Model Card: Recidivism Forecasting

Model details

- Developed by Ashna Ramaswamy at Boston College in 2023.
- Random Forest Classifier.
- Trained using recidivism data to output the probability of recidivism, a value between 0 and 1, based on inmate data related to demographics, security, and behaviors.

Intended use

- Intended to be used in the justice system to support decision-makers in predicting the likelihood of recidivism for current inmates.
- Intended to improve the fair administration of justice.
- Not intended to replace human judgement.
- Not intended to discriminate against minority groups or reinforce systemic inequalities in the justice system.

Features

This model is trained based on a diverse range of demographics, including but not limited to:

- Race
- Gender
- Age at release
- Supervision risk score and level
- Education*

During training, the model compares the correlations of the inmate's demographics to whether or not they are a repeat offender before outputting the probability of recidivism. It then measures the accuracy against whether or not the inmate repeated their crime. For example, here are the predicted outcomes of 50 inmates, as well as the accuracy score:

```
sample = train.iloc[:50,]
sample
```

	ID	Gender	Race	Age_at_Release	Residence_PUMA	Gang_Affiliated	Supervision_Risk_Score_First	Supervision_Level_First	Education_Level	Dependents	...
0	1	M	BLACK	5	16	0	3	2	0	3	...
1	2	M	BLACK	3	16	0	6	1	2	1	...
2	6	M	WHITE	4	17	0	5	2	1	0	...
3	8	M	BLACK	4	16	0	5	0	1	3	...
4	11	M	WHITE	5	5	0	3	1	2	1	...
5	15	M	WHITE	3	5	0	7	2	2	1	...
6	22	M	BLACK	3	16	0	5	2	2	3	...
7	23	F	WHITE	6	5	2	4	3	1	0	...
8	27	M	WHITE	6	14	0	2	1	2	0	...
9	36	M	BLACK	6	10	0	2	2	2	0	...
10	37	M	WHITE	5	14	0	3	3	1	2	...
11	38	M	BLACK	3	3	1	6	0	2	0	...
12	46	M	BLACK	4	24	0	4	1	2	3	...

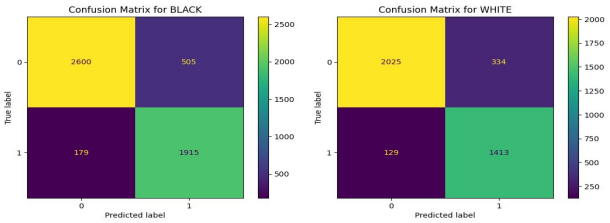
```
[258] sample_test_predict = newrfmodel.predict(sample[predictive_features])
      sample_probabilities = rfmodel.predict_proba(sample[predictive_features])
      print(sample_probabilities[:, 1])
      sklearn.metrics.accuracy_score(sample['Recidivism_Arrest'],sample_test_predict)

      [0.172 0.844 0.088 0.204 0.828 0.162 0.36  0.154 0.282 0.424 0.164 0.862
       0.294 0.03  0.622 0.438 0.166 0.156 0.484 0.212 0.562 0.196 0.258 0.534
       0.19  0.222 0.784 0.858 0.796 0.378 0.714 0.662 0.232 0.364 0.082 0.842
       0.868 0.12  0.484 0.602 0.134 0.8   0.514 0.794 0.402 0.166 0.728 0.746
       0.488 0.54 ]
      0.76
```

This same operation is performed on a test dataset, resulting in an array of predictive probabilities of recidivism.

The AUC of this dataset is 0.70172.

*The complete list of features is listed on the second page.

Evaluation



Example of the confusion matrices for black and white inmates.

		FPR	FNR	FDR
Demographic	Black	26.37%	6.88%	20.87%
	White	23.64%	6.37%	19.12%
	Female	31.18%	4.21%	23.77%
	Male	24.50%	7.10%	19.68%
	18-22 years	22.35%	10.96%	18.27%
	28-32 years	23.27%	6.56%	21.48%
	33-37 years	26.44%	5.87%	20.91%
	38-42 years	25.07%	6.67%	18.06%
	43-47 years	22.04%	6.60%	18.06%
	48+ years	28.01%	7.56%	21.88%

Ethical considerations

Recidivism forecasting can be a useful tool in the justice system, which can prevent or predict future repeat offenses and inform security-related concerns for any individual. However, there are numerous underlying issues associated with predictive modeling using criminal justice data. Namely, there may be bias against minority groups in the training data set, resulting in a skewed algorithm that provides discriminatory outcomes. Moreover, the "risk environment" of individuals may be different relative to the environment at the time of re-arrest.[1] Additionally, the model is an oversimplification of the complex nature of recidivism, and cannot adequately summarize human agency and individual circumstances.

[1]"Measuring Recidivism." National Institute of Justice, 20 Feb. 2008, nij.ojp.gov/topics/articles/measuring-recidivism#:~:text=One%20of%20the%20many%20difficulties. Accessed 11 May 2023.

Complete list of features and their descriptions:

Categorical:

- Age at Release
- Gang Affiliated
- Supervision Risk Score First
- Supervision Level First
- Education Level
- Dependents
- Prison Offense
- Prison Years
- Prior Arrest Episodes: Felony
- Prior Arrest Episodes: Misdemeanors
- Prior Arrest Episodes: Violent
- Prior Arrest Episodes: Property
- Prior Arrest Episodes: Drug
- Prior Arrest Episodes: PP Violation Charges
- Prior Arrest Episodes: Domestic Violence Charges
- Prior Arret Episodes: Gun Charges
- Prior Conviction Episodes: Felony
- Prior Conviction Episodes: Misdemeanors
- Prior Conviction Episodes: Violent
- Prior Conviction Episodes: Property
- Prior Conviction Episodes: Drug
- Prior Conviction Episodes: PP Violation Charges
- Prior Conviction Episodes: Domestic Violence Charges
- Prior Conviction Episodes: Gun Charges
- Prior Revocations: Probation
- Prior Revocations: Parole
- Condition MH: Substance Abuse
- Condition: Cognitive Ed
- Condition: Other
- Violations: Electronic Monitoring
- Violations: Instruction
- Violations: Fail to Report
- Violations: Move Without Permission
- Delinquency Reports
- Program Attendances
- Program Unexcused Absences

Numerical:

- Average Days per Drug Test
- Drug Tests THC Positive
- Drug Tests Cocaine Positive
- Drug Tests Meth Positive
- Drug Tests Other Positive
- Percent Days Employed