

Predicting Criminal Sentencing

Machine learning the justice system

CS 4780 Fall '11
Final Project

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Motivation

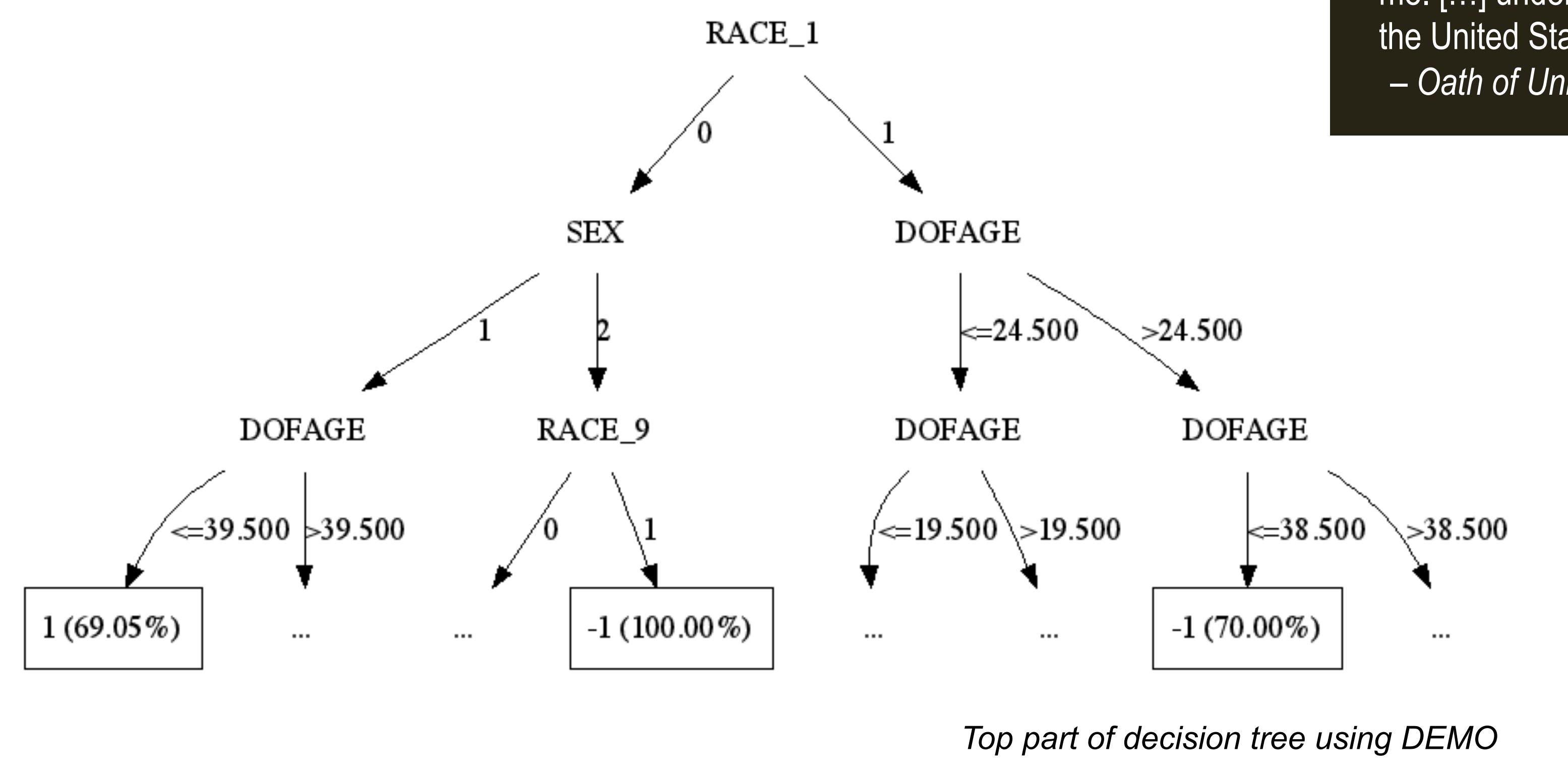
Human judges use a combination of objective knowledge of law and some subjective judgment to determine a criminal's sentence. We use machine learning techniques learned in class to create a predictor for criminal sentences using the Pennsylvania sentencing data from 1998. From these predictors, we determine the most critical factors involved in criminal sentencing.

Questions

Can we create a machine that can, with reasonable accuracy, match the decisions of the human judges and reveal the true factors that influence sentences? Are sentences determined solely and fairly according to just the crime, as the judges swore under oath, or are other variables, such as demographics, interfering with the decisions? If the judges are making purely objective decisions, is it possible to reverse-engineer parts of the law by looking at the sentences that criminals received?

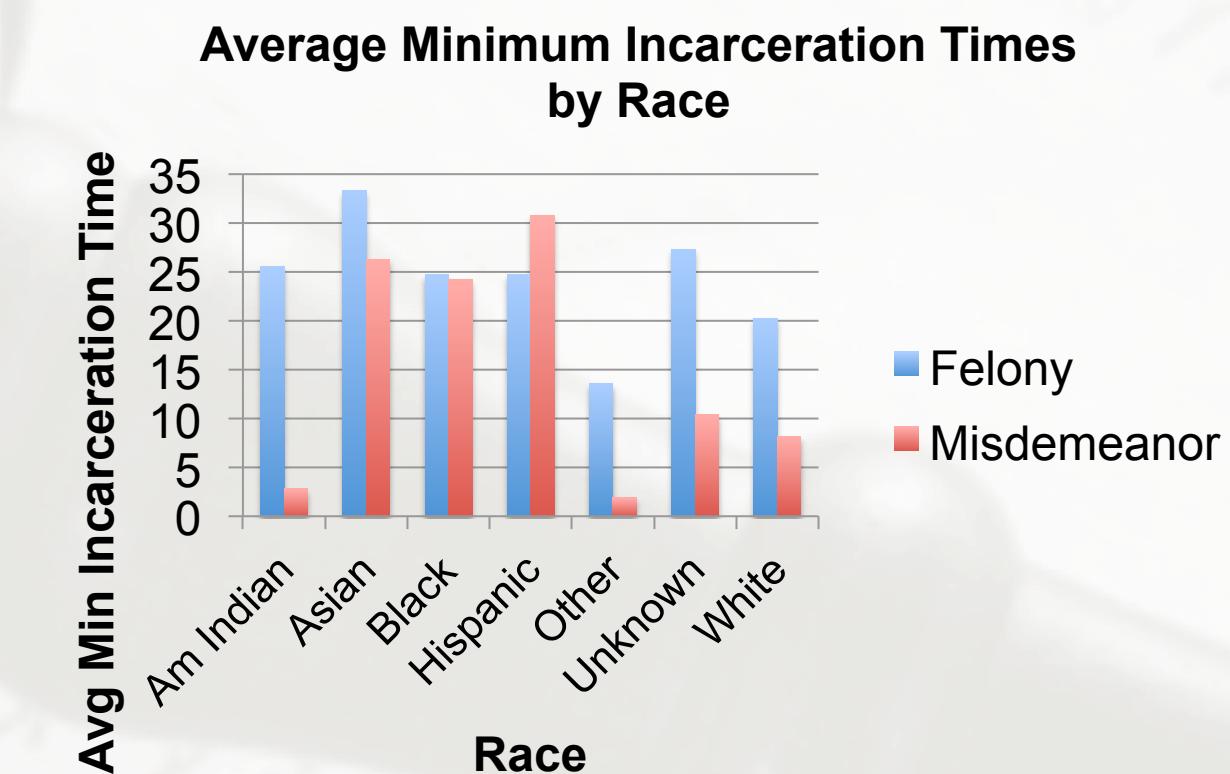
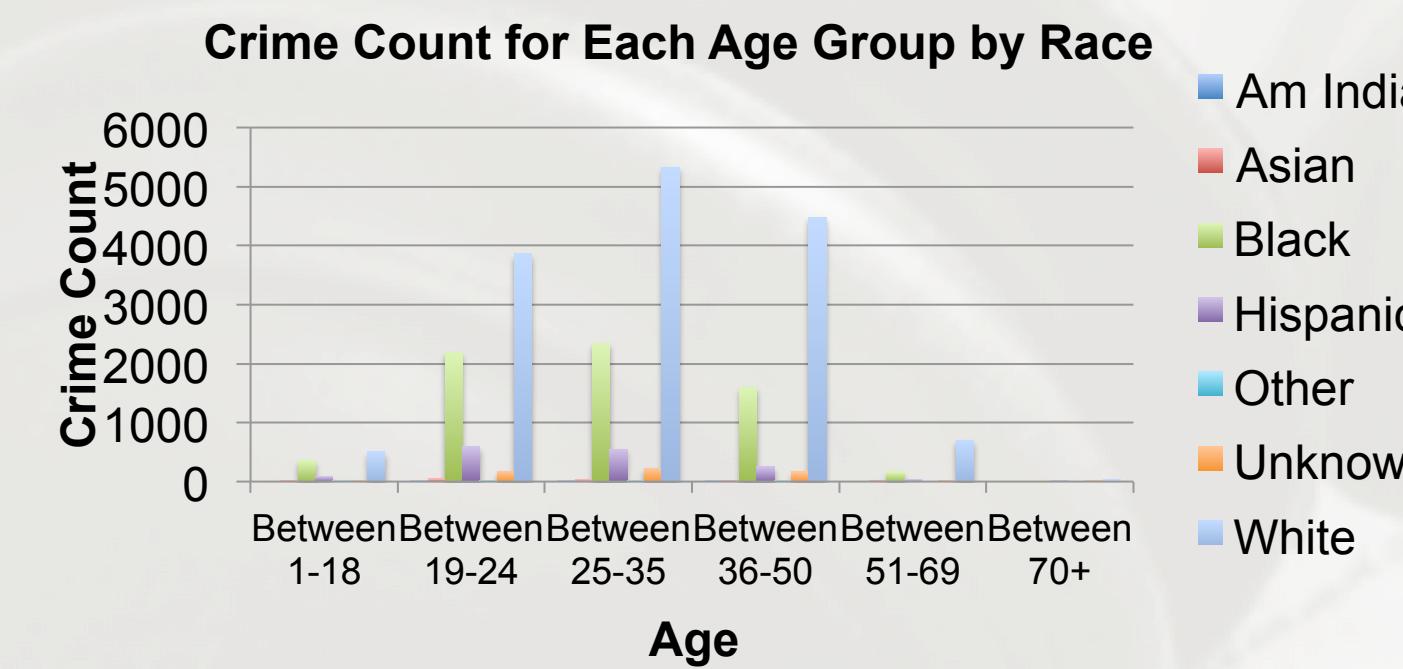
Methods

- Bayes, Decision tree (C4.5), Linear SVM, kNN
- Label being predicted: INCMIN (minimum incarceration time)
- Variable sets used:
 - **DEMO**[graphics]: SEX, DOFAGE (age on date of offense), RACE
 - **CRIME**: FINE, GRADE (), COMPLETE (), DOS_UNO (date of sentence), COUNTY (), PCSOFF (), PCSSUB (), DOF_UNO (date of offense), DISP (disposition)
 - **BASE**: DEMO + CRIME

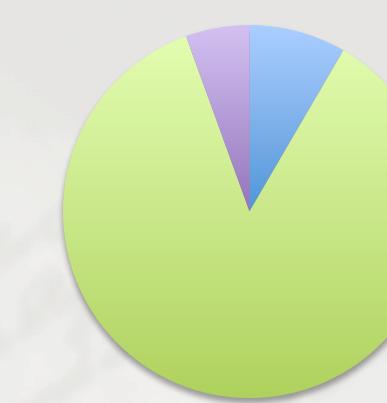


"I [...] solemnly swear that I will administer justice without respect to persons, and do equal right to the poor and to the rich, and that I will faithfully and impartially discharge and perform all the duties incumbent upon me. [...] under the Constitution and laws of the United States. So help me God."
– Oath of United States Justices and Judges

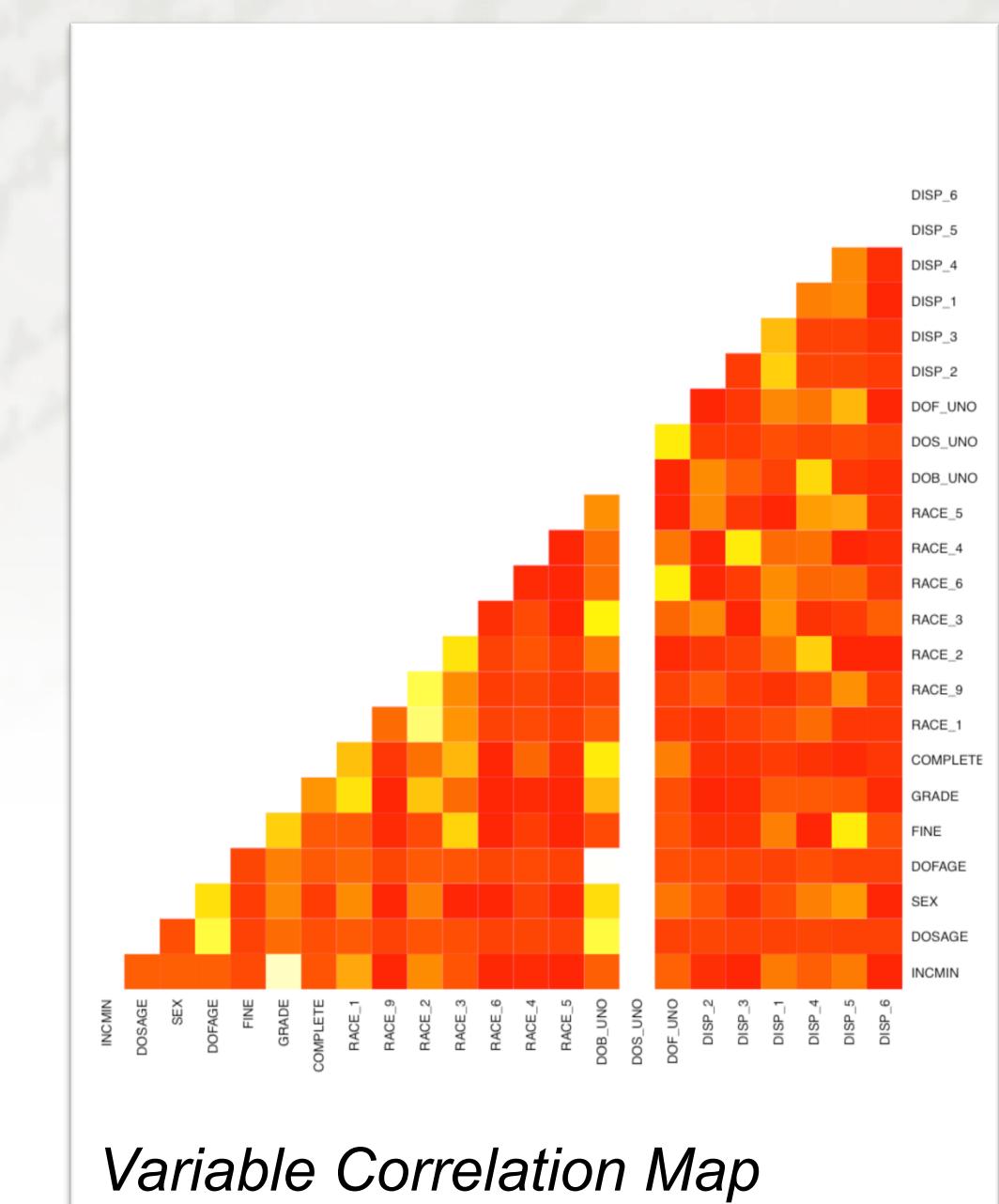
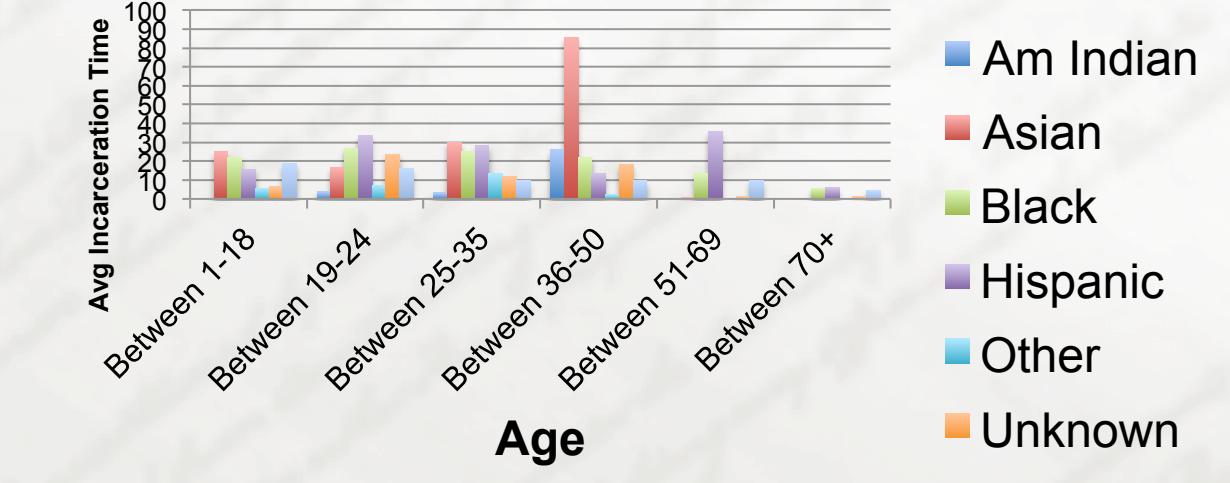
Statistics



Population Normalized Total Minimum Incarceration Times (Misdemeanor + Felony)



Avg Min Incarceration Time for Each Age Group by Race



TODO: some sort of conclusion after getting more data.

Findings

Variable Set	Method	Accuracy
DEMO	Bayes	0.629
	C4.5	0.659
	Linear SVM	0.637
	kNN	0.643
CRIME	Bayes	
	C4.5	
	Linear SVM	
	kNN	
RACE	Bayes	
	C4.5	
	Linear SVM	
	kNN	

Conclusion & Remaining Work

"[method], using variables x, x, x, can predict the criminal's sentence with xx accuracy."

We will repeat our experiments using varying subsets of variables, and include more variables describing aspects of the criminal, offense, and trial that we have not incorporated yet.

References

Pennsylvania Commission on Sentencing. PENNSYLVANIA SENTENCING DATA, 1998. ICPSR version. State College, PA:Pennsylvania Commission on Sentencing, 2000. Ann Arbor, MI: Interuniversity Consortium for Political and Social Research, 2002.

