To: Libby Schaaf, Mayor of Oakland

From: Kristin Chang, Data Scientist at Department of Prisons

Subject: **Recidivism Algorithm for Statewide Prison to Employment Initiative**

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Dear Mayor Schaaf,

      I am writing to bring your attention to an exciting development from the Oakland Department of Prisons. Our team has conducted an analysis on the [California Statewide Prison to Employment Initiative](#) and recidivism trends of our city to create a more efficient and fiscally conservative method of resource allocation.

      The budget for this initiative proposes $36million over two years to fund 1,000 ex-offenders to undergo a local employment training program through our parole and probation departments. The cost is roughly $36,000 per ex-offender over two years to provide workforce skills, education, and enabling upward mobility for ex-offenders to smooth the transition back into society and ultimately prevent repeat offenses from occurring. Participation in this program is extremely beneficial to Oakland as it increases the labor market utilizing State dollars to enhance our communities. Further, and most importantly, the city benefits by decreasing the number of repeat offenders making our communities stronger, safer, and decreasing local prison spending.

      Oakland is currently offering the job training program to all ex-offenders on a first-come, first-serve basis. While the program has succeeded in helping the enrollees re-enter the workforce, recidivism rates in Oakland have not decreased significantly. This is due to the inadequate evaluation of ex-offenders' likelihood to recidivate upon their release and improper targeting of the job training program. To lower recidivism rates, it is pertinent that individuals who are highly likely to recidivate enter the job training program. The social implications of not enrolling these individuals include spiraling costs in prison maintenance, social services, and fragmented social networks. Additionally, the program would be allocating resources to individuals who are less likely to recidivate. While this is not necessarily a waste of resources, it is an inefficient use of State funds and we would not be able to declare the program a success for lowering recidivism in our final grant report back to the State Department.

      Our team built a statistical model to predict an individual's likelihood to recidivate based on their sex, age, race, previous offenses, and length of stay in prison. The model was constructed using past data to determine that the abovementioned factors significantly affect an individual's likeliness to recidivate. We also used past data to observe if the model accurately predicts whether or not different individuals recidivated. The results of the model can be observed in the following outcomes:

- True Positive = model predicted recidivism, recidivism occurred
- False Positive = model predicted recidivism, recidivism did not occur
- True Negative = model predicted no recidivism, recidivism did not occur
- False Negative = model predicted no recidivism, recidivism did occur

Our goal is to enroll all individuals where the model predicts recidivism into the job training program. However, as previously discussed, it is costly when we predict recidivism, but it does not occur (False Positive) or when we predict no recidivism, but it does occur (False Negative). Thus, we would want to minimize False Positive and False Negative results. Considering the focus of the initiative is to decrease Oakland's recidivism rate, we would prioritize minimizing False Negatives that result in recidivism over False Positives that do not result in recidivism.

It is also important to note our team observed that when the results are broken down by racial groups, and the different outcome possibilities, the distribution of the results are uneven. This is shown in the bar plot below:
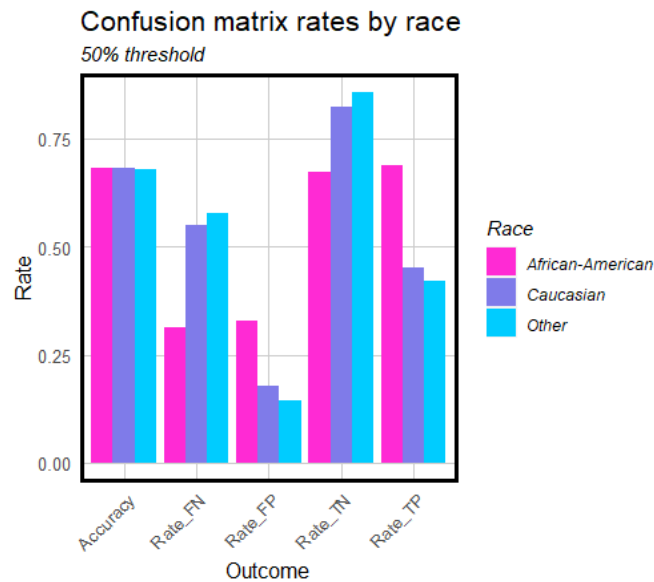

These results are based on the model's classification method that if an individual's probability of recidivism is greater than 50%, this individual is predicted to recidivate. The outcomes of this 50% threshold indicate that African-American individuals are more likely to recidivate at significantly disproportionate rates compared to other groups. These results would require approximately $20million to be allocated to the job training program over 2 years as shown in the chart below:

50% Threshold identified

Threshold	Race	Variable	Count	Cost
0.5	African-American	Count_TN	257	0
0.5	Caucasian	Count_TN	260	0
0.5	African-American	Count_TP	287	10332000
0.5	Caucasian	Count_TP	86	3096000
0.5	African-American	Count_FN	130	0
0.5	Caucasian	Count_FN	105	0
0.5	African-American	Count_FP	125	4500000
0.5	Caucasian	Count_FP	56	2016000

What is exciting about the statistical method our team has used for this model, is the ability to adjust these thresholds across racial groups in order to ensure algorithmic fairness. In other words, we can consider the context of historical over-policing of the African-American community in Oakland and adjust the classification such that recidivism is predicted fairly across racial groups. The results of this adjustment are shown below:

Confusion matrix rates by race
Thresholds: AA 60%, C 50%, O 50%
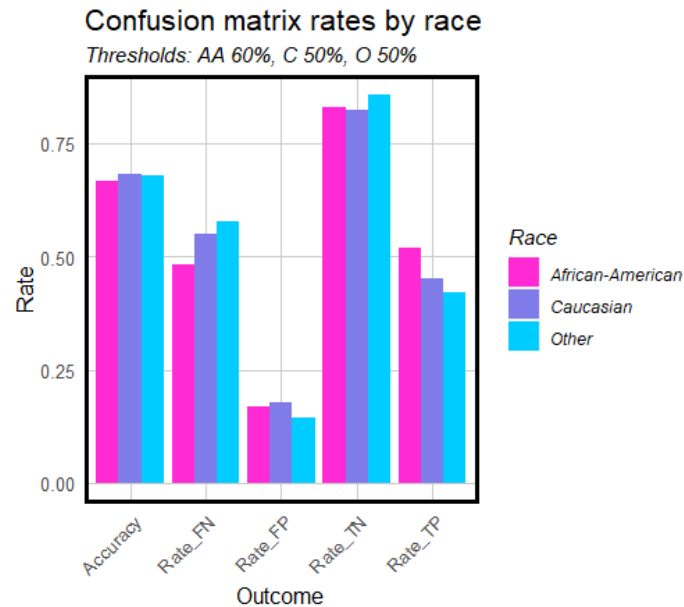
These results show a more even distribution, which works towards ensuring a fair process on the city's behalf. Additionally, this outcome would be cheaper, costing approximately $17million as shown below:

Optimal Threshold identified

Threshold	Race	Variable	Count	Cost
0.5	Caucasian	Count_TN	260	0
0.6	African-American	Count_TN	317	0
0.5	Other	Count_TN	119	0
0.5	Caucasian	Count_TP	86	3096000
0.6	African-American	Count_TP	216	7776000
0.5	Other	Count_TP	40	1440000
0.5	Caucasian	Count_FN	105	0
0.6	African-American	Count_FN	201	0
0.5	Other	Count_FN	55	0
0.5	Caucasian	Count_FP	56	2016000
0.6	African-American	Count_FP	65	2340000
0.5	Other	Count_FP	20	720000

We hope you consider our work in the context of Oakland's complex history of policing and resource allocation to different racial groups. Our team strongly urges the implementation of this algorithm because it will guide the city to more effectively utilize State funds for the Prison to Employment Initiative in a fair and fiscally conservative manner.