CS 211 Final Project

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For this dataset, the algorithm is called COMPAS, which is Correctional Offender Management Profiling for Alternative Sanctions. This is a popular commercial algorithm used by judges and parole officers to rate the likelihood of recidivism for criminal defendants.

Dataset: https://github.com/HaoyuanP/CS211-Final-Project/blob/main/cox-violent-parsed.csv

For this project, we follow the analysis ideas :

Analysis ideas

- **For a workload of queries on several columns, compare the Laplace and Gaussian mechanisms**

We catch up three columns separately, which is age, start, and decile_score , then separately using workload_mech_vec and workload_gaussian_vec to get six results separately.

For age and start, we want to know the workload of 100 random elements, so in range_query we generate 100 random range queries over age and start in the dataset. Then use the workload_mech_vec and workload_gaussian_vec, and compare the difference between these two methods.

For decile_score columns, the decile_score have the range from 1 to 10, we chose 1-4 as the range for the lower bound range to generate 100 different queries for testing the workload of queries on this column.

In conclusion, comparing these data, we got that gaussian is more accuracy than laplace mechanism, the reason is gaussian allows us to use L2 sensitivity.

- **Analyze clipping parameters for some of the columns (e.g. for summation)**

We compared the age with laplace mechanism and clipped_age with laplace mechanism, clip(lower=10, upper=90). We choose the age from 10-90. We thought that it won't be many people at this age who will reoffend. The percentage error of clipped_age and original data are

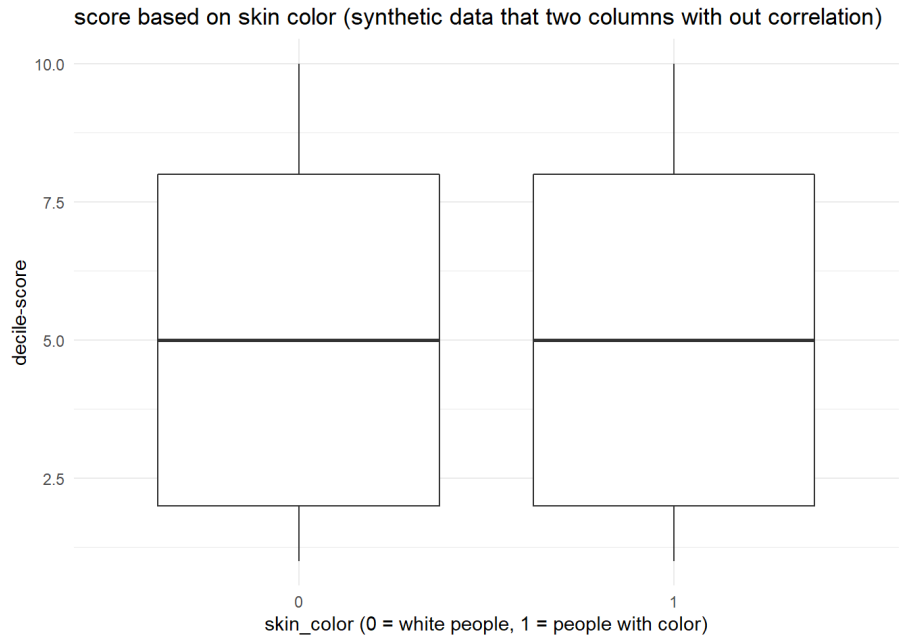
low at teenage age 20+. However, the percentage errors are much higher in their 70s, 80s and 90s compared to other data.

- **Synthetic Data (connection between race and score) (use R to check to relationship between those two columns)**

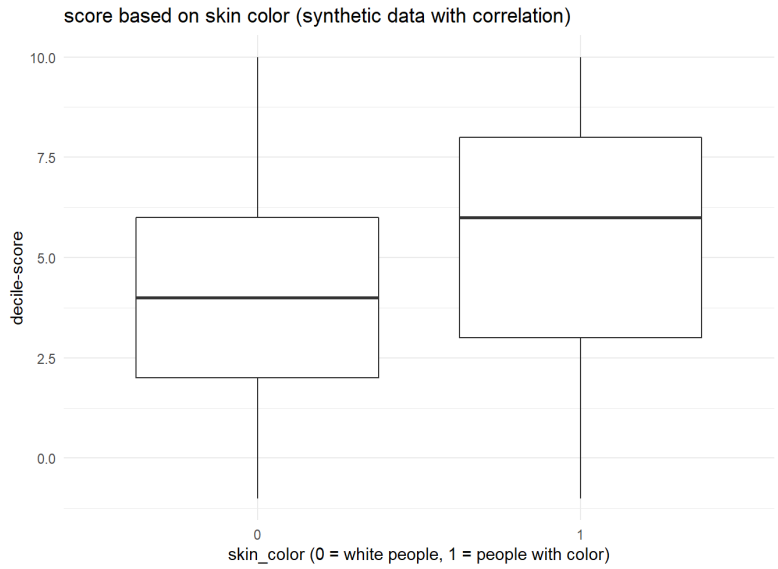
In this part, we used decile score and race columns in the dataset. And we use two different ways to generate synthetic data. One way is from homework10, by using `gen_data_one_column` to generate each data for the columns and using two private one-way marginals to generate the synthetic data, another way is using a two-way marginal for generating two-column synthetic data.

After generating those two new dataframe, we store them as csv files, and use R to check the connection between race and score. We clean and reset the csv file, and separate all races into two groups, one is white people, another is people with color.

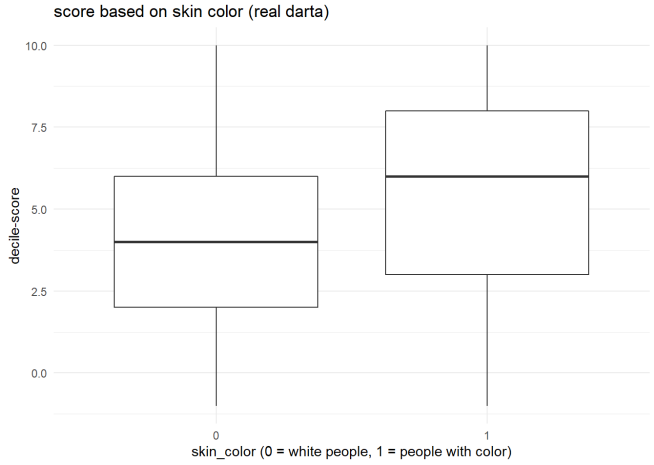
The result that using two private one-way marginals does not show any correlation between those two columns:



and the way that using two-way marginal shows the relationship between race and score:



Here is the boxplot that show relationship between races and score based on the real data:



Compare between data that using two-way marginal shows the relationship and the real data, we can get almost the same result. And the data that using two-way marginal and adding noise by laplace mechanism works well, so we can conclude that results show that the COMPAS usually gives higher scores to people with color than the white people.