NODA: Can Gradient Boosted Trees Predict Rearrests More Accurately than Humans?

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Background: Prosecutorial Decisions in the New Orleans District Attorney's Office (NODA)

NBER researchers used court data to create a model that was better than judges at predicting who would show up for a court date. We investigate how machine learning fares at an earlier decision in the process: whether to press or drop charges.

Our framework:

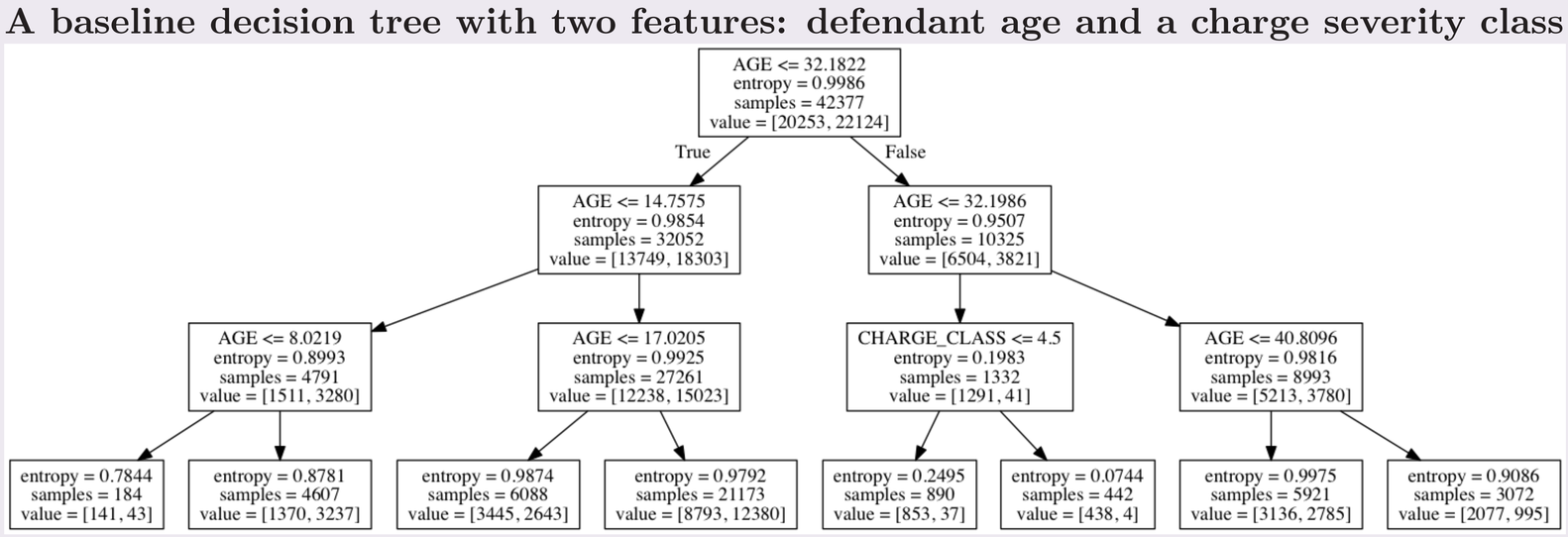
· **Train a model to predict a rearrest risk score for any defendant.**

· **Stratify screening attorneys into groups of increasing strictness.**

· **Assess performance vis-a-vis attorneys by predicting risk on marginal cases between strictness groups.**

Baseline Prediction of Rearrest

A baseline decision tree with two features: defendant age and a charge severity class



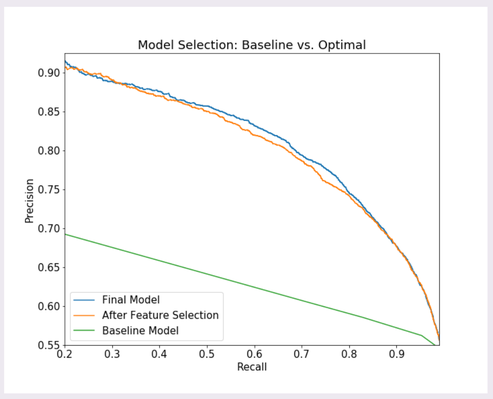
The baseline model F-score was 0.65.

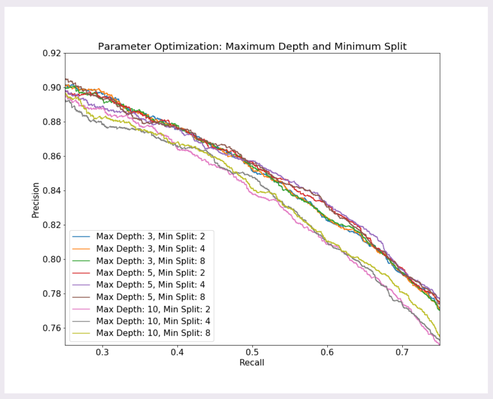
Gradient Boosted Trees: Feature Selection and Optimization

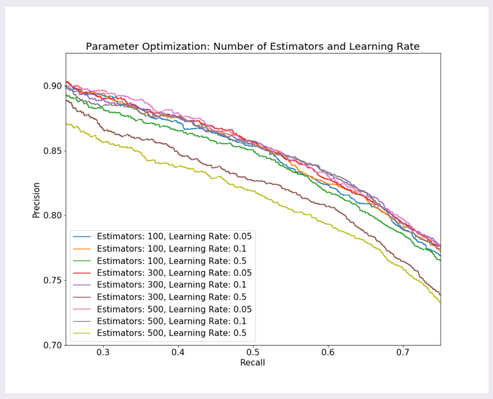
From our baseline decision tree model, we optimized gradient boosted trees over:

· **5 target variables: predicted rearrest from 1 to 5 years in the future**

· **20 different features, 81 combinations of model parameters**





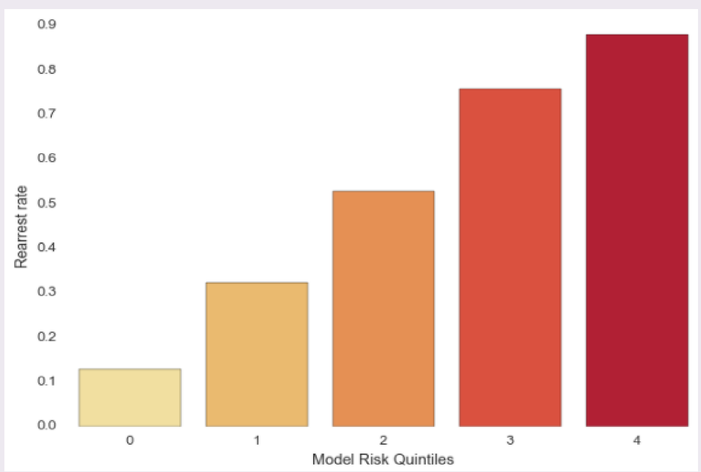


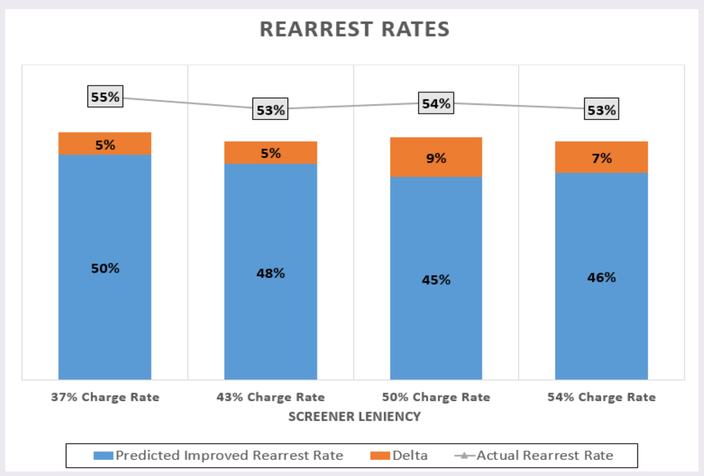
	Predicted No Rearrest	Predicted Rearrest
No Rearrest	3909	1387
Rearrest	1260	4438

The final model increased F-Score to 0.77.

Measuring the Model's Impact on Prosecutorial Decisions

The model assigns a predicted risk score to everyone in the arrest registry who was not charged. The chart on the left shows how well the model sorts these arrestees. The model's quintiles are ranked in order of increasing predicted risk and the y-axis shows the share that were rearrested.





We stratified prosecutors by strictness and applied the model's predictions to the marginal cases between lenient and strict groups of prosecutors. Strictness was quantified by a prosecutor's charge rate. The chart on the right shows the difference in rearrest rates when using the model to determine who to charge based on predicted risk.

NODA Data

Official data from 1988 to 1999,

· **280,000 cases**

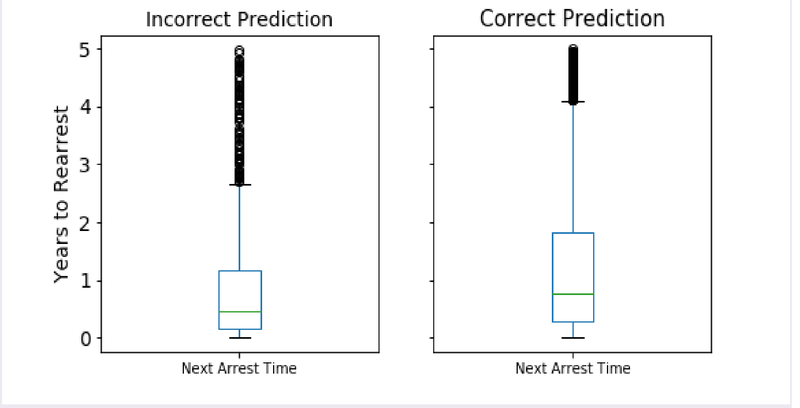
· **145,000 defendants**

· **430,000 charges**

with extensive details at every decision node from arrest to the case closing.

Error Analysis

Correct vs. incorrect predictions:
-There was no evidence of data leakage or the use of information not available on the date of arrest.
-Most incorrectly predicted rearrested instances were rearrested within less than a year.



Conclusion

When the model chose which defendants should be charged based on predicted risk, it lead to better outcomes in terms of rearrest rates when compared to the strict group of prosecutors. The potential policy implication is that a lower rearrest rate can be achieved while maintaining the same charge rate.

Next Steps

1. Examine the converse: Is it possible to arrive at the same rearrest rate at a lower charge rate? This would alleviate some of the burden on the New Orleans court system and public defenders.

2. Examine the counterfactual: Use matching methods to predict the risk of arrestees who were charged.