# EduViz: Visualizing Statewide Assessment Data Final Presentation

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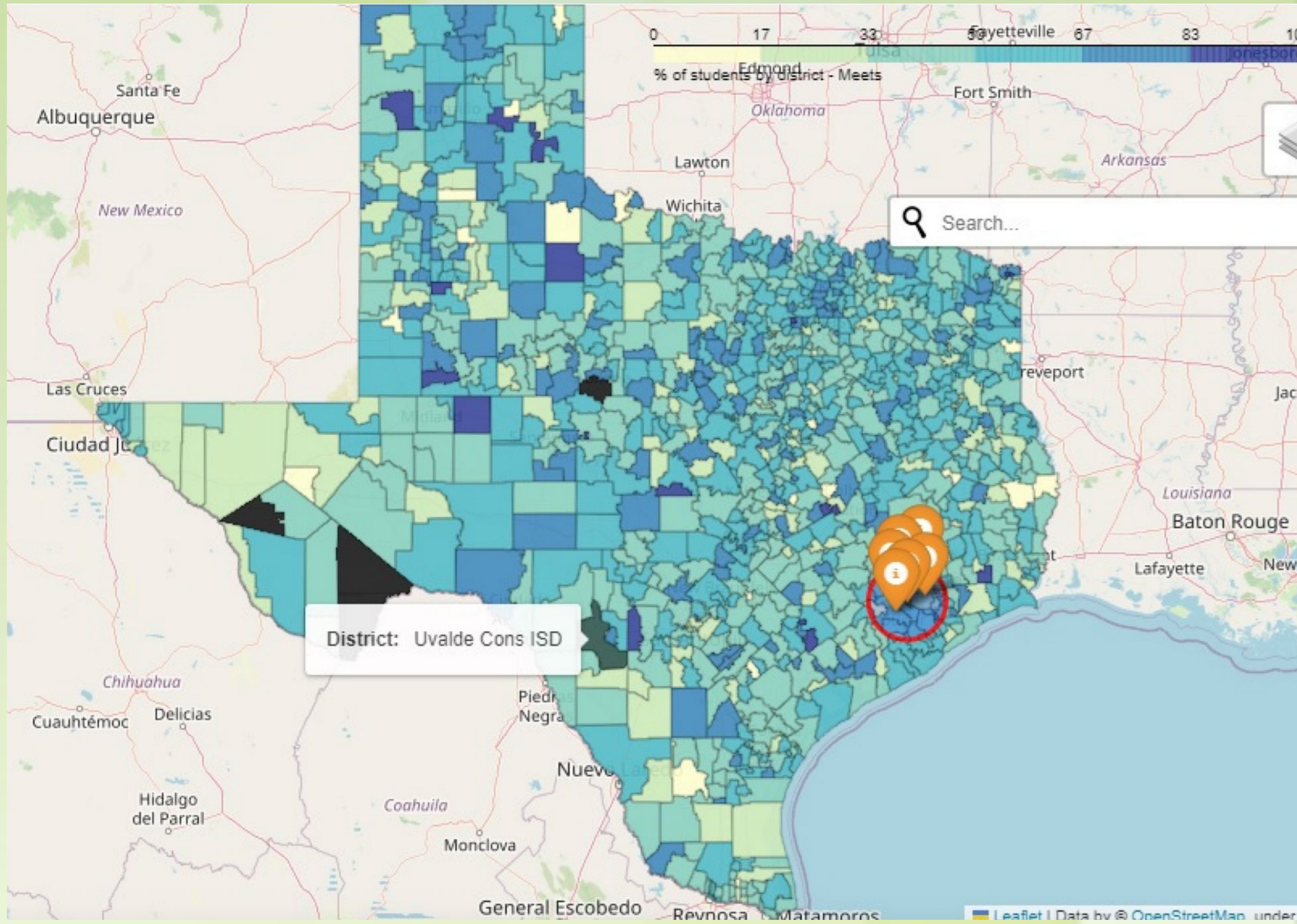
Visualization for Machine Learning

# Contents





District: Uvalde Cons ISD
Search...
% of students by district - Meets
Albuquerque
Santa Fe
New Mexico
Las Cruces
Lawton
Wichita
Fort Smith
Arkansas
Oklahoma
Louisiana
Baton Rouge
Lafayette
Chihuahua
Delicias
Cuauhtémoc
Hidalgo del Parral
Coahuila
Monclova
General Escobedo

# Introduction

- A lot of state-level End of Year assessment data gets gathered
- Individual districts struggle with doing in-house ML/data analysis
- Growing need for data-driven decision making
- District-level work results from state-level statistics! Can we use district results to predict state-wide changes?
- Debate between policy makers and teachers

# Prior Related Work

**Leveraging Visualization and Machine Learning Techniques in Education: A Case Study of K-12 State Assessment Data**

by Loni Taylor [1], Vibhuti Gupta [2,*] and Kwanghee Jung [3]

1 Department of Biomedical Data Science, School of Applied Computational Sciences, Meharry Medical College, Nashville, TN 37208, USA

2 Department of Computer Science and Data Science, School of Applied Computational Sciences, Meharry Medical College, Nashville, TN 37208, USA

3 Department of Educational Psychology and Leadership, Texas Tech University, Lubbock, TX 79409, USA

* Author to whom correspondence should be addressed.

**The timeless beauty of data: inventing educational pasts, presents and futures through data visualisation**

Tatiana Mikhaylova & Daniel Pettersson

Pages 142-158 | Received 11 Sep 2023, Accepted 18 Jan 2024, Published online: 30 Jan 2024

Cite this article https://doi.org/10.1080/17508487.2024.2308689 Check for updates

**Application of Data Visualization and Machine Learning Algorithms for Better Decision Making**

Olta Llaha [1], Azir Aliu [2]

[1,2] *South East European University, Tetovo, North Macedonia*

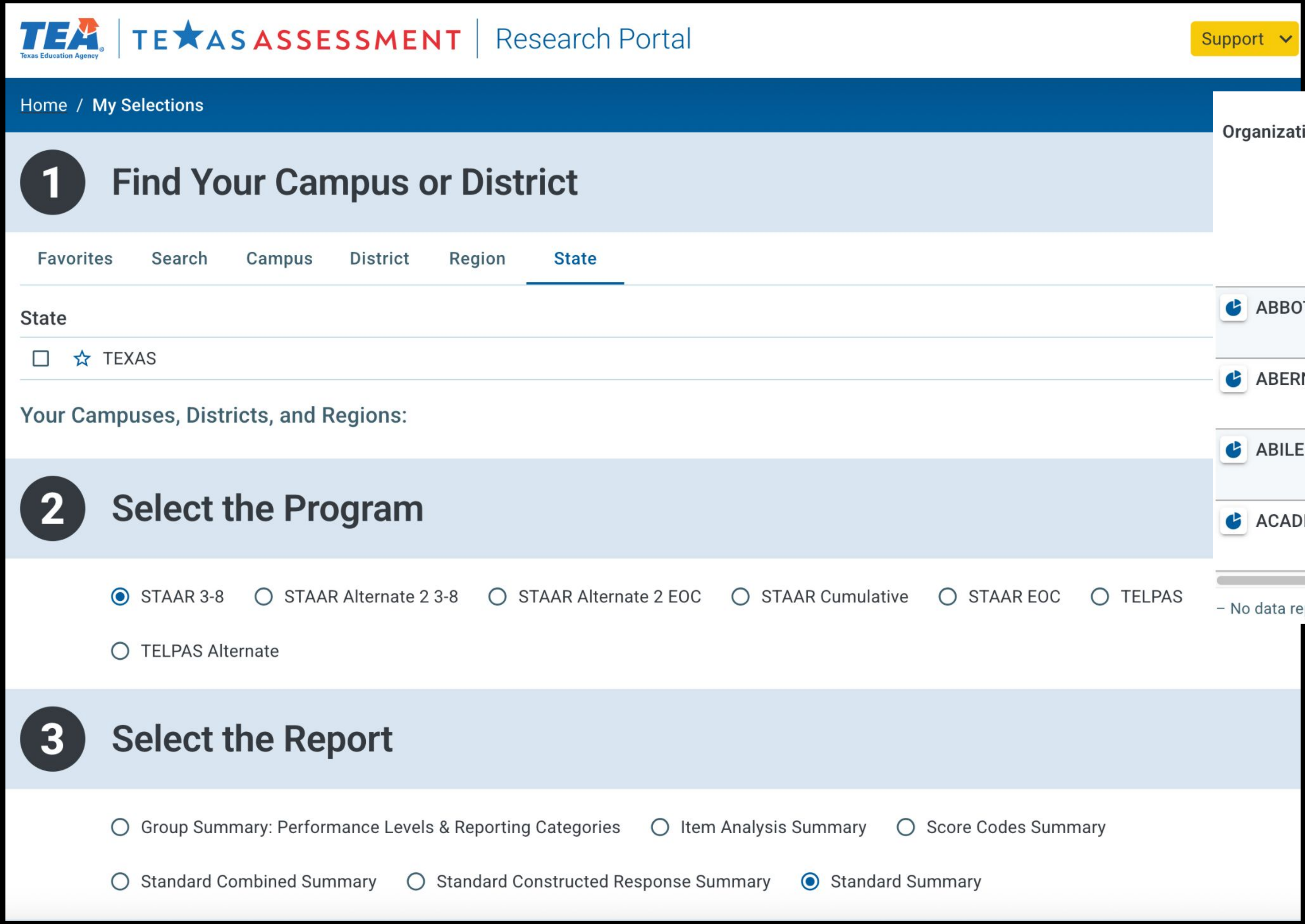
**Digital education governance: data visualization, predictive analytics, and 'real-time' policy instruments**

Ben Williamson

Pages 123-141 | Received 30 Sep 2014, Accepted 23 Mar 2015, Published online: 29 Apr 2015

Cite this article https://doi.org/10.1080/02680939.2015.1035758 Check for updates

# Data Used



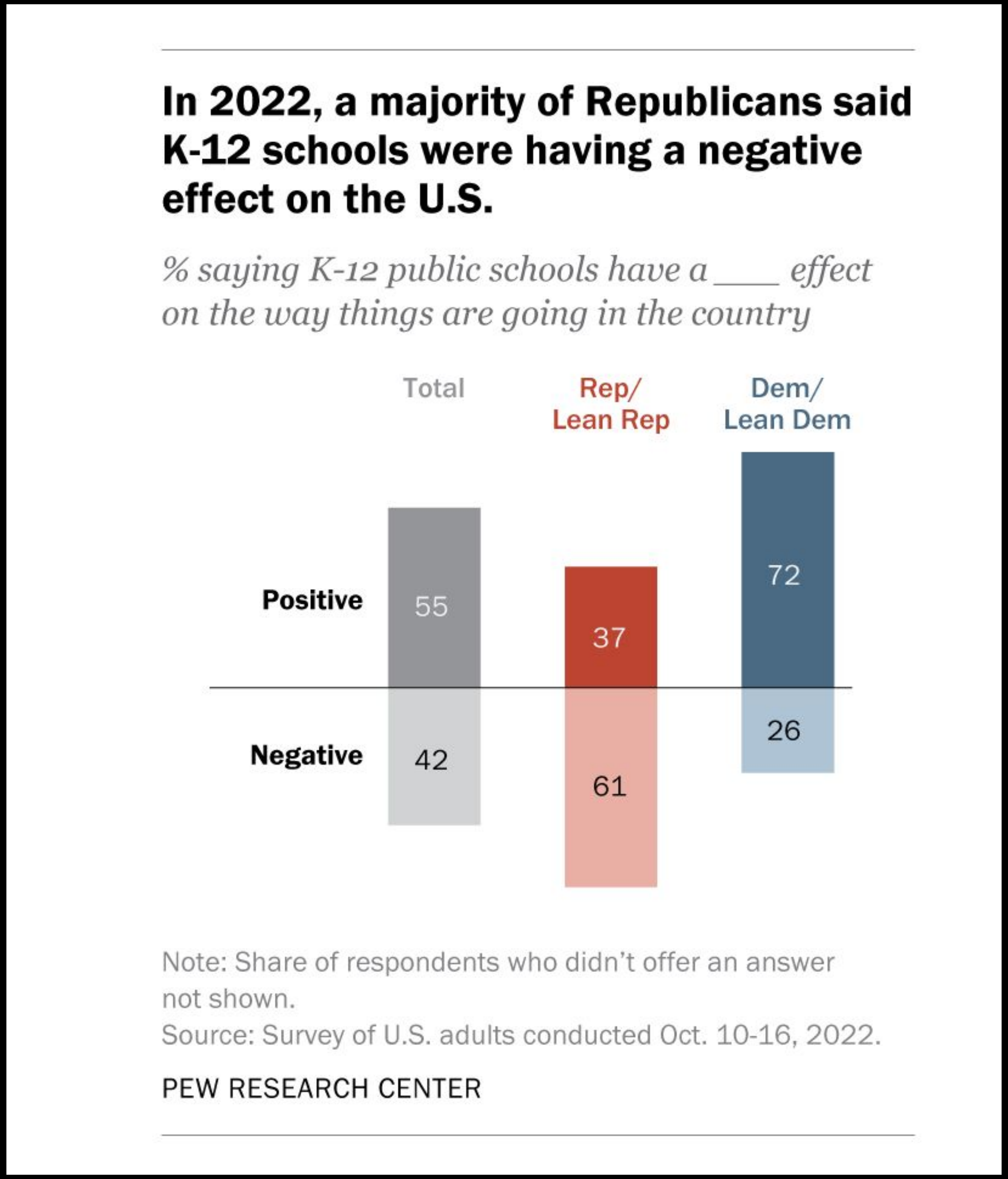

| Organization | Administration | Tested Grade | STAAR - Mathematics | | | | | | STAAR Spanish - Ma | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Tests Taken | Average Scale Score | Performance Levels: Did Not Meet | Approaches and Above | Meets and Above | Masters | Tests Taken | Average Scale Score |
| ABBOTT ISD | Spring 2023 | 5 | 15 | 1731 | 13% 2 Tests | 87% 13 Tests | 67% 10 Tests | 40% 6 Tests | 0 | |
| ABERNATHY ISD | Spring 2023 | 5 | 53 | 1672 | 13% 7 Tests | 87% 46 Tests | 64% 34 Tests | 23% 12 Tests | 0 | |
| ABILENE ISD | Spring 2023 | 5 | 1,057 | 1598 | 28% 298 Tests | 72% 759 Tests | 37% 391 Tests | 12% 127 Tests | 19 | 15 |
| ACADEMY ISD | Spring 2023 | 5 | 129 | 1658 | 12% 16 Tests | 88% 113 Tests | 55% 71 Tests | 17% 22 Tests | 0 | |

– No data reported for fewer than 5 students.

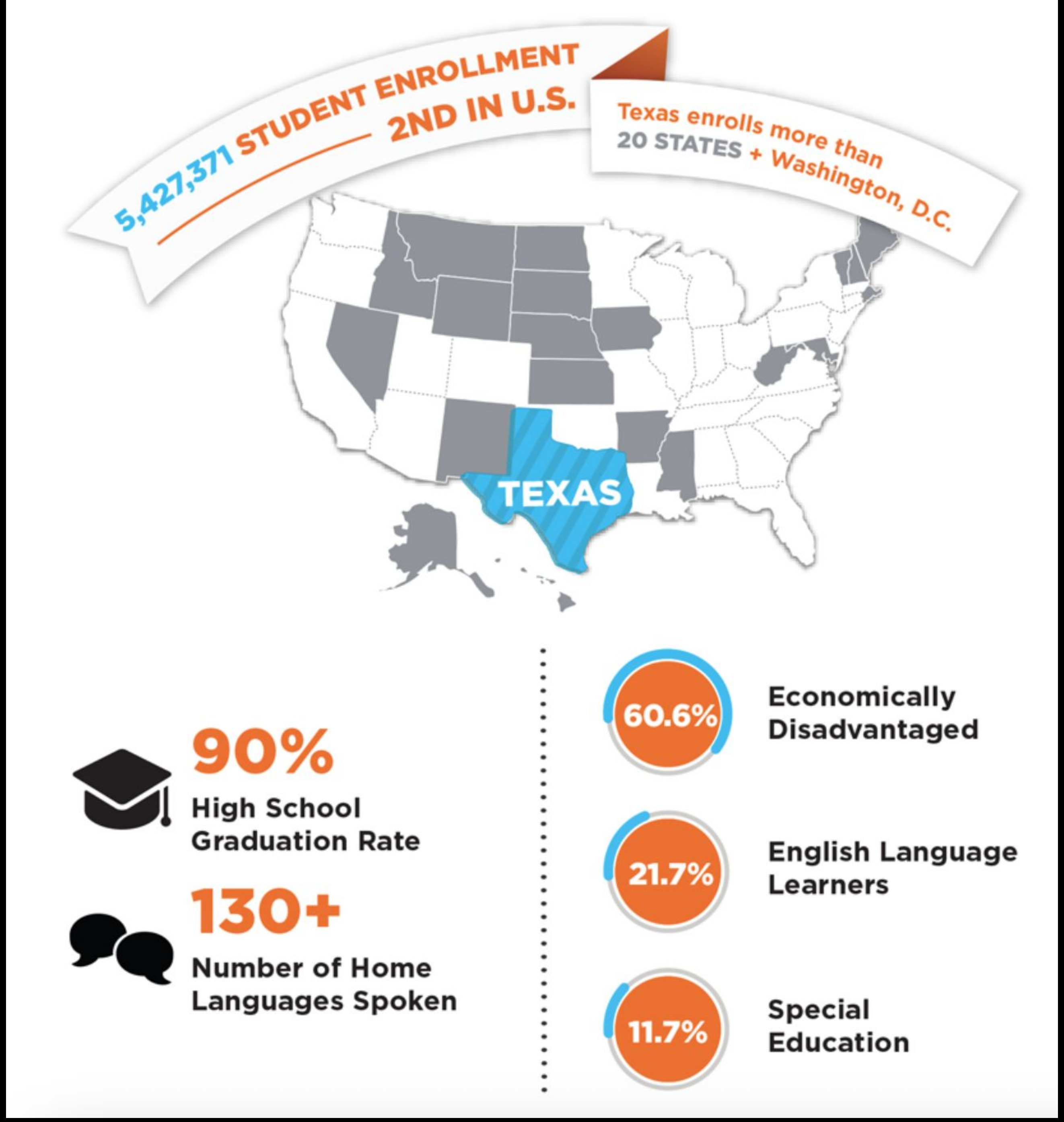
Total: over 1200 school districts

2022-2024 train; 2025 test

# Why it matters?




Increasing political impacts on education




Huge education system with diverse student body

# Tools and Methodology

Build and train predictive ML models to forecast student performance (both continuous scores and pass/fail outcomes) across diverse Texas educational systems.

Break down to specific districts for regression models and set 70% meeting expectations as threshold for binary classification models.

## Regression Models

Generative Additive Model (GAM), Gradient Boosting Regressor (RBG), Logistic Regression

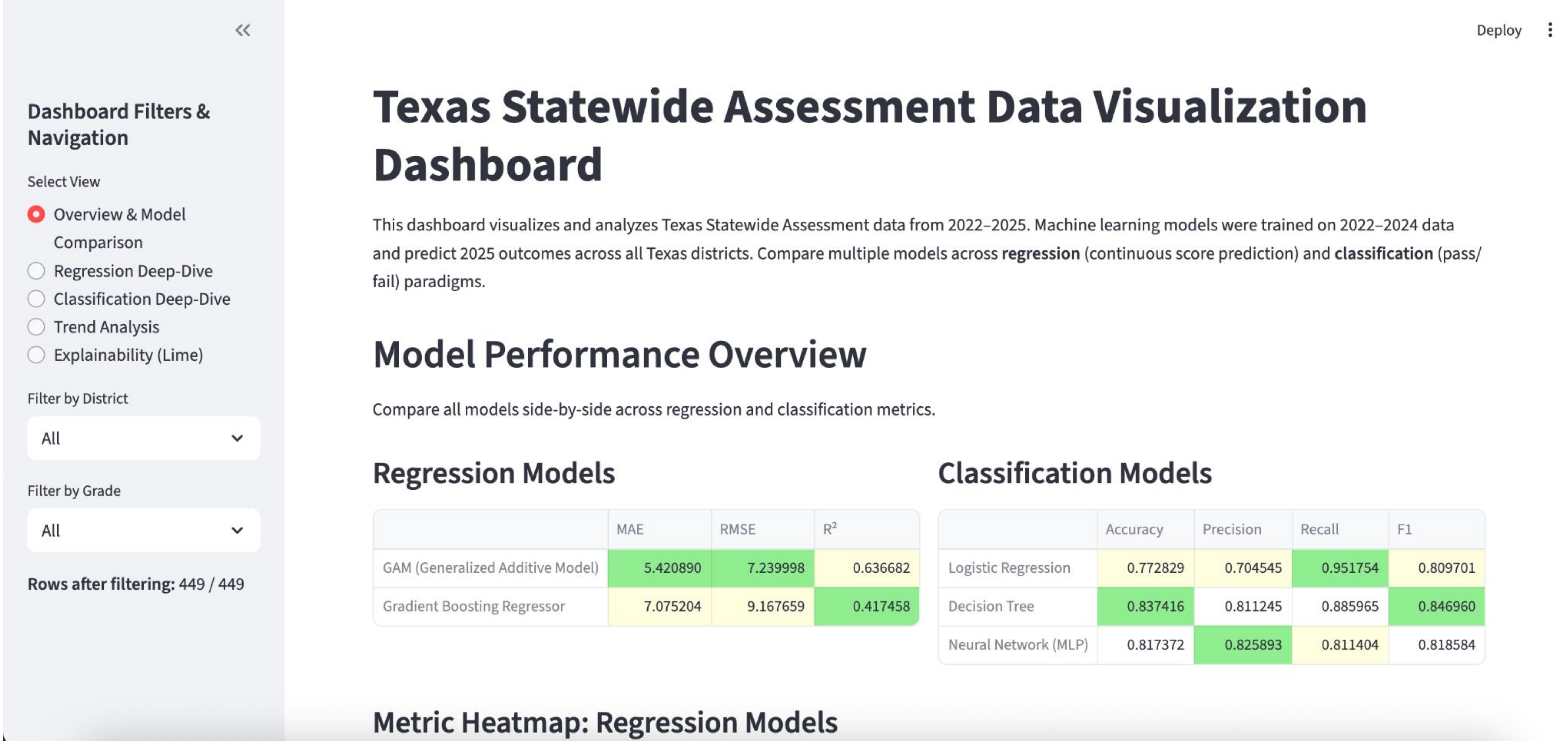
## Classification Models

Logistic Regression, Decision Tree, Simple Neural Network/MLP (70% threshold)

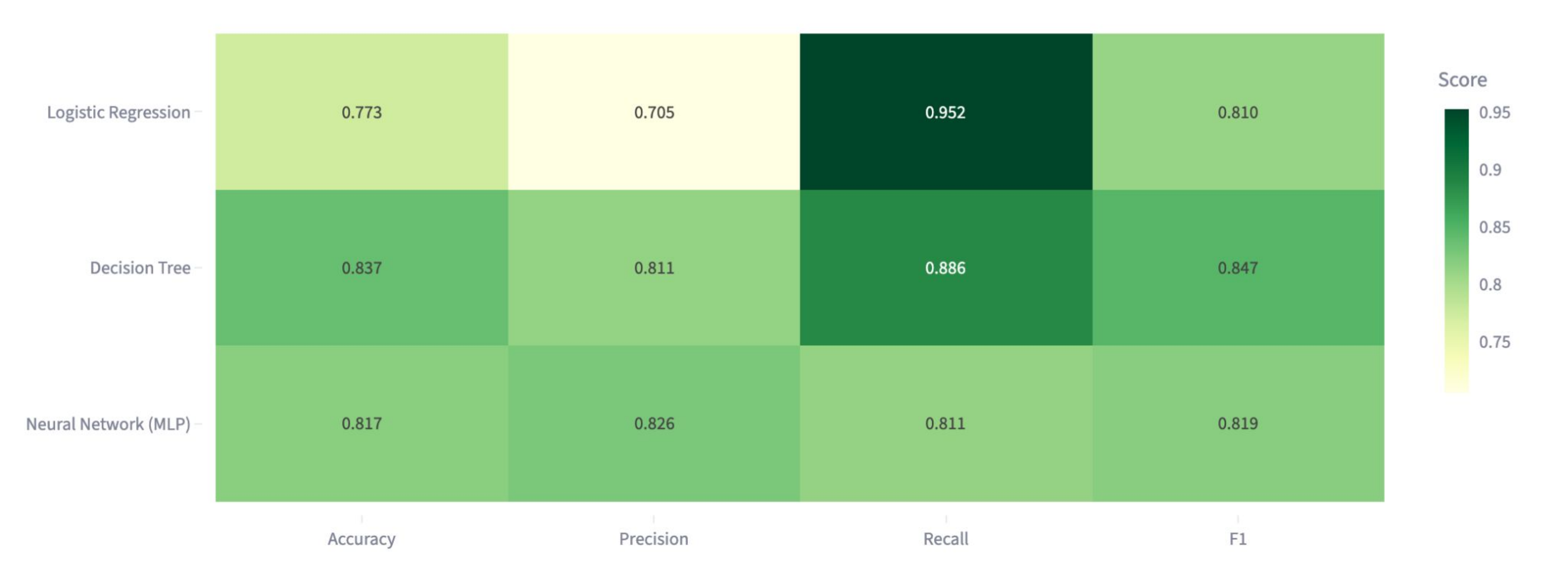
## Creating Visualizations

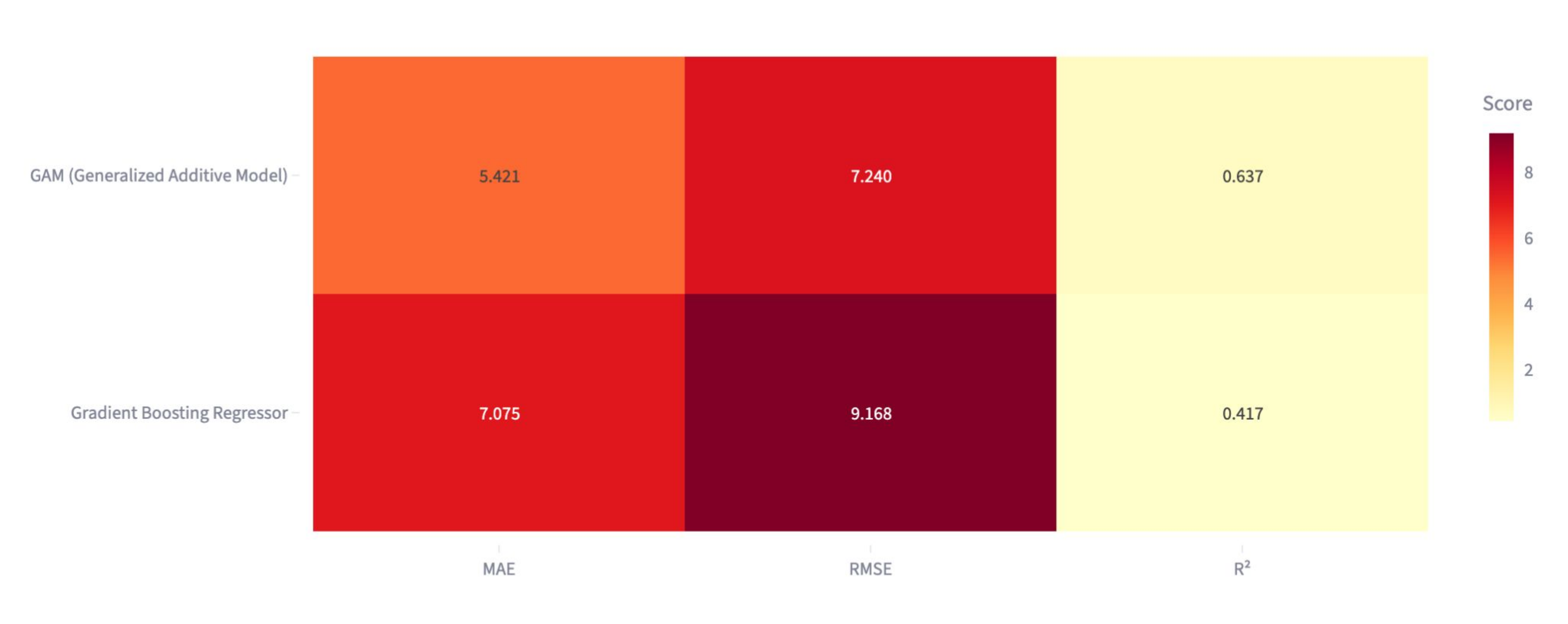
Confusion Matrices, Heatmaps, ROC curves, etc.

# Findings and Results

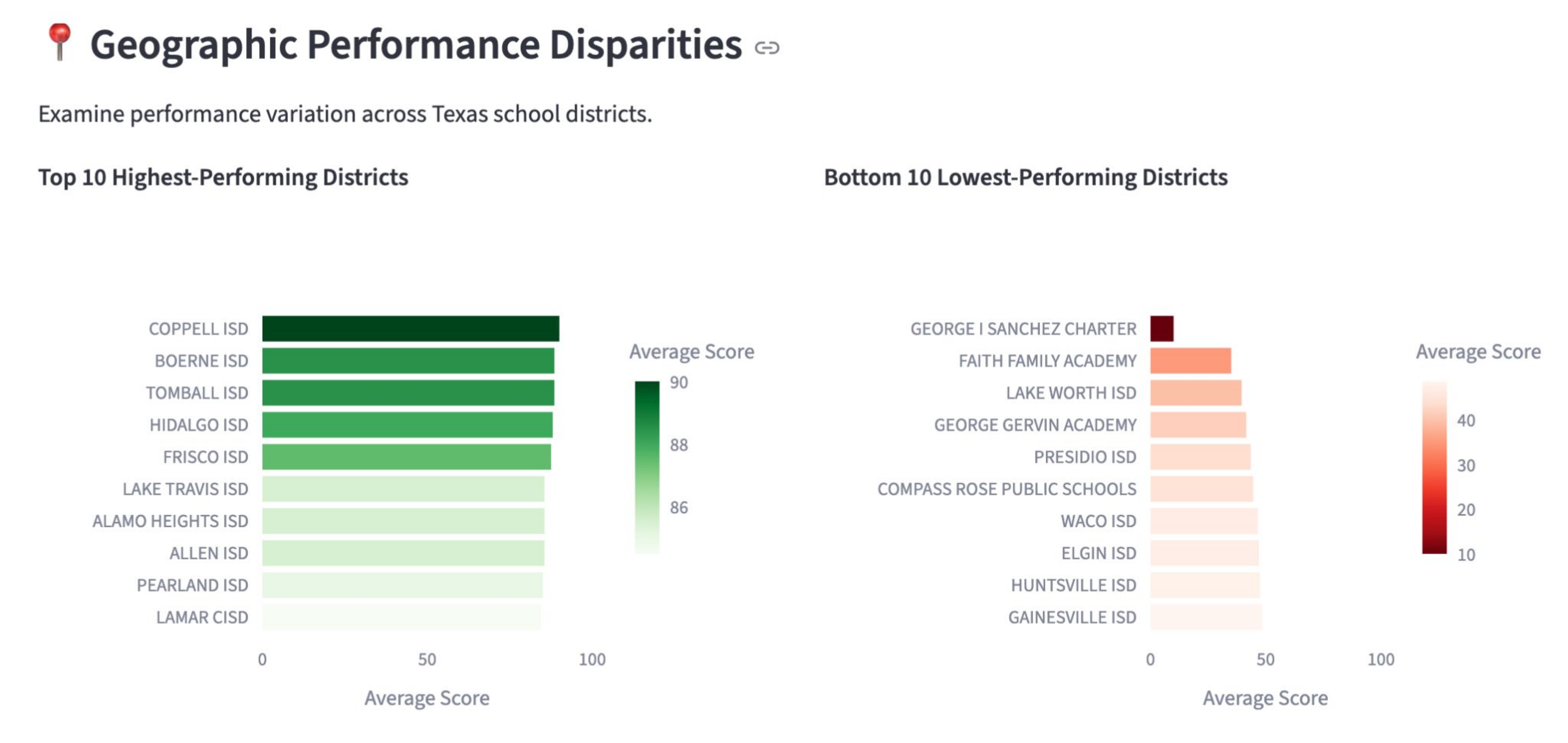

Deploy
Dashboard Filters & Navigation
Select View
Overview & Model Comparison
Regression Deep-Dive
Classification Deep-Dive
Trend Analysis
Explainability (Lime)
Filter by District
All
Filter by Grade
All
Rows after filtering: 449 / 449
Texas Statewide Assessment Data Visualization Dashboard
This dashboard visualizes and analyzes Texas Statewide Assessment data from 2022–2025. Machine learning models were trained on 2022–2024 data and predict 2025 outcomes across all Texas districts. Compare multiple models across regression (continuous score prediction) and classification (pass/fail) paradigms.
Model Performance Overview
Compare all models side-by-side across regression and classification metrics.
Regression Models
MAE
RMSE
R²
GAM (Generalized Additive Model)
5.420890
7.239998
0.636682
Gradient Boosting Regressor
7.075204
9.167659
0.417458
Classification Models
Accuracy
Precision
Recall
F1
Logistic Regression
0.772829
0.704545
0.951754
0.809701
Decision Tree
0.837416
0.811245
0.885965
0.846960
Neural Network (MLP)
0.817372
0.825893
0.811404
0.818584
Metric Heatmap: Regression Models

# Overview of Models




# General Predictions



Choose classification model

Logistic Regression (w/ probability)

Accuracy

0.773

Precision

0.705

Recall

0.952

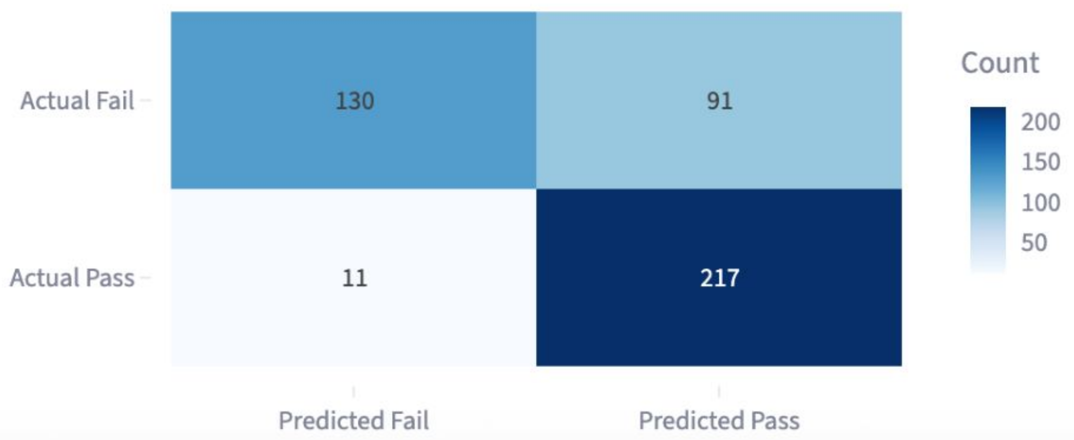
F1-Score

0.810

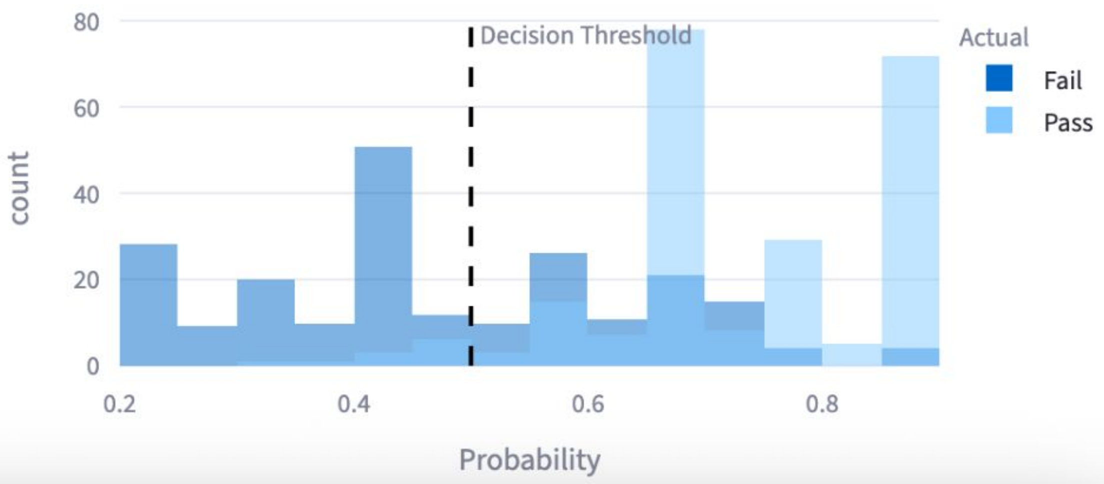
AUC-ROC

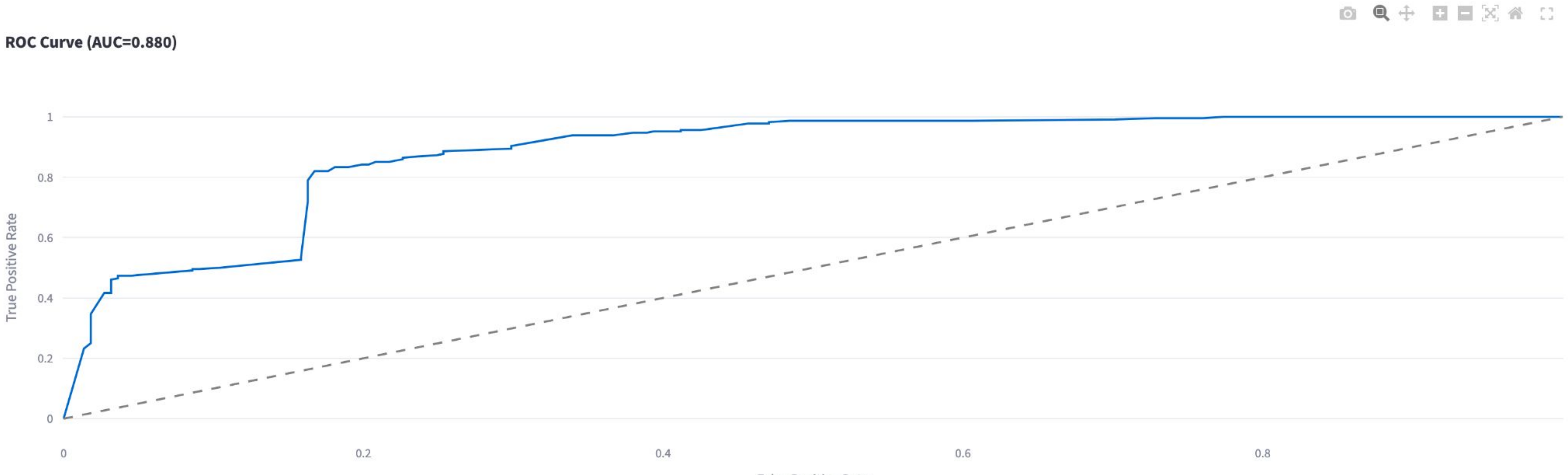
0.880

## Confusion Matrix




## Prediction Distribution

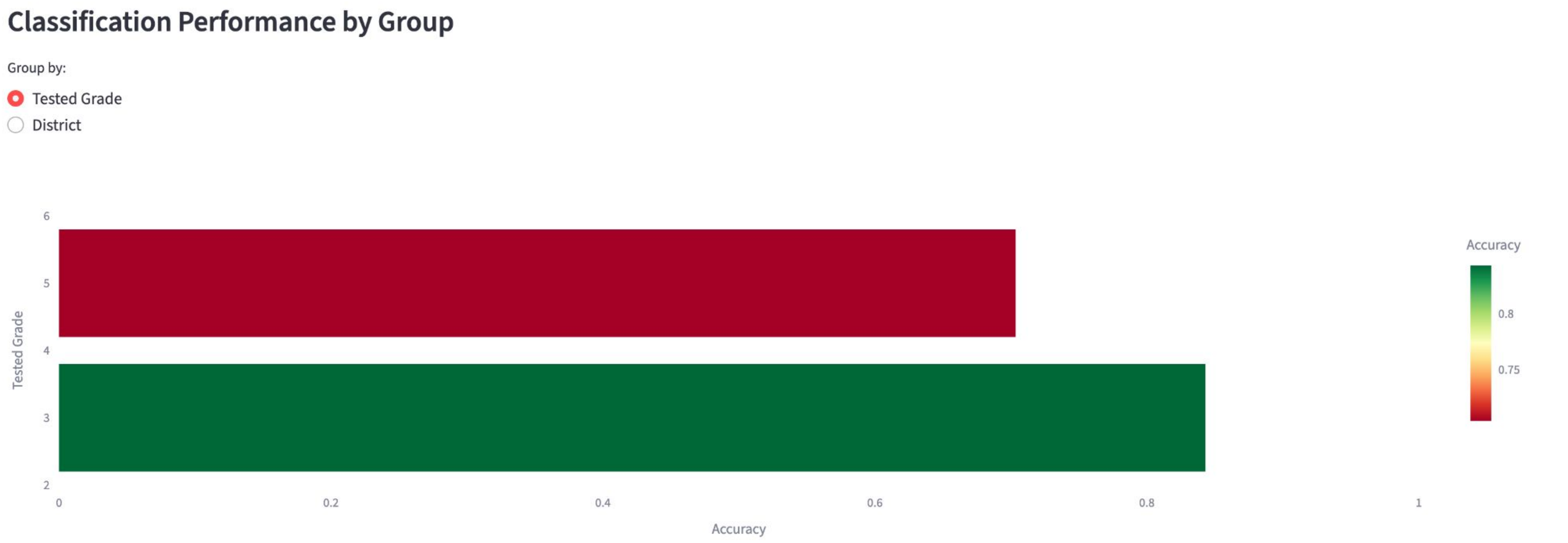


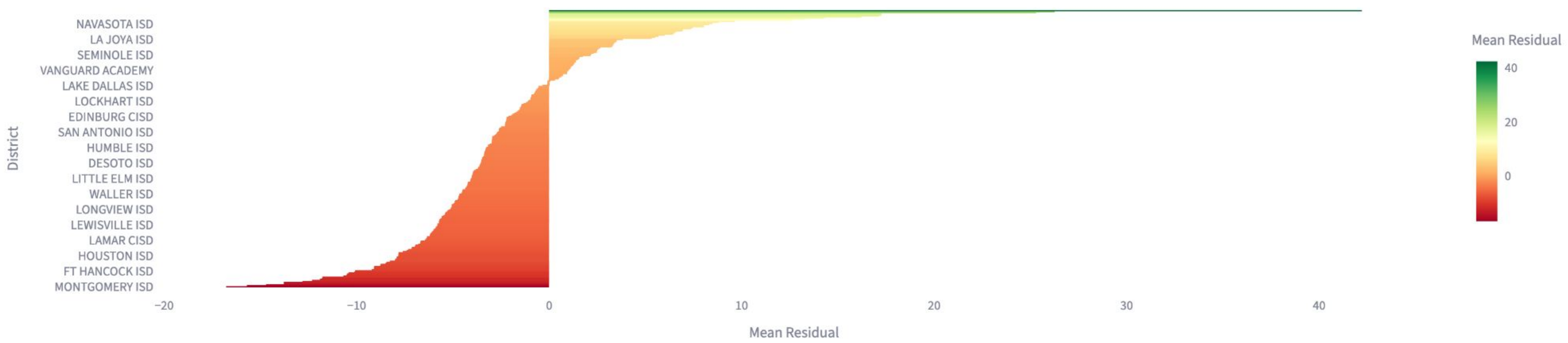



# Model Biases

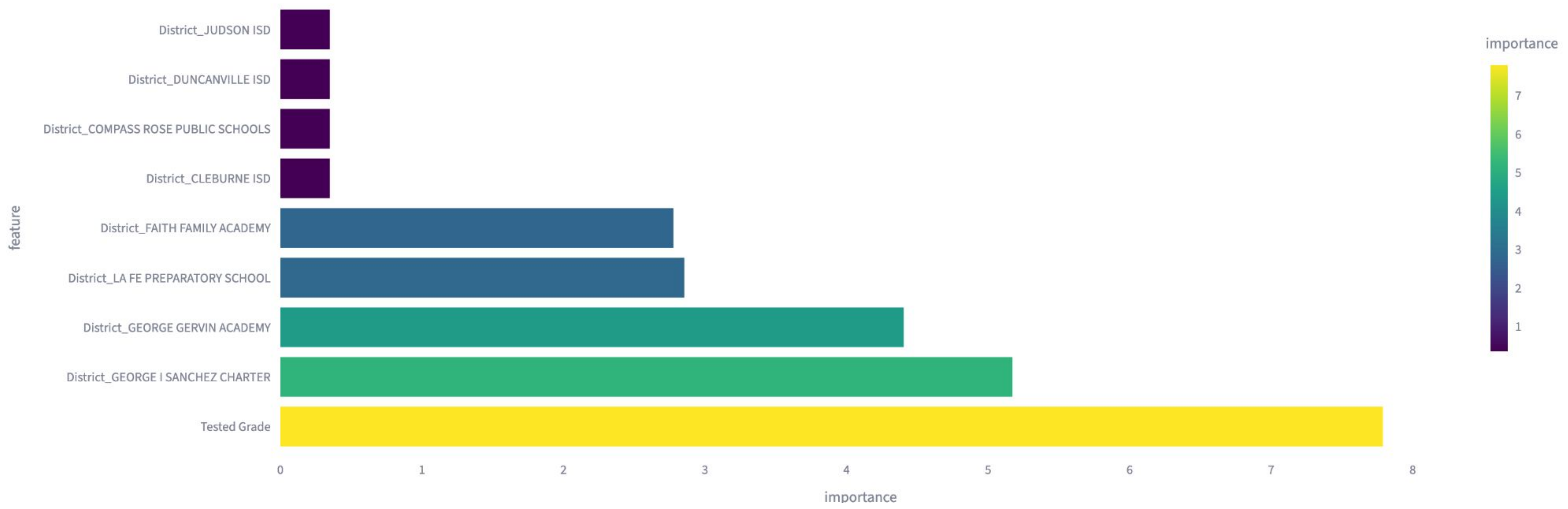
In general, all **classification** models had a much easier time predicting 3rd grade performance than 5th grade performance.

**Regression** models overestimated performance on larger districts and underestimated mostly on smaller, rural districts.



## Combined Global (surrogate) importances

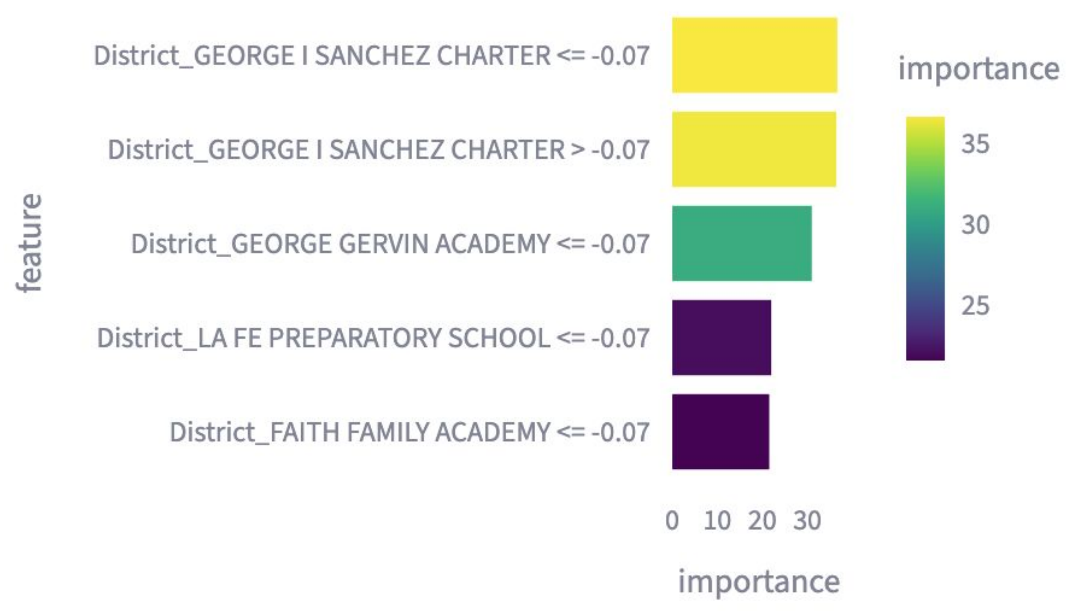



| | feature | importance |
|---|---|---|
| 8 | Tested Grade | 7.7897 |
| 5 | District_GEORGE I SANCHEZ CHARTER | 5.1723 |
| 4 | District_GEORGE GERVIN ACADEMY | 4.4045 |
| 7 | District_LA FE PREPARATORY SCHOOL | 2.8536 |
| 3 | District_FAITH FAMILY ACADEMY | 2.7769 |
| 0 | District_CLEBURNE ISD | 0.349 |
| 1 | District_COMPASS ROSE PUBLIC SCHOOLS | 0.349 |
| 2 | District_DUNCANVILLE ISD | 0.349 |
| 6 | District_JUDSON ISD | 0.349 |

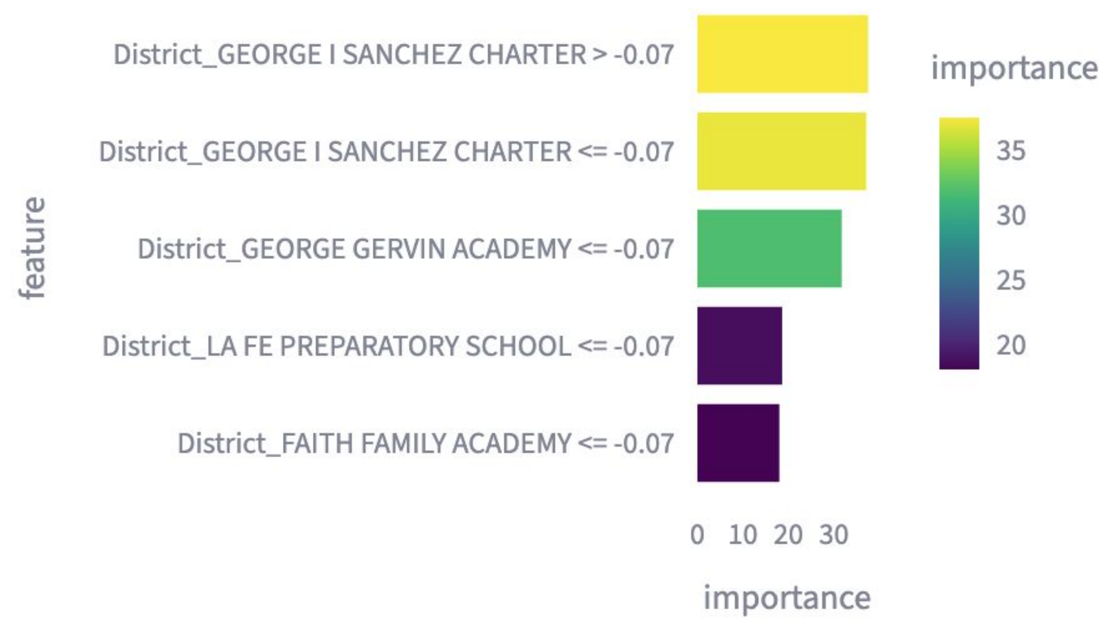
# LIME explanations

Models were able to find specific districts that need support.
Locally, smaller districts with more challenging students are the biggest explainers according to LIME

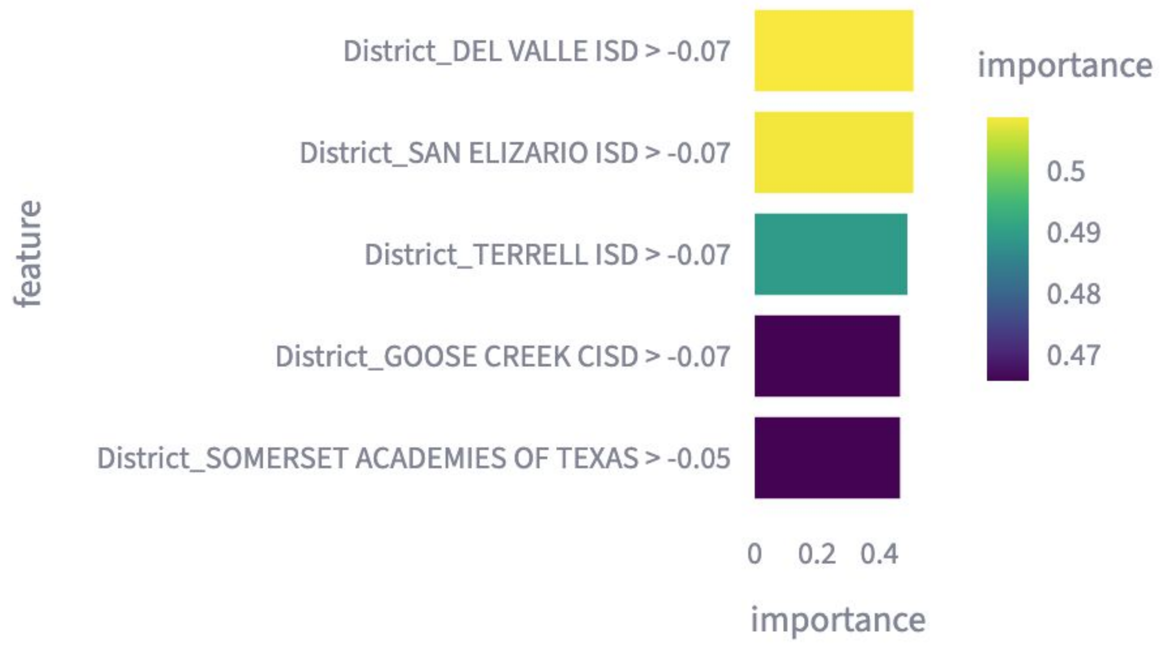
GAM



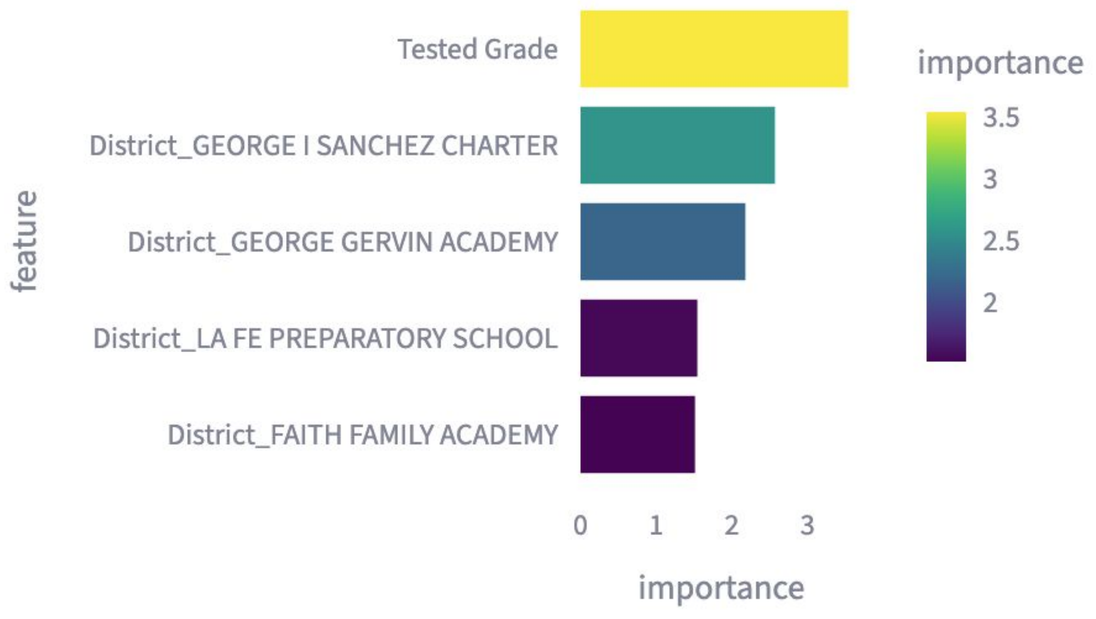

GBR




LogisticRegression




GAM_GlobalImportance



# LIME explainer matches reality

George I Sanchez Charter: 89.9% of students were considered at risk of dropping out of school. 68.1% of students were enrolled in bilingual and english language learning programs.

Charter schools receive less funding from the government compared to their public district counterparts, which are mainly funded by property tax in TX.

### Risk factors

A student is identified as being at risk of dropping out of school based on state-defined criteria. A student is defined as "economically disadvantaged" if he or she is eligible for free or reduced-price lunch or other public assistance.

At-risk students
**89.9 %**
Statewide: 53.2%

Economically disadvantaged
**93.5 %**
Statewide: 62.3%

Limited English proficiency
**63.5 %**
Statewide: 24.4%


#### SAT

The average SAT score for students graduating in **2022-2023**, with critical reading, writing and mathematics results combined. The maximum score is 2400. For the small percentage of students who took the redesigned SAT with a maximum score of 1600, their scores were converted to the equivalent scores on the previous SAT using College Board concordance tables.

Avg. SAT score
**938**
Statewide: 978

#### ACT

The average ACT composite score for students graduating in **2022-2023**. The maximum score is 36.

Avg. ACT score
**15.8**
Statewide: 19.2

### Chronic absenteeism

The chronic absenteeism rate for students during the **2022-2023** school year. It measures the number of students who were absent for at least ten percent of the school year.

All students
**49.4 %**
Statewide: 20.3%

African American
**66.7 %**
Statewide: 24.8%

American Indian
**N/A**
Statewide: 21.3%

Asian
**N/A**
Statewide: 7.6%

Hispanic
**49.2 %**

Pacific Islander
**N/A**

White
**Masked**

Two or more races
**Masked**

# Conclusion

# Future Work

### Dimensionality Reduction

Applying PCA to identify underlying latent dimensions and reduce noise.

### Integrate geographic analysis

Using GeoJSON to create choropleth maps

### Dig into funding amount and  sources

A lot of political and economic reasons why schools fail. Would be cool to connect them to current data.

# Thank You!

Any Questions?