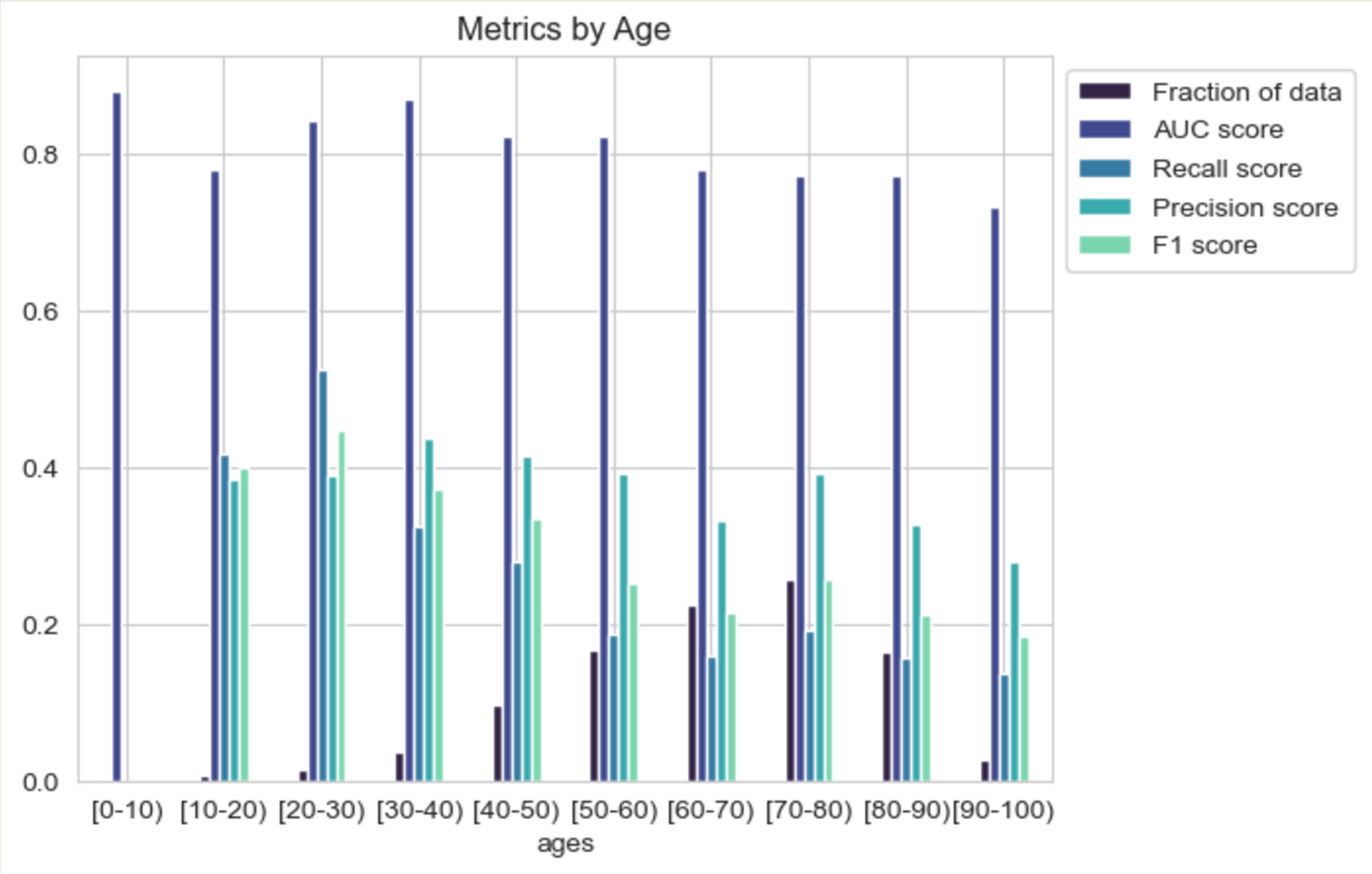


ROC curves for all models

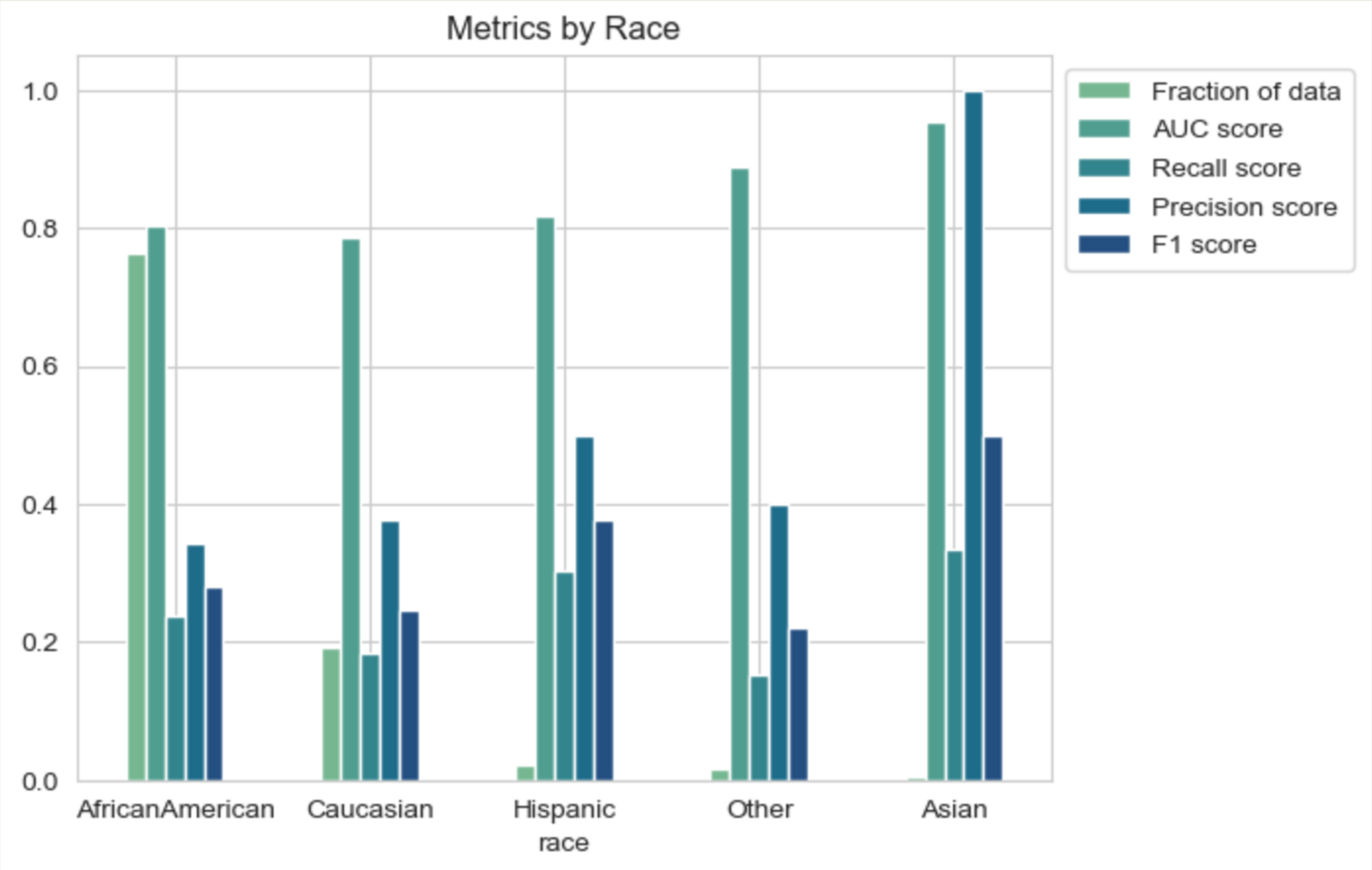


Final XG Boost Metrics by gender

OUR METRICS/OUTCOMES

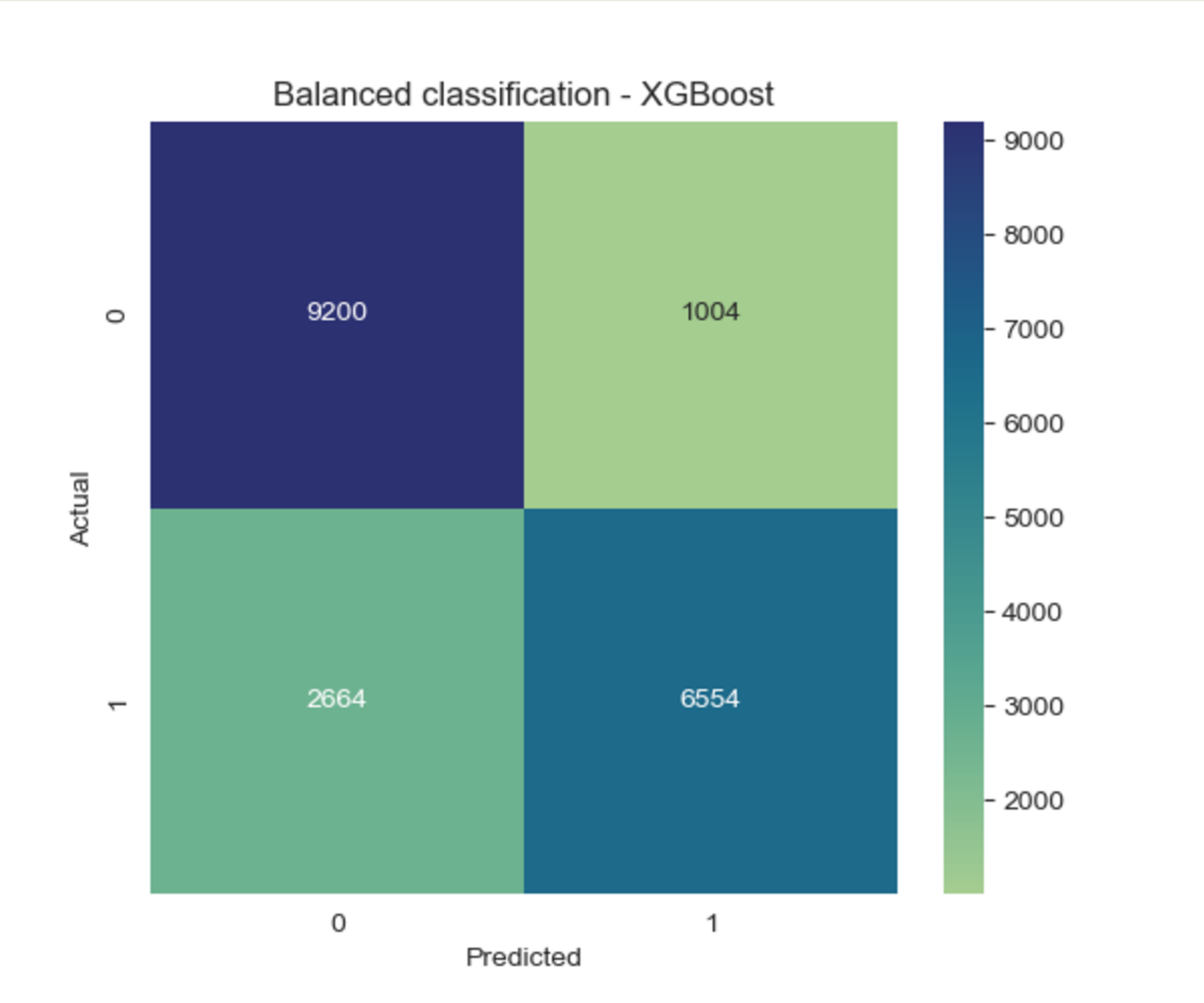


Final XG Boost Metrics by age

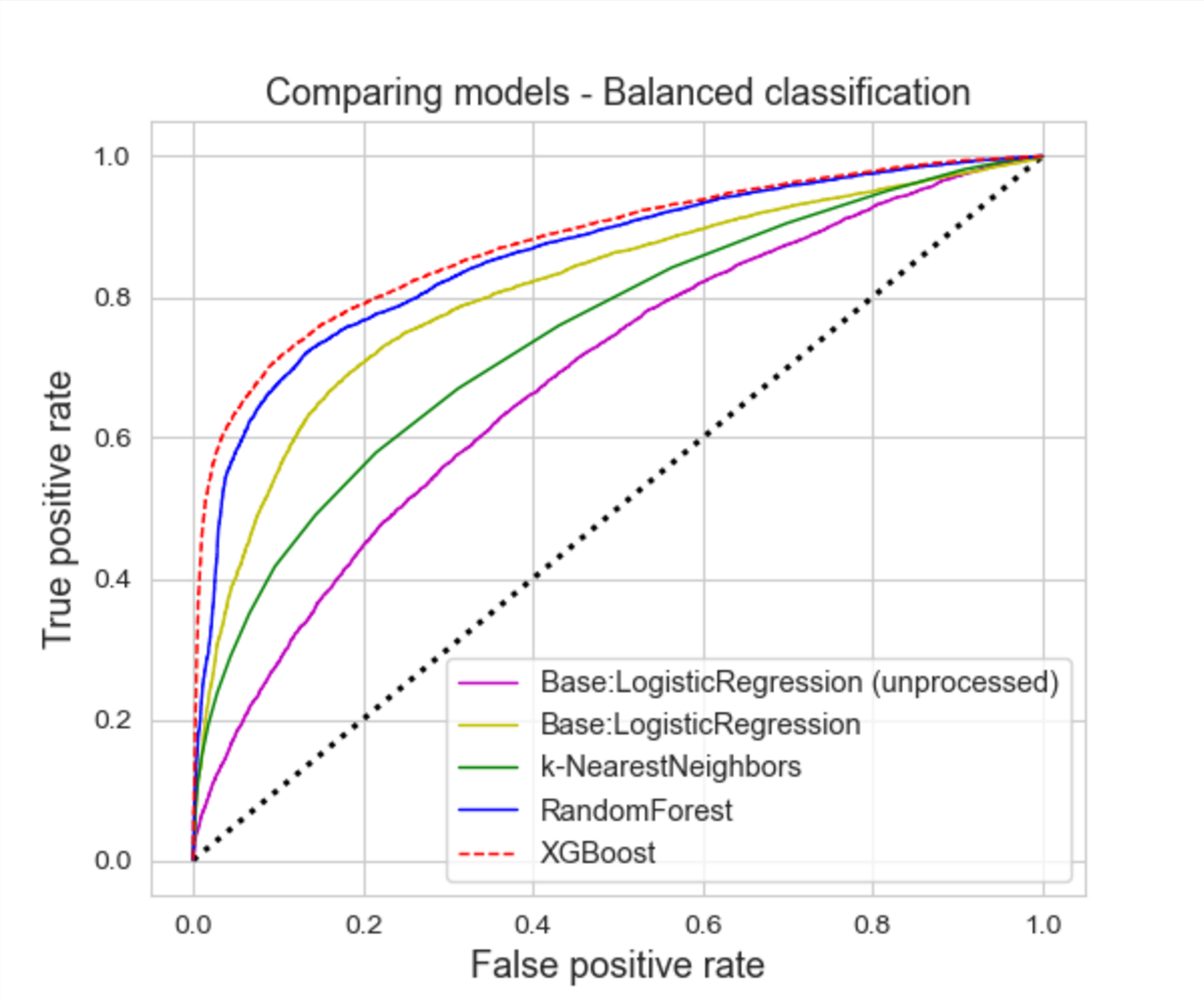


Final XG Boost Metrics by race

OUR METRICS/OUTCOMES



Confusion matrix for balanced classification (readmitted vs not)



Comparing models

CONCLUSIONS

Evaluate

While we can classify readmissions vs non-readmissions, distinguishing <30 day readmissions among the other data remains a difficult open problem.

Adapt

In future, we hope to incorporate a bias audit framework to review the methods, metrics and outcomes in order to ensure fairness.

Use deep reinforcement learning models to improve precision and recall scores.

Launch

Procedures and processes can be applied to much larger electronic health record datasets like MIMIC-III or MIMIC-IV.

Collaborate with industry experts, incorporate domain knowledge into models, obtain practical action items.

Monitor

Track metrics and performance across larger/different datasets.

Iterate

The processes outlined can be modified for standalone inpatient provider using their historical clinical data, or a provider network.

Thank you.

Faircare Analytics