DBS
Live more, Bank less

CBG Analytics

Model Performance, Fairness and Explainability Report

Model ID:
Model Name:
Country:
Model Developer (Project Lead):
Date:

I. Model Description

This is a supervised regression task ...

II. List of Prohibited Features

religion, nationality, birth place, gender, race

III. Algorithmic Fairness

Algorithmic fairness assesses the models based on technical definitions of fairness. If all are met, the model is deemed to be fair.

Fairness deviation threshold is set at **0.2**. Absolute fairness is 1, so a model is considered fair for the metric when the **metric is between 0.80 and 1.20**.

Prohibited Feature: `SchoolHoliday`
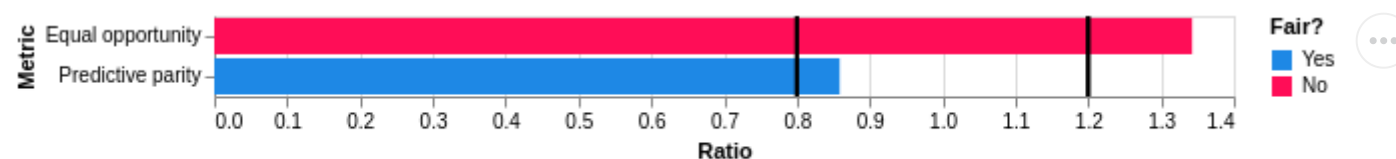
Fairness Class `SchoolHoliday=0` vs rest

	Metric	Ratio	Fair?
0	Equal opportunity	0.759796	No
1	Predictive parity	0.997787	Yes
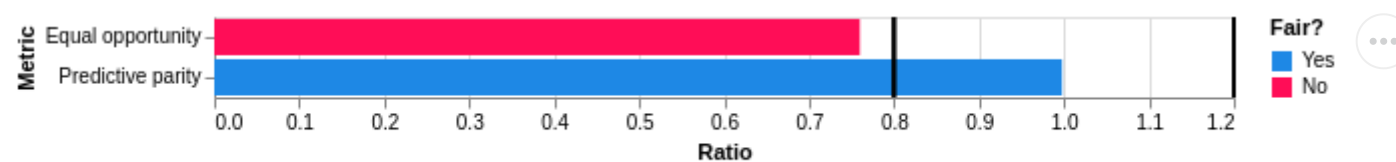
Overall: **Not Fair**

Fairness Class `SchoolHoliday=1` vs rest

	Metric	Ratio	Fair?
0	Equal opportunity	1.342681	No
1	Predictive parity	0.858702	Yes

Overall: **Not Fair**

Fairness Class `SchoolHoliday=2` vs rest

	Metric	Ratio	Fair?
0	Equal opportunity	1.039272	Yes
1	Predictive parity	1.225490	No
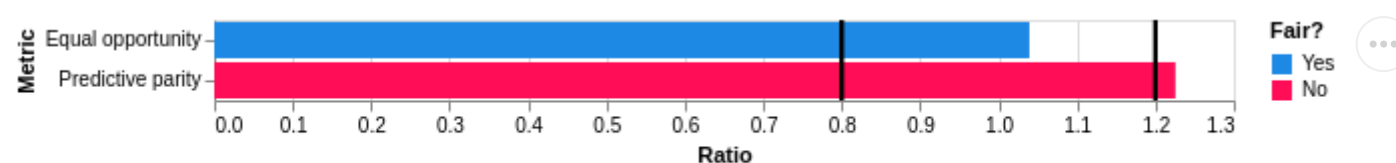
Overall: **Not Fair**

Prohibited Feature: `DayOfWeek`

Fairness Class `DayOfWeek=0` **vs rest**

	Metric	Ratio	Fair?
0	Equal opportunity	6.576012	No
1	Predictive parity	0.966240	Yes
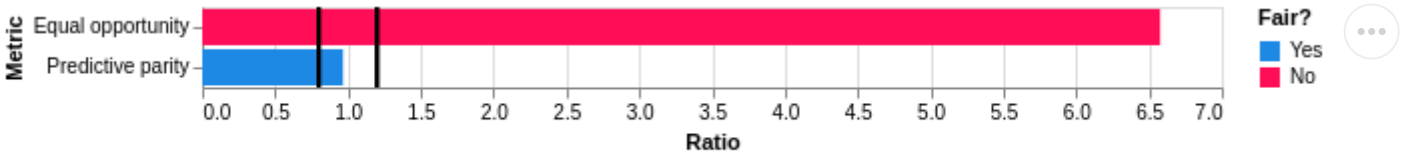
Overall: **Not Fair**

Fairness Class `DayOfWeek=1` **vs rest**

	Metric	Ratio	Fair?
0	Equal opportunity	0.549565	No
1	Predictive parity	0.890476	Yes
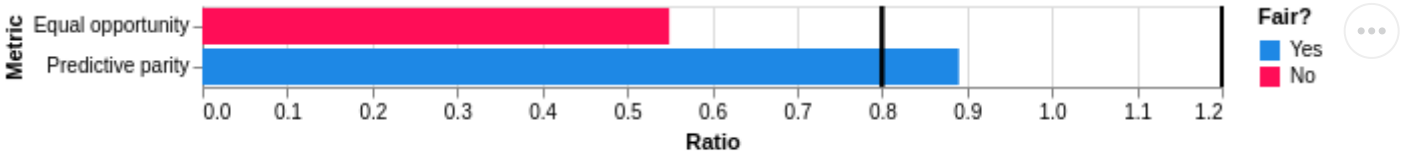
Overall: **Not Fair**

Fairness Class `DayOfWeek=2` **vs rest**

	Metric	Ratio	Fair?
0	Equal opportunity	0.896426	Yes
1	Predictive parity	1.123596	Yes
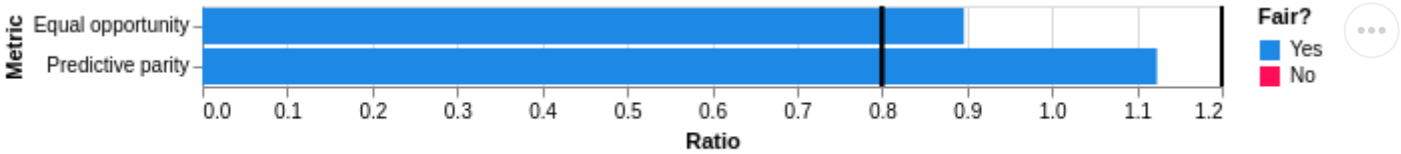
Overall: **Fair**

IV. Model Explainability

SHAP Summary Plots of Top Features
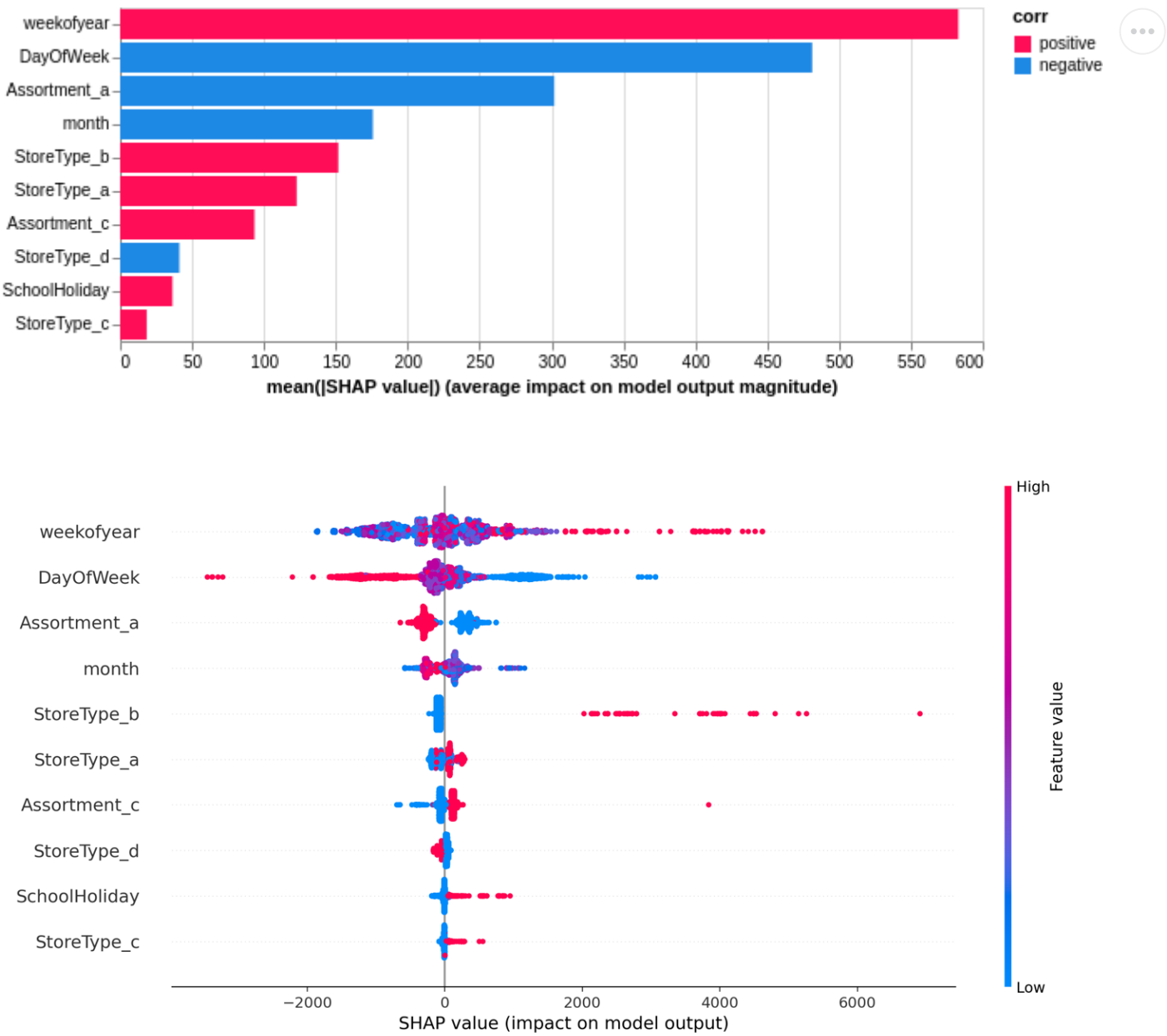
The top features are `weekofyear` , `DayOfWeek` , `Assortment_a` , `month` , `StoreType_b` .

[Placeholder]

V. Model Performance

```
Model MSE = 7003977.0357
```

VI. Conclusion

Model performance: [Placeholder]

Explainability: [Placeholder]

The top features that have positive correlation with their model output are `weekofyear` , `StoreType_b` , `StoreType_a` , `Assortment_c` , `SchoolHoliday` , `StoreType_c` .

The top features that have negative correlation with their model output are `DayOfWeek` , `Assortment_a` , `month` , `StoreType_d` .

Fairness: We consider the model to be fair if it is deemed to be fair for all metrics. From the table below, overall the model is considered **not fair**.

	Prohibited Variable	Fair?
0	SchoolHoliday-class0	No
1	SchoolHoliday-class1	No
2	SchoolHoliday-class2	No
3	DayOfWeek-class0	No
4	DayOfWeek-class1	No
5	DayOfWeek-class2	Yes

Appendix

Dependence Plots of Top Features

Feature: `weekofyear`
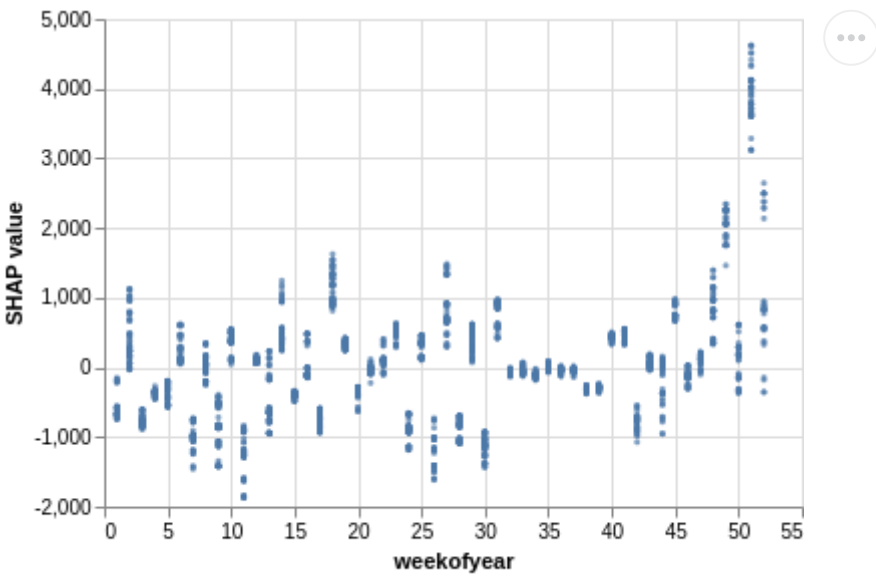
Feature: `DayOfWeek`
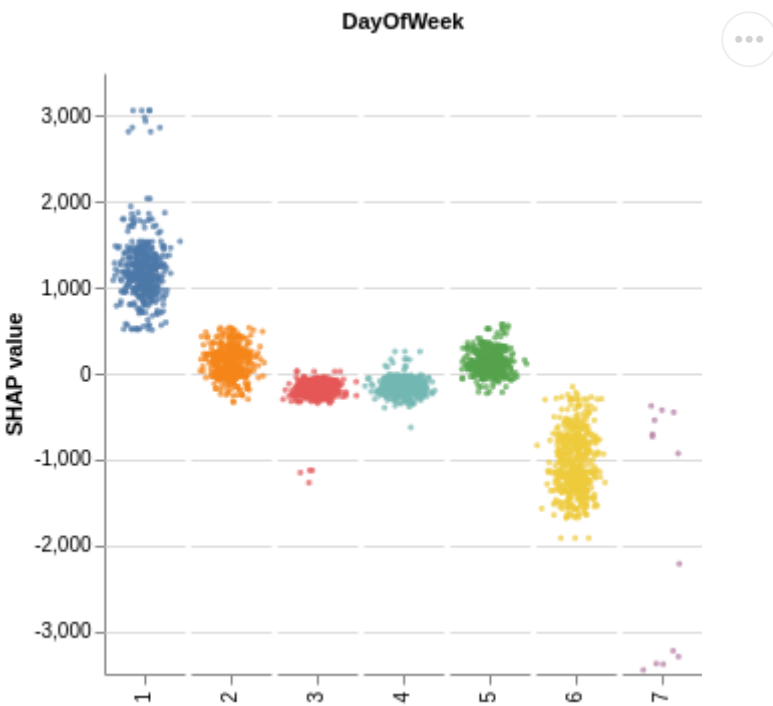
Feature: `Assortment_a`
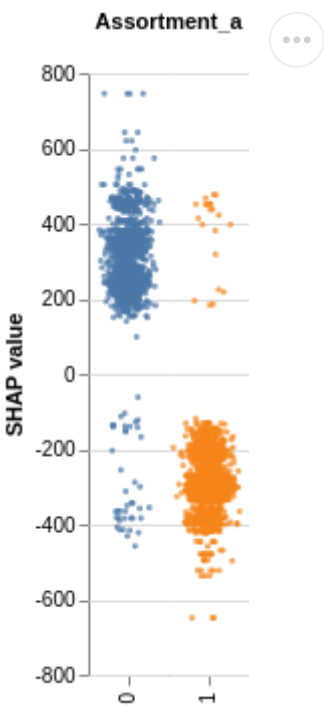
Feature: `month`
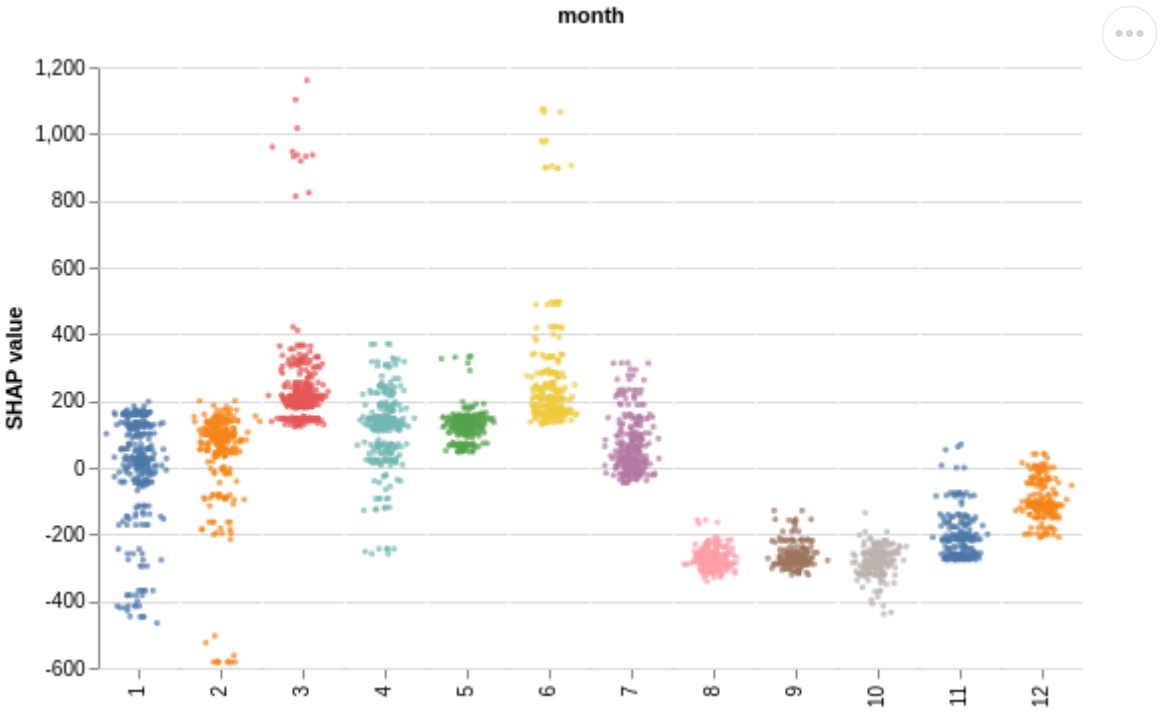
Feature: `StoreType_b`
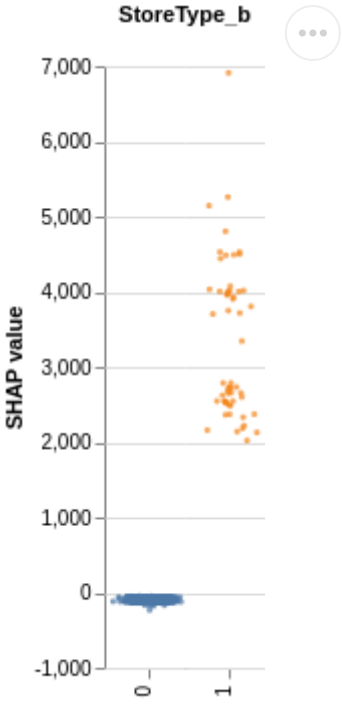
Feature: `StoreType_a`
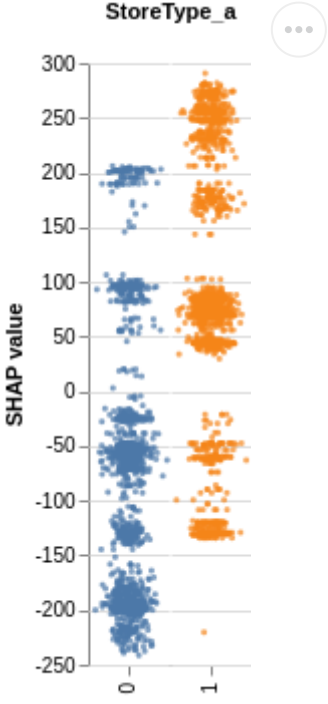
Feature: `Assortment_c`
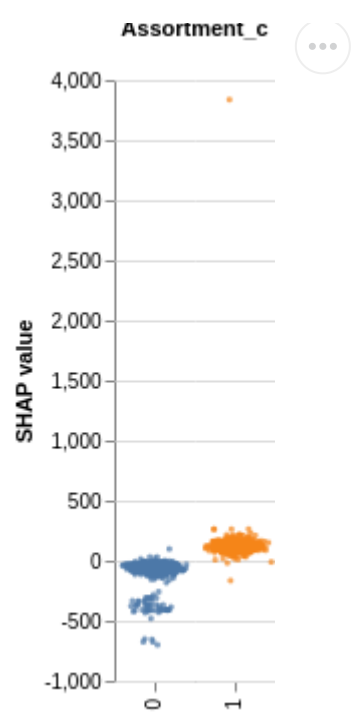
Feature: `StoreType_d`
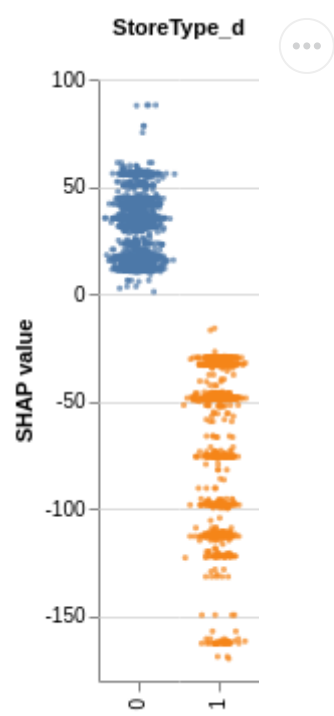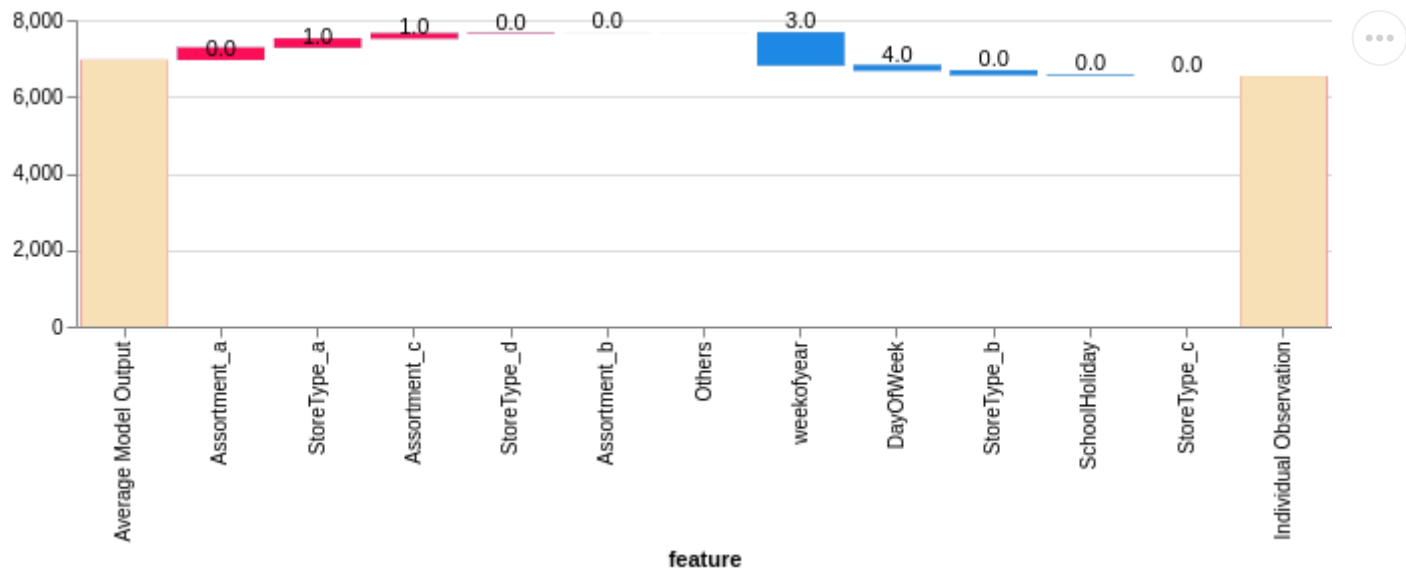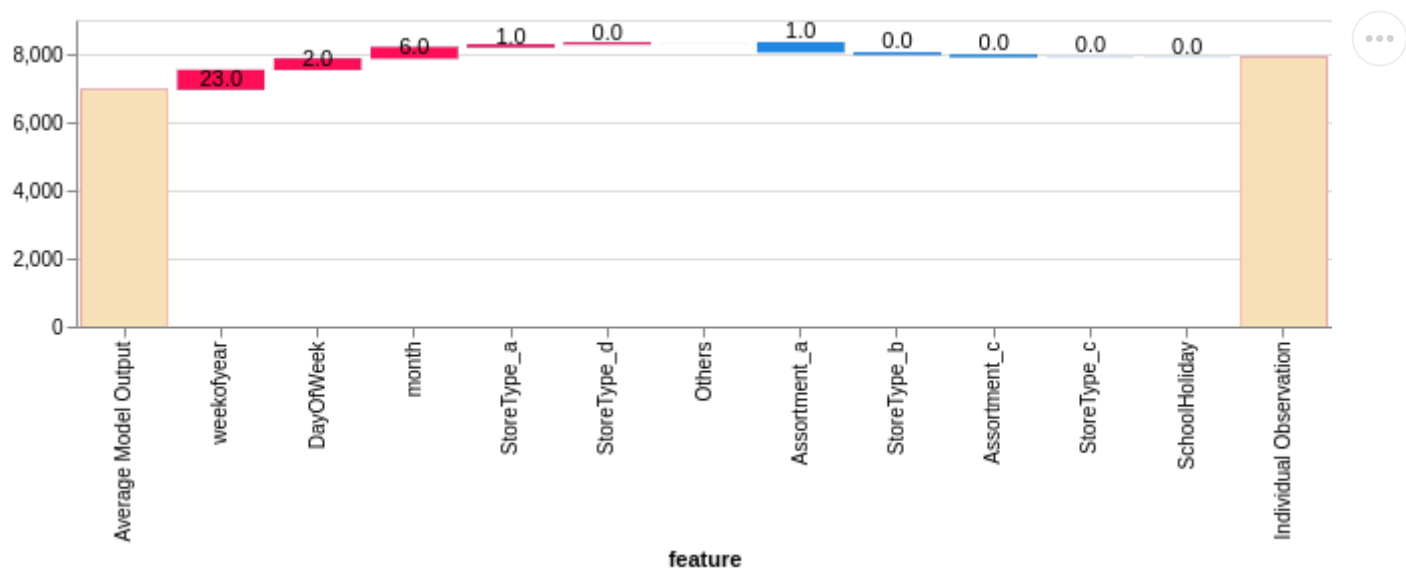

Feature: `SchoolHoliday`
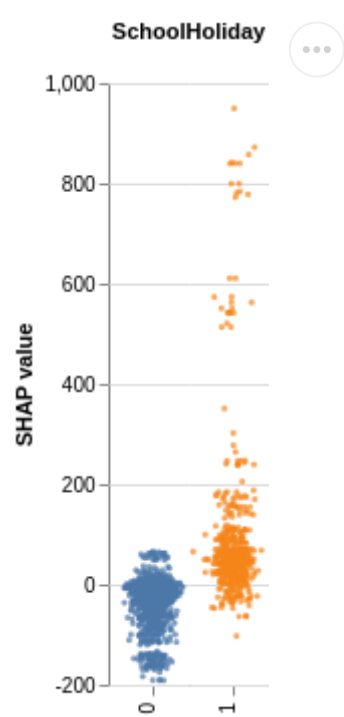
Feature: `StoreType_c`
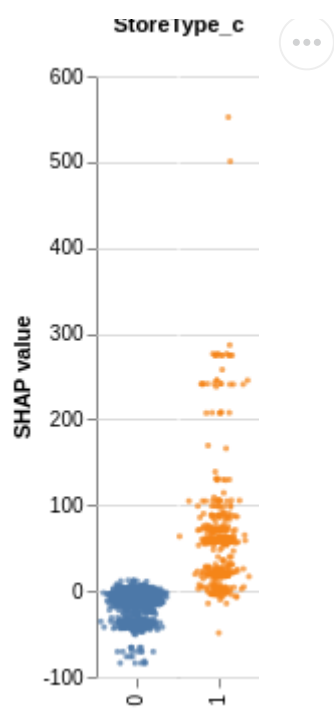
Sample Individual Explainability

Sample from Class=0: SHAP Contribution to Model Prediction

Sample from Class=1: SHAP Contribution to Model Prediction

Sample from Class=2: SHAP Contribution to Model Prediction
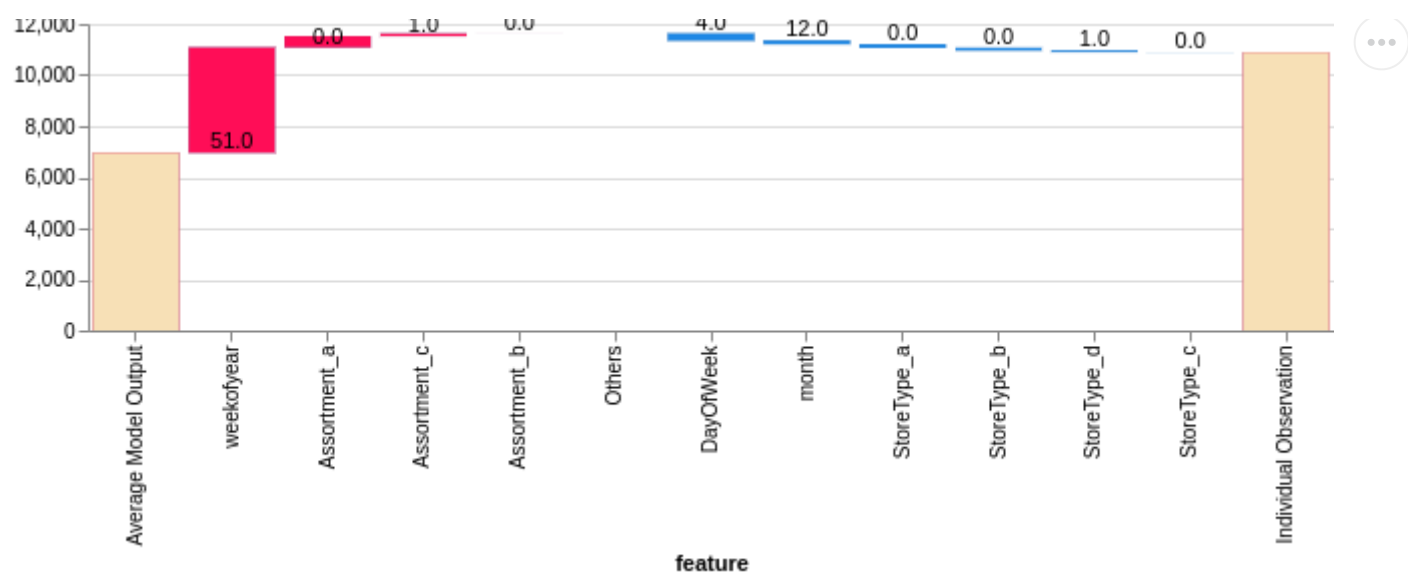
Algorithmic Fairness

Prohibited Feature: `SchoolHoliday`

Fairness Class `SchoolHoliday=0` **vs rest**

Fairness is when **ratio is between 0.80 and 1.20**.
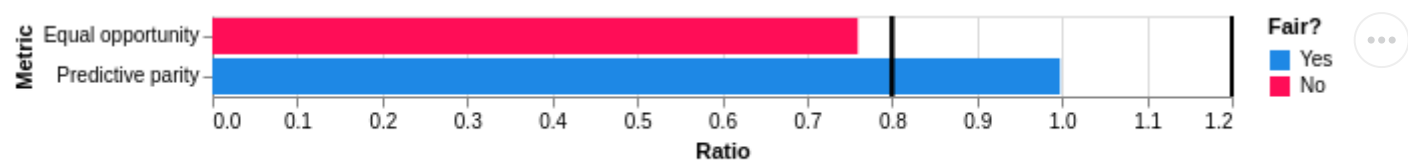
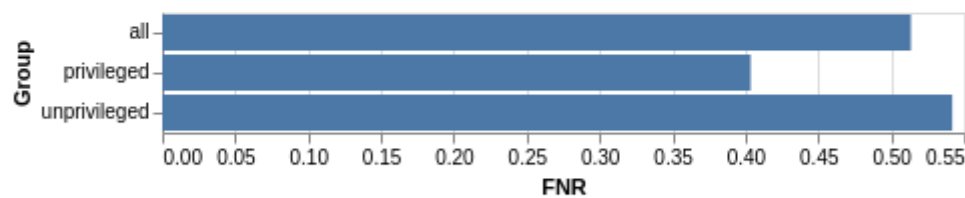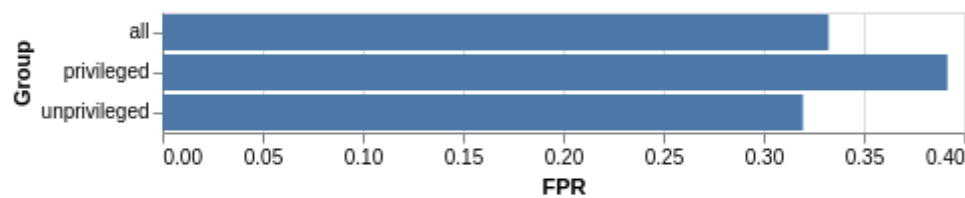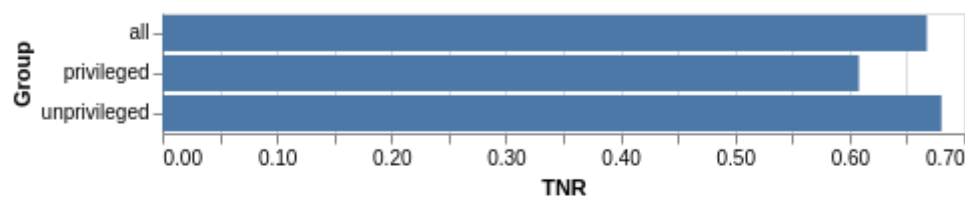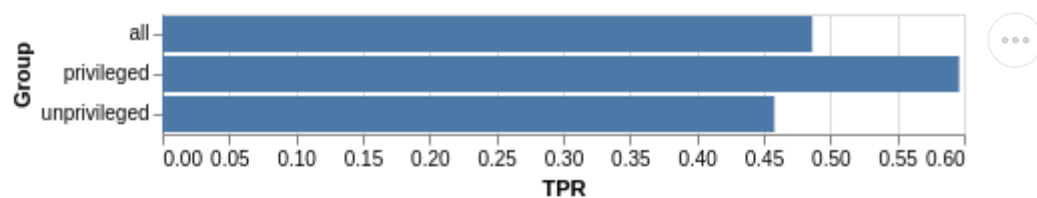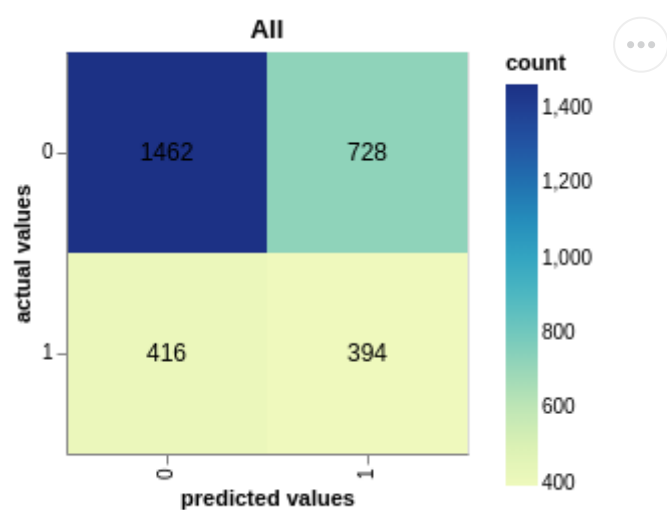|	Metric	Unprivileged	Privileged	Ratio	Fair?
0	Equal opportunity	0.274769	0.361635	0.759796	No
1	Predictive parity	0.728600	0.730216	0.997787	Yes

Performance Metrics

FDR

Group
all
privileged
unprivileged

0.00 0.05 0.10 0.15 0.20 0.25 0.30 0.35 0.40 0.45

FOR

Group
all
privileged
unprivileged

0.00 0.10 0.20 0.30 0.40 0.50 0.60 0.70

ACC

Group
all
privileged
unprivileged

0.00 0.05 0.10 0.15 0.20 0.25 0.30 0.35 0.40 0.45 0.50 0.55 0.60 0.65

selection_rate

Group
all
privileged
unprivileged

0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8

precision

Group
all
privileged
unprivileged

0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8

recall

Group
all
privileged
unprivileged

0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8

sensitivity

Group
all
privileged
unprivileged

0.00 0.10 0.20 0.30 0.40 0.50 0.60 0.70

specificity

Group
all
privileged
unprivileged

0 200 400 600 800 1,000 1,200 1,400

power

Group
all
privileged
unprivileged

0.00 0.05 0.10 0.15 0.20 0.25 0.30 0.35

error_rate

Confusion Matrices

All

actual values

0 | 684 | 484
1 | 531 | 1301

0 | 1
predicted values

count
1,200
1,000
800
600

Fairness Class `SchoolHoliday=1` **vs rest**

Fairness is when **ratio is between 0.80 and 1.20**.
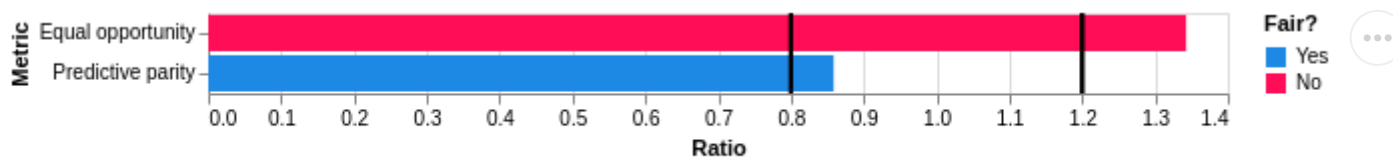
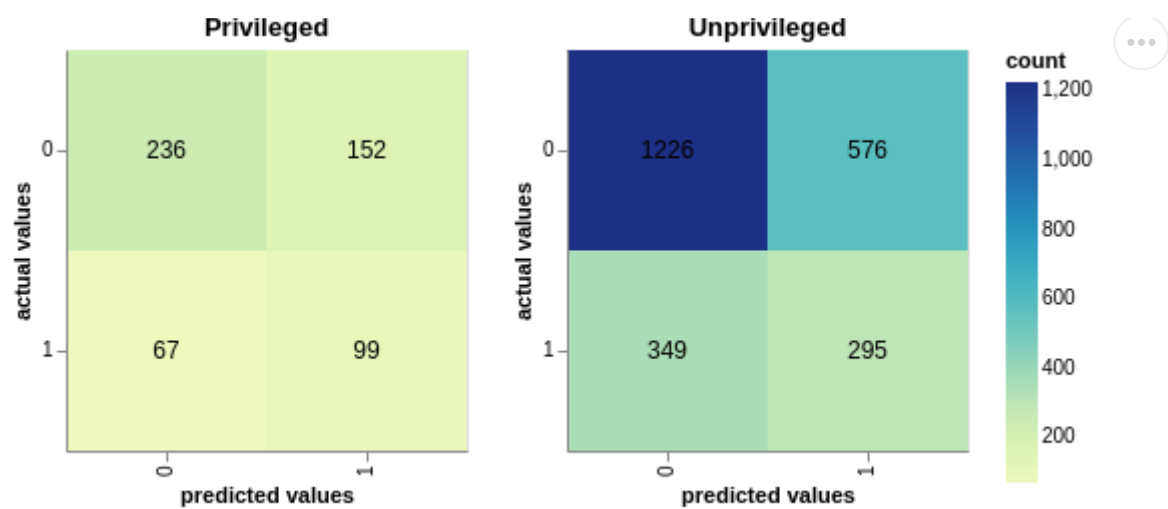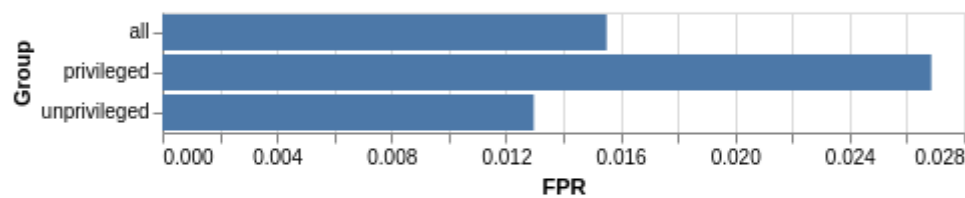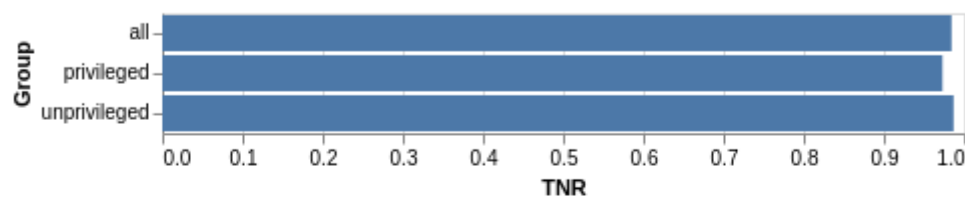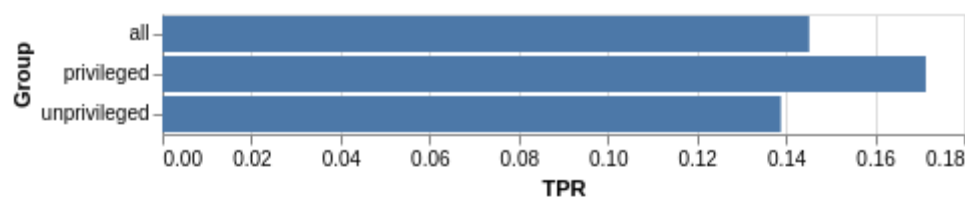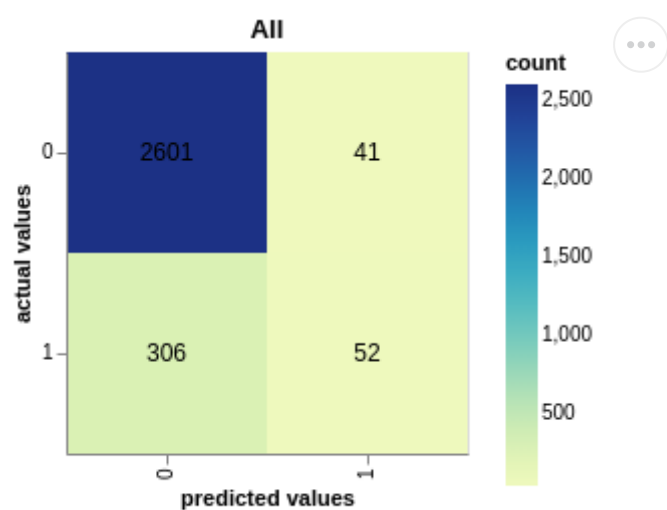|	Metric	Unprivileged	Privileged	Ratio	Fair?
0	Equal opportunity	0.541925	0.403614	1.342681	No
1	Predictive parity	0.338691	0.394422	0.858702	Yes

Performance Metrics

Confusion Matrices

All

Fairness Class `SchoolHoliday=2` **vs rest**

Fairness is when **ratio is between 0.80 and 1.20**.
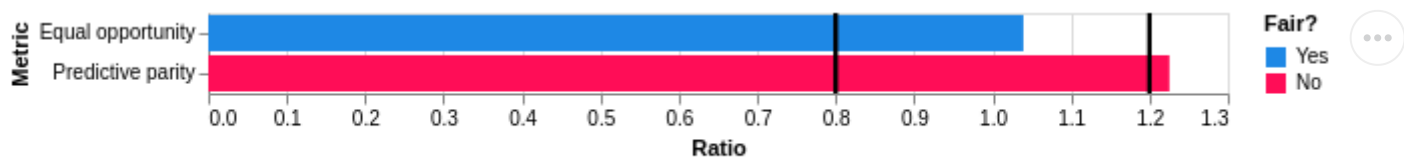
	Metric	Unprivileged	Privileged	Ratio	Fair?
0	Equal opportunity	0.861111	0.828571	1.039272	Yes
1	Predictive parity	0.588235	0.480000	1.225490	No

Performance Metrics

Confusion Matrices

All
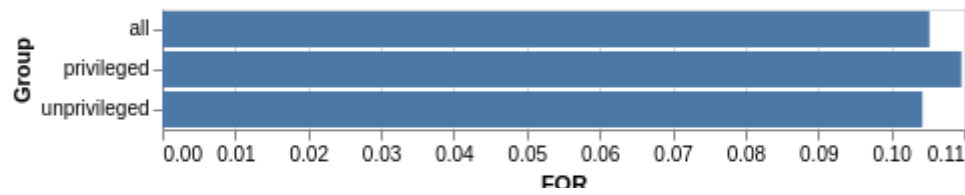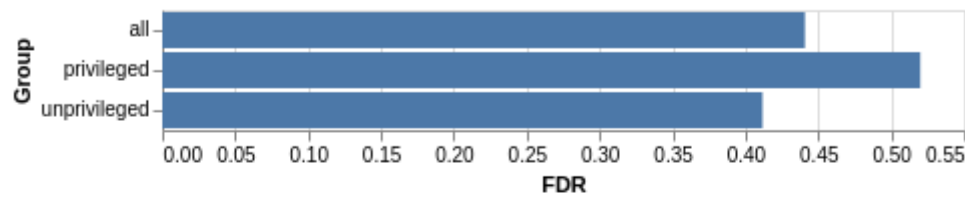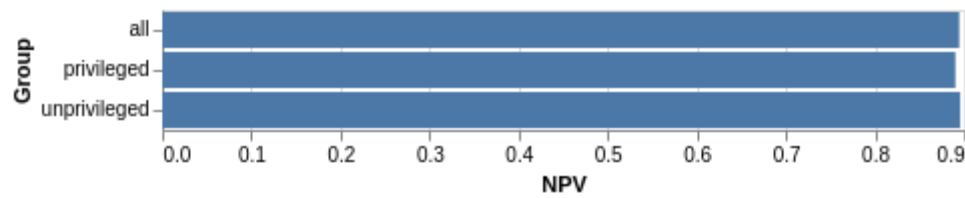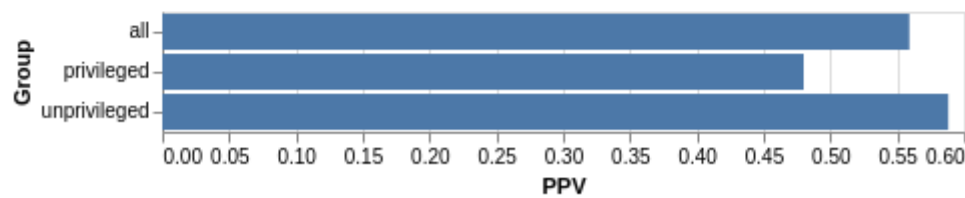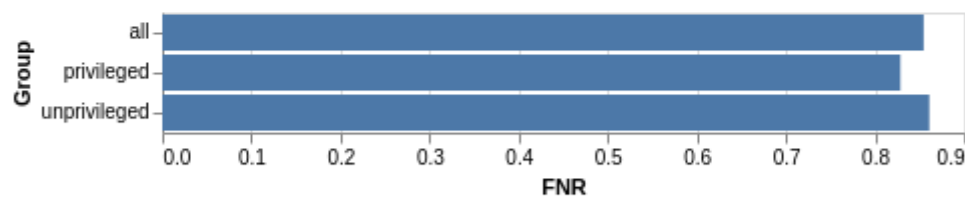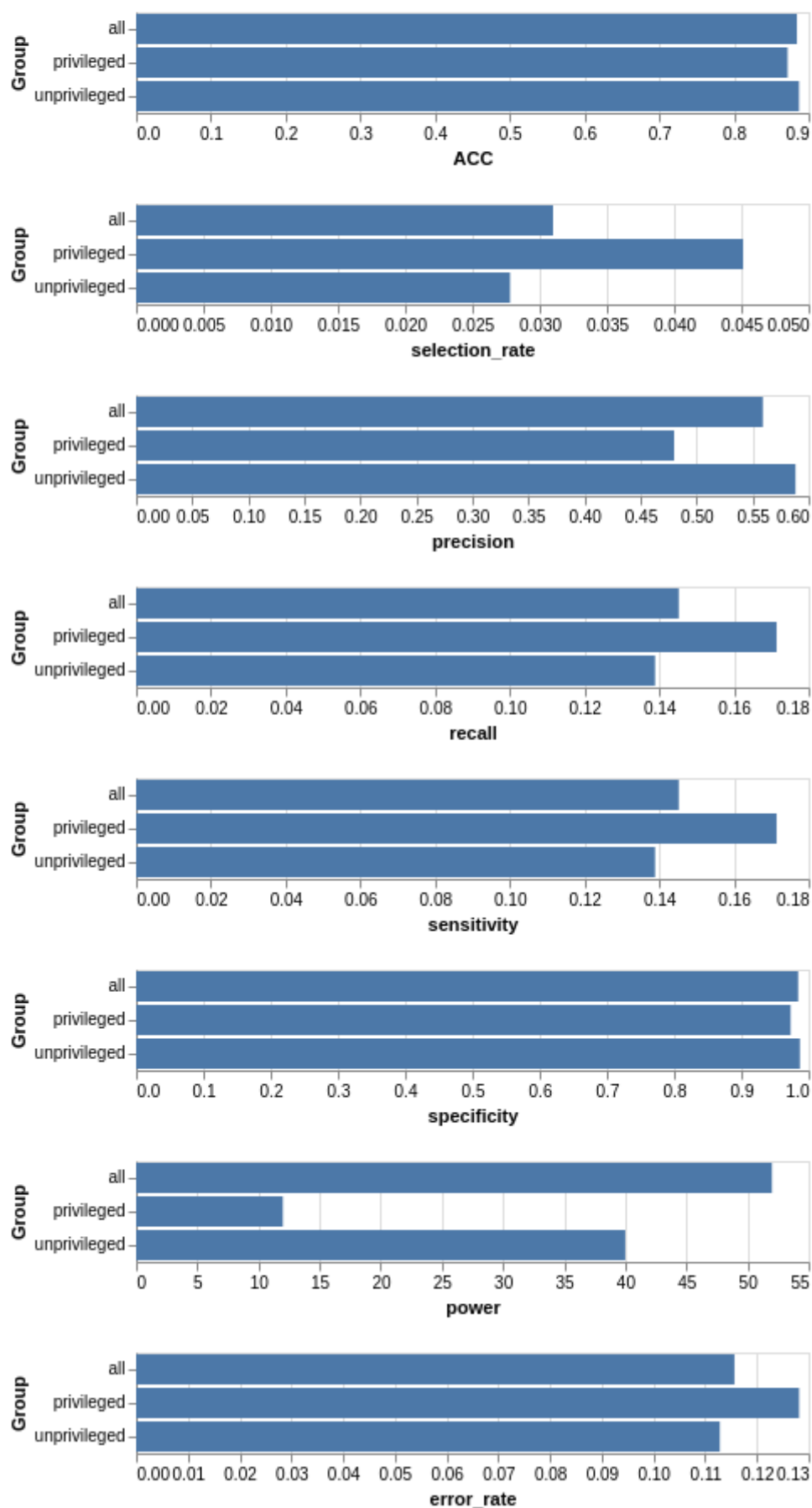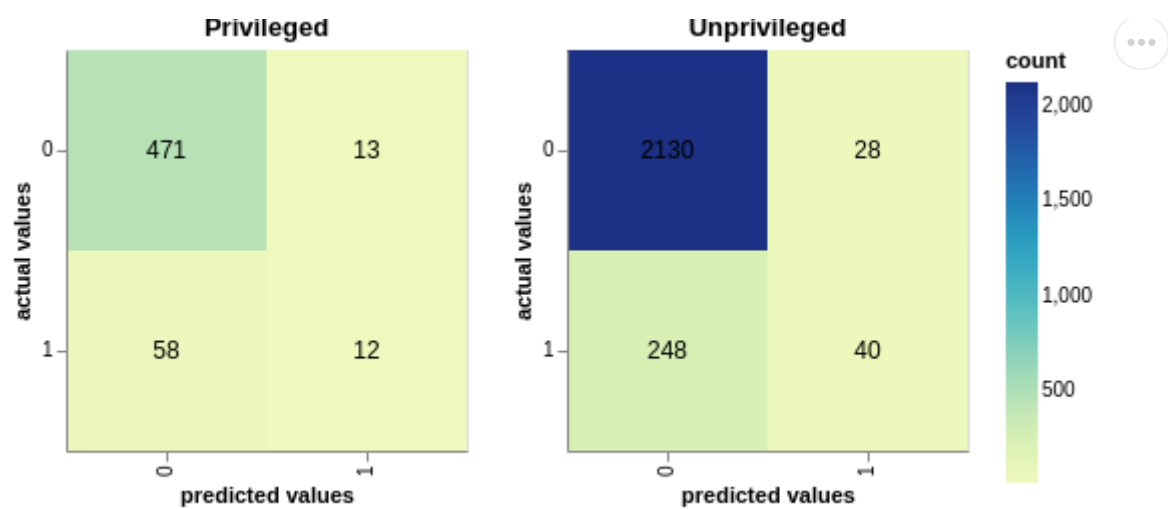
Prohibited Feature: `DayOfWeek`

Fairness Class `DayOfWeek=0` **vs rest**

Fairness is when **ratio is between 0.80 and 1.20**.
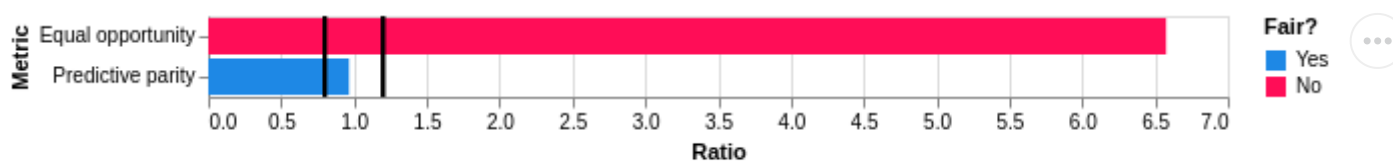
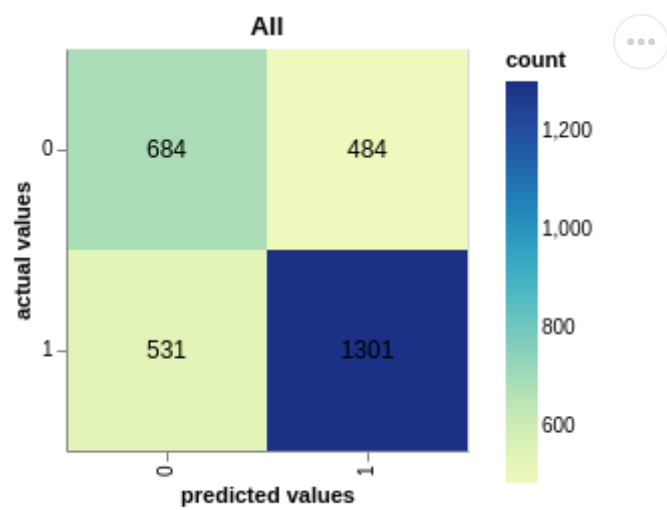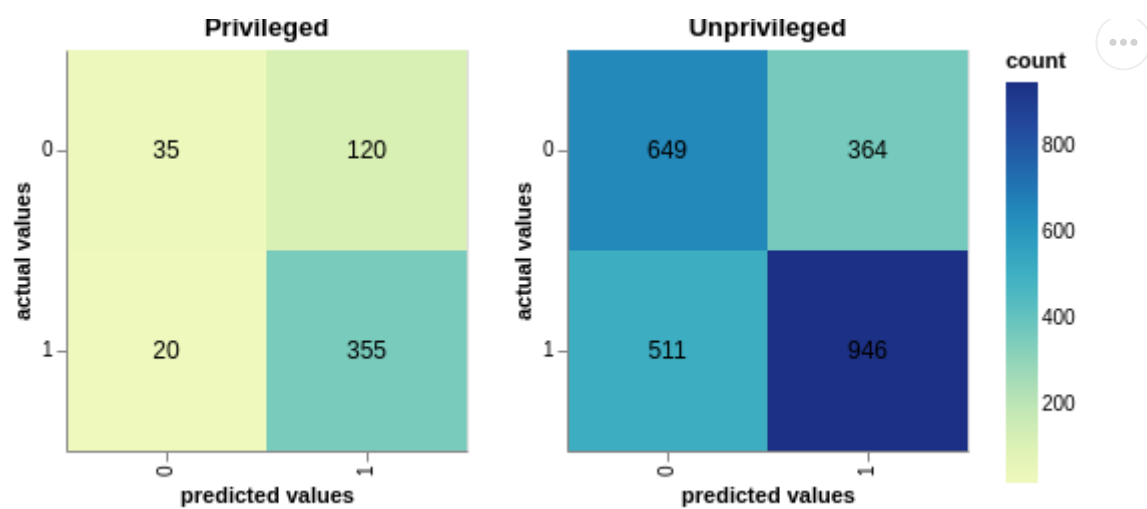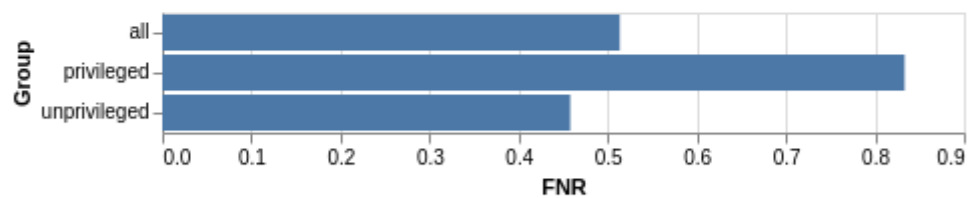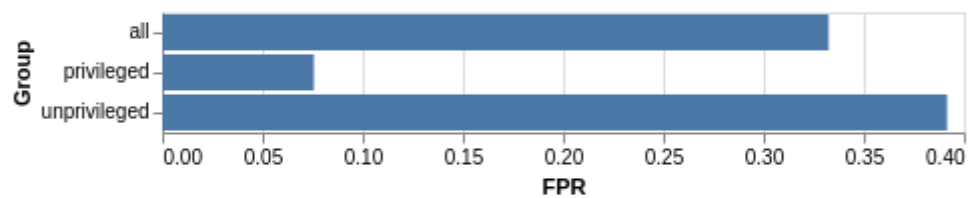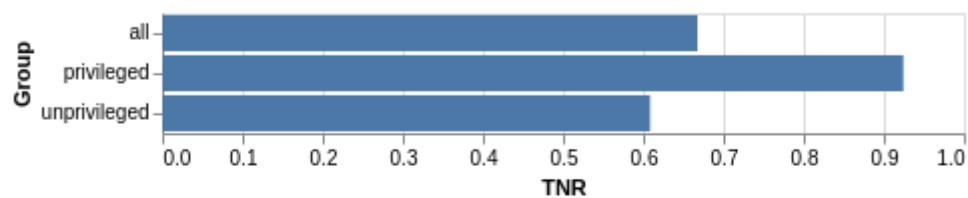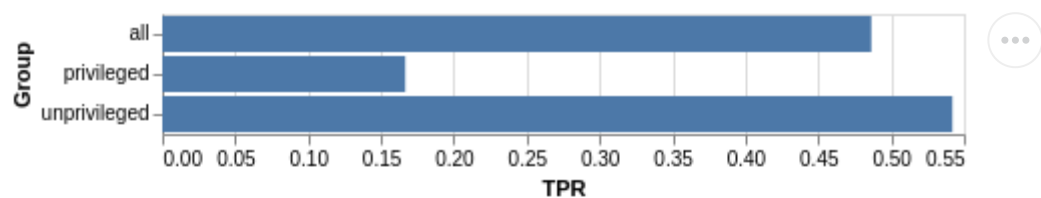|	Metric	Unprivileged	Privileged	Ratio	Fair?
0	Equal opportunity	0.350721	0.053333	6.576012	No
1	Predictive parity	0.722137	0.747368	0.966240	Yes

Performance Metrics

Confusion Matrices

All

Privileged

	predicted values 0	predicted values 1
actual values 0	35	120
actual values 1	20	355

Unprivileged

	predicted values 0	predicted values 1
actual values 0	649	364
actual values 1	511	946

Fairness Class `DayOfWeek=1` **vs rest**
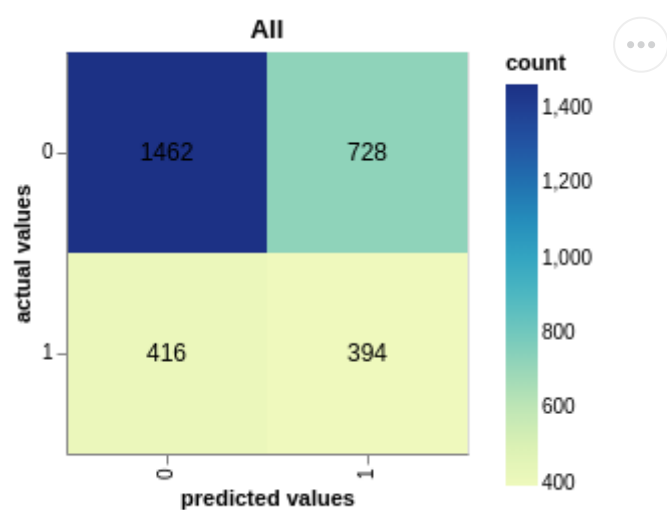
Fairness is when **ratio is between 0.80 and 1.20**.
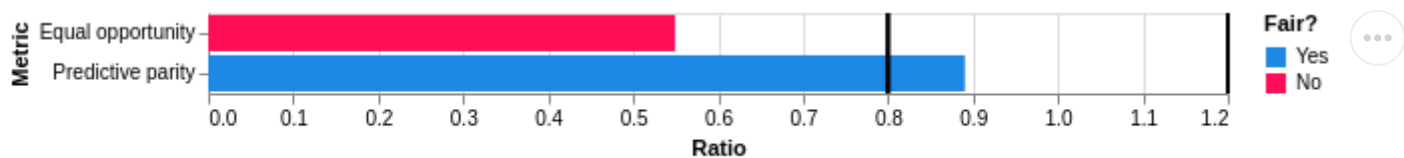
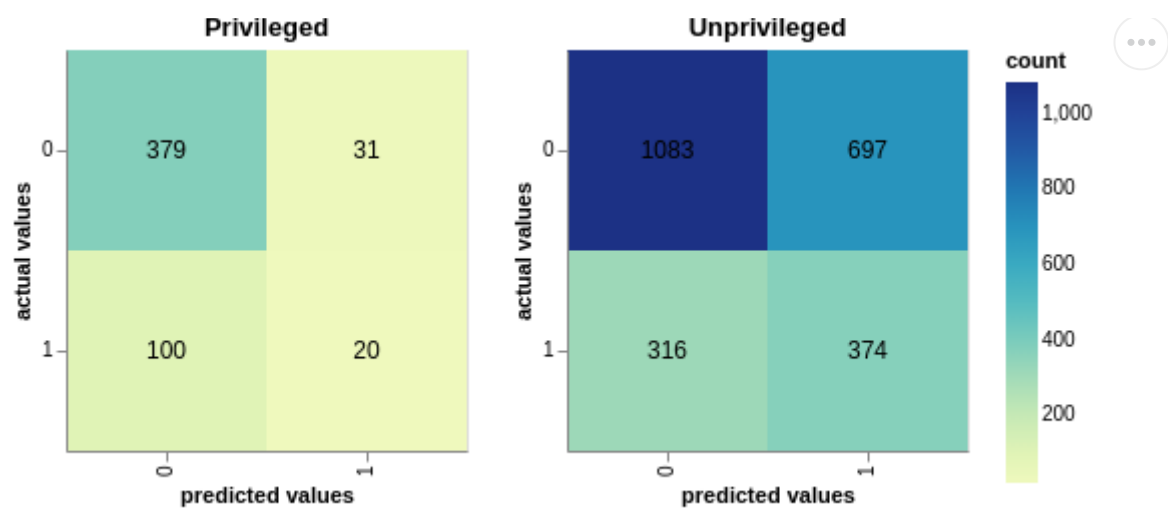|	Metric	Unprivileged	Privileged	Ratio	Fair?
0	Equal opportunity	0.457971	0.833333	0.549565	No
1	Predictive parity	0.349206	0.392157	0.890476	Yes

Performance Metrics
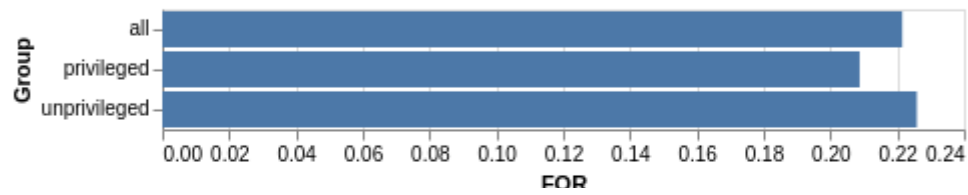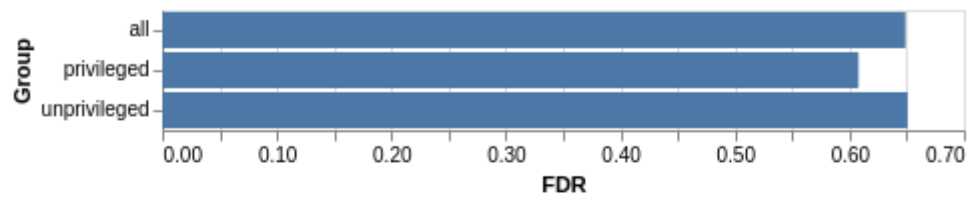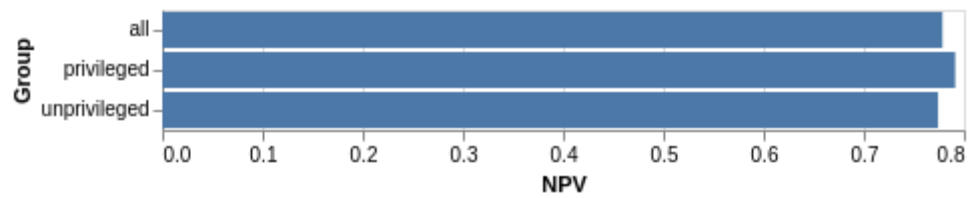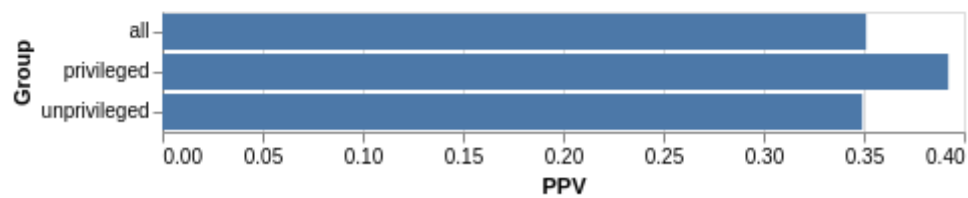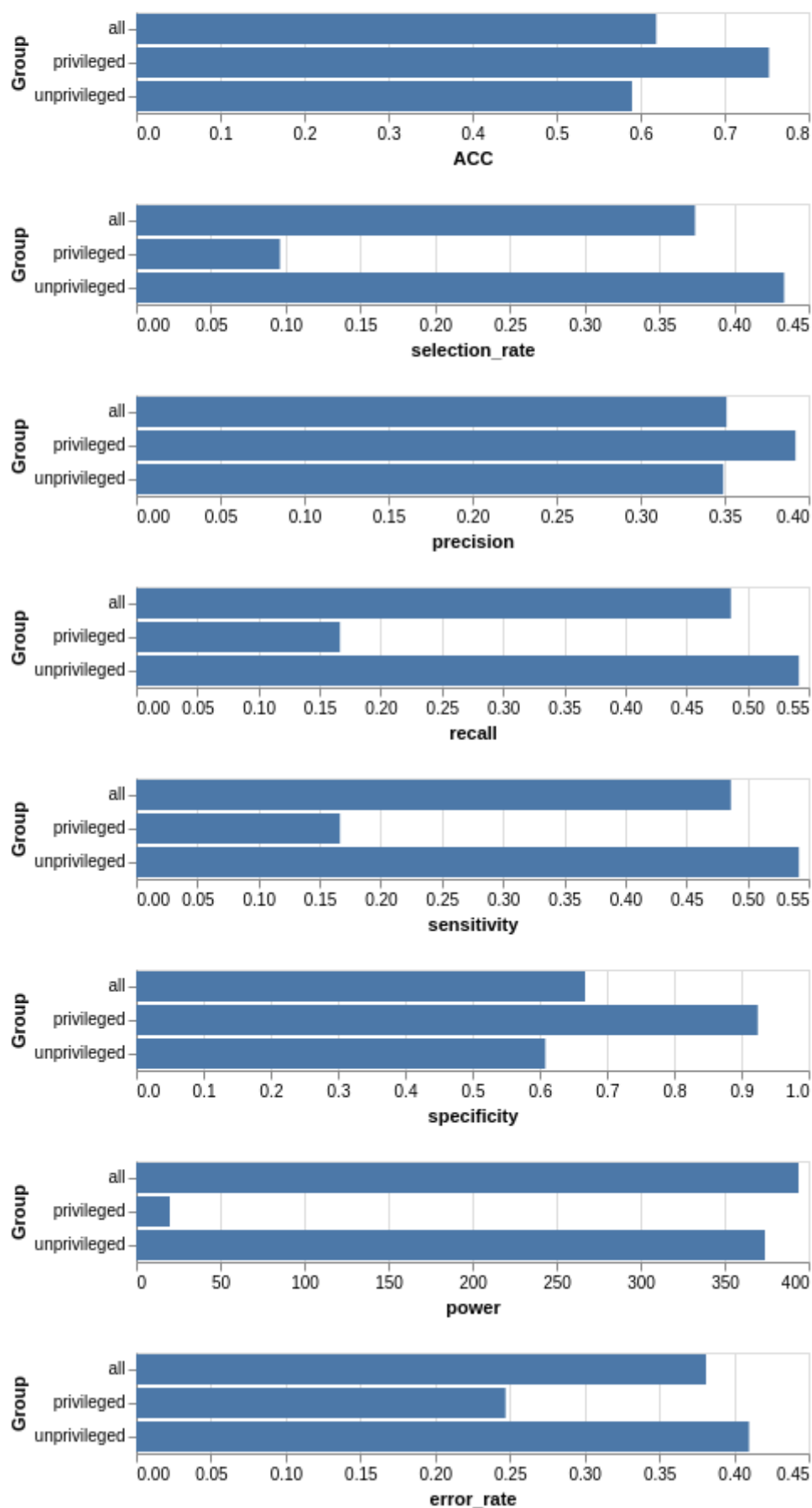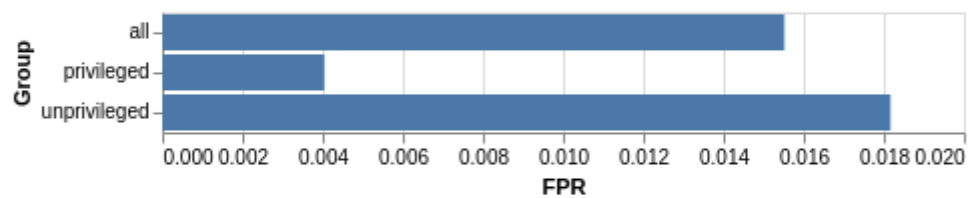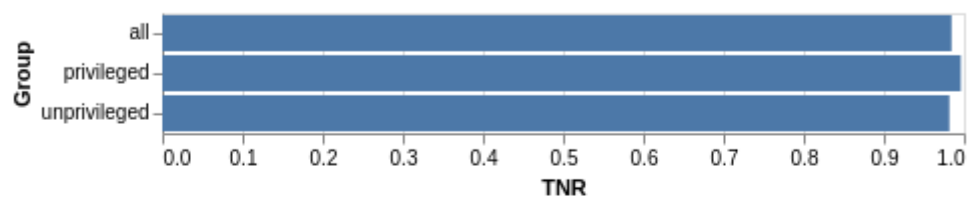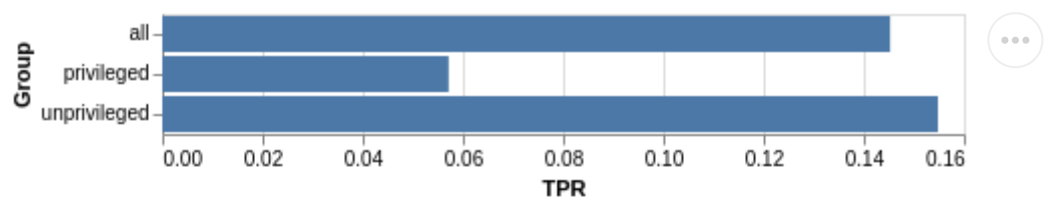
Confusion Matrices

Fairness Class `DayOfWeek=2` **vs rest**
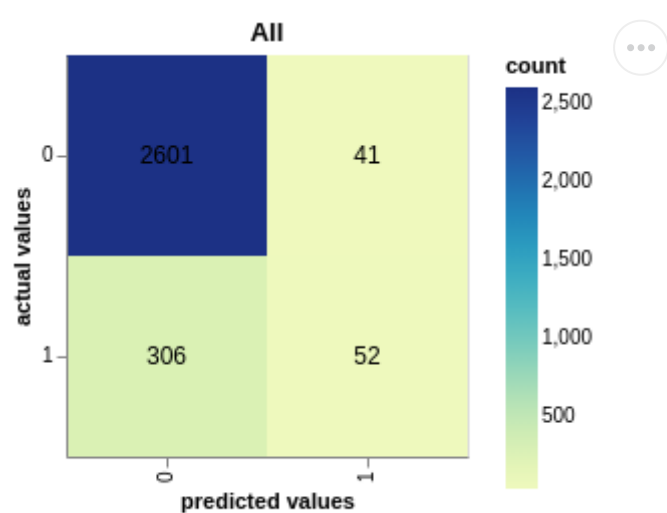
Fairness is when **ratio is between 0.80 and 1.20**.
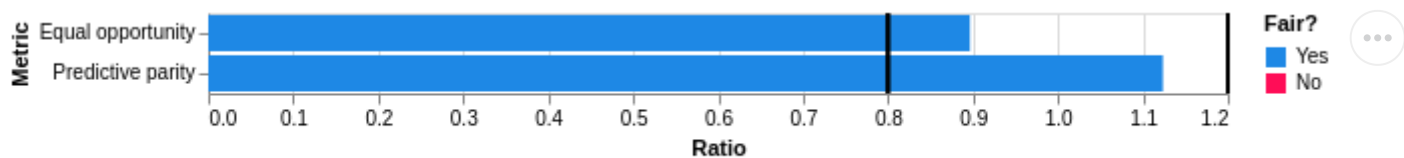
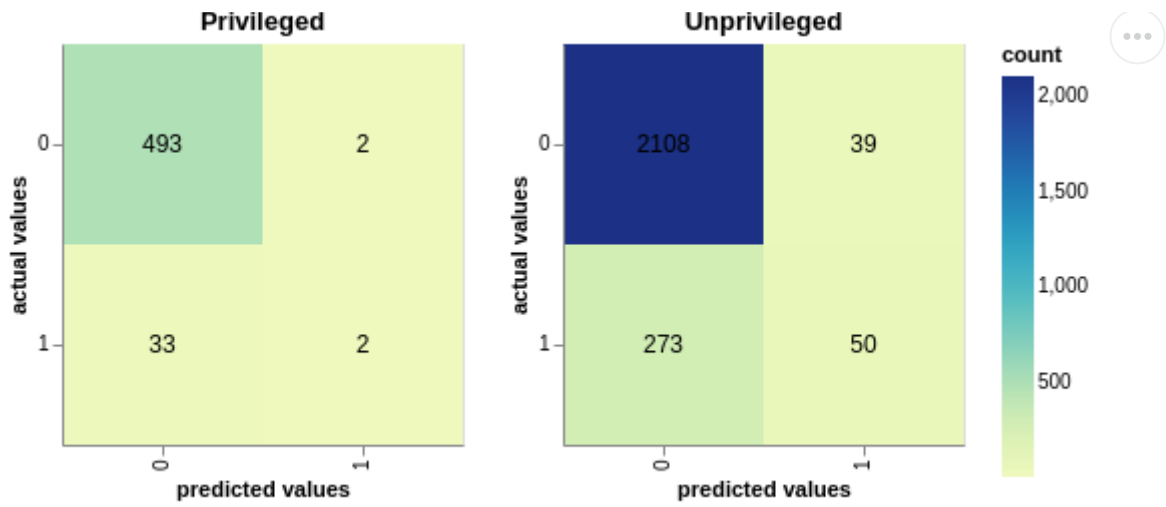|	Metric	Unprivileged	Privileged	Ratio	Fair?
0	Equal opportunity	0.845201	0.942857	0.896426	Yes
1	Predictive parity	0.561798	0.500000	1.123596	Yes

Performance Metrics

Confusion Matrices

All
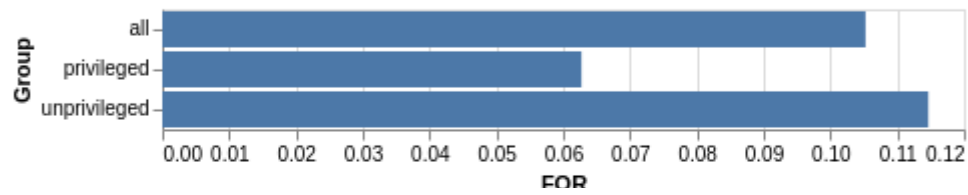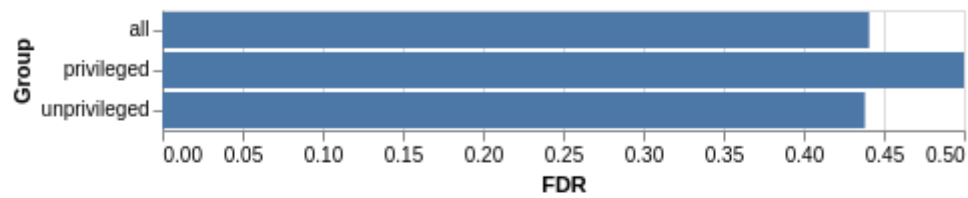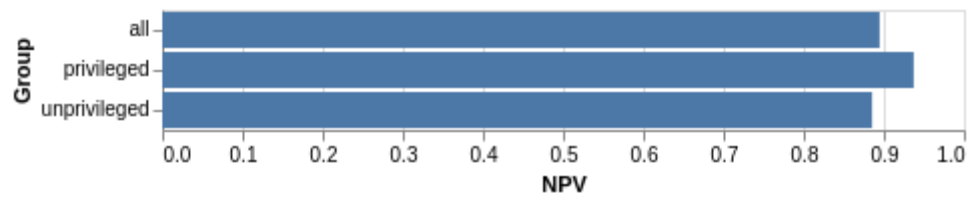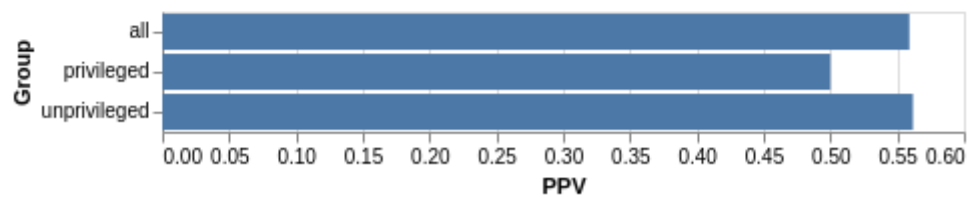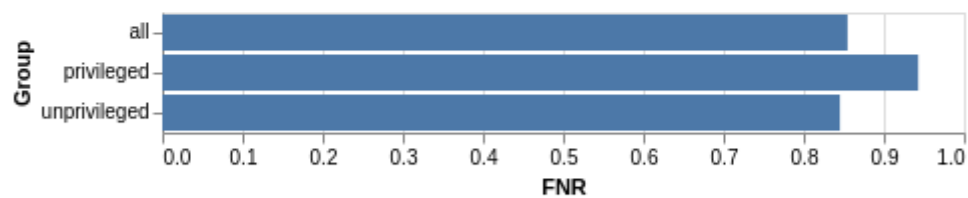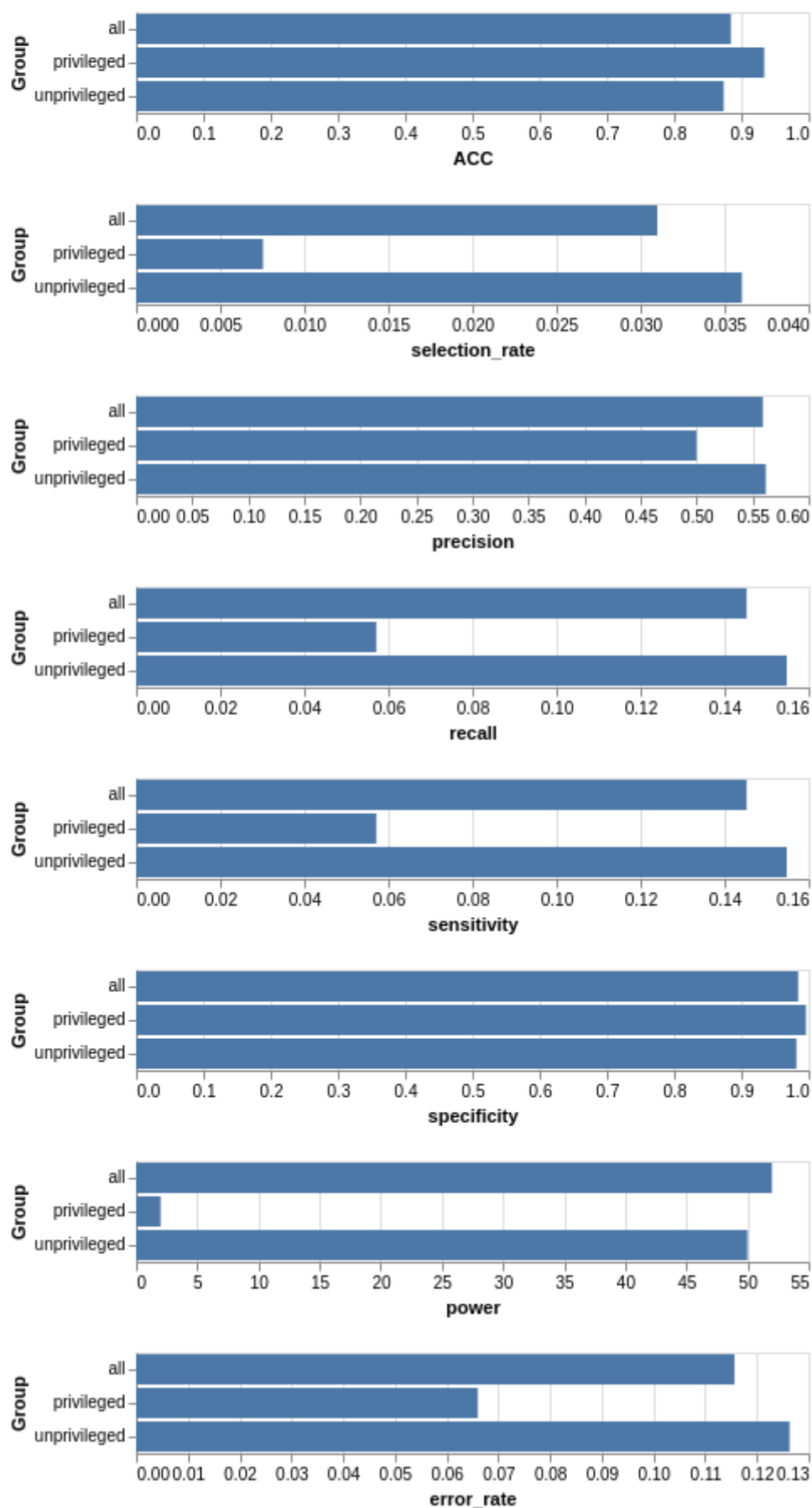
Notes

Equal opportunity:

$$\frac{\text{FNR}(D = \text{unprivileged})}{\text{FNR}(D = \text{privileged})}$$

Predictive parity:

$$\frac{\text{PPV}(D = \text{unprivileged})}{\text{PPV}(D = \text{privileged})}$$