APCOMP 221: Critical Thinking in Data Science - Final Project Proposal

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Background

In recent years, in pursuit of efficiency and economy, professionals in a wide range of fields, including finance, health-care, and even policing, have adopted machine learning tools to revolutionize their respective industries. Combined with an increasingly large amount of data and cheap data storage, researchers and industry practitioners alike started to dig in the data they have collected to find patterns or insights that might be of potential use. However, if not properly inspected, designers of machine learning models might overlook biases inherent within the dataset and models built using this biased dataset might pose serious threats and create wider ramifications. Predictive policing is a good example.

As police departments across the U.S. have started to adopt predictive policing systems such as PredPol, both the systems' reliability and the potential bias they exhibit towards minority neighborhoods are put into question. A large part of the reason is that the data used to train the predictive models might be biased.

Data that predictive policing models are trained on might be biased for multiple reasons:

- Human bias towards race and social-economic status in historical records
- Differences in levels of community trust in police and the desired amount of local policing, which may lead to under or over crime reporting rates

Even with the most accurate machine learning model, predictions made based on such a biased data set will reproduce the patterns and unknown biases in police data. Because the data is collected as a by-product of police activity, predictions made based on patterns learned from this data do not pertain to future instances of crime on the whole. Therefore, the algorithm is trained to predictive future *policing* based on biased historical records, rather than what it is built to do in the first place - predicting future *crimes*.

To make matter even worse, if the police department indeed decides to adopt the algorithm trained on biased data, as future crime reports come in, pre-existing patterns will only be exacerbated as police patrol areas with a high number of reported crimes more while neglecting areas where patrol activity was less historically. Such a feedback loop can potentially bias the system even more as it resembles a self-fulfilling prophecy, or if police departments using this model decides to refine the model using more recent data.

Proposed Project

For our final project, we will try to build very simple predictive policing models and showcase how easy it can be achieved with reasonable precision and accuracy. We will use the *Police Department Incident Reports: 2018 to Present* dataset obtained from the open data initiative by the City of San Francisco. The dataset contains 333,016 police reports and offers granular information such as incident date, time, category, police district, latitudes, and longitudes.

Using this dataset, we will train a range of machine learning models to predict the number of crimes at each police district and validate the results for an out-of-sample period. We will demonstrate how easy it is to build a weapon of “math” destruction that might aggravate existing biases.

If time permits, we will also perform a simulation study to show that, if bias (such as racial bias) exists within historical data, as new data comes in, the refined model will worsen the existing bias.

Sources

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