

JNTN: Crime Prediction in SF

John Iselin, Takuma Kinoshita, Naoyuki Komada, Ted Kumagai,¹

¹ *University of California Berkeley*



Introduction: Using Metropolitan-Geographical Data for Predictions

Relevant Example:

Police across the US are training crime-predicting AIs on falsified data

A new report shows how supposedly objective systems can perpetuate corrupt policing practices.

by Karen Hao February 13, 2019

“Predictive policing algorithms are becoming common practice in cities across the US. Though lack of transparency makes exact statistics hard to pin down, PredPol, a leading vendor, [boasts](#) that it helps “protect” 1 in 33 Americans. The software is often touted as a way to help thinly stretched police departments make more efficient, data-driven decisions.”

-[Karen Hao](#)

“Maybe we can solve poverty and unemployment and housing issues using government data in a more beneficial way.”

-Rashida Richardson, the director of policy research at AI Now

Datasets

SF police data (2015/1/1 ~ 2019/3/31)

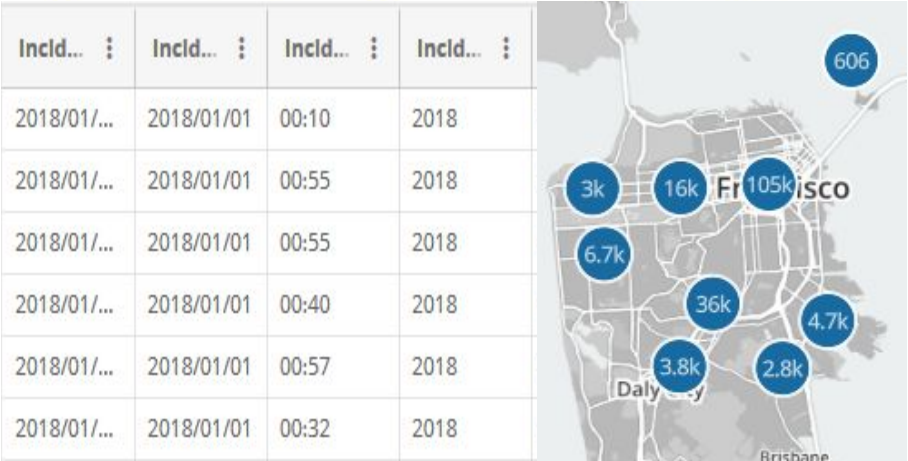
latitude	longitude	incident_type
37.784908299430455	-122.40479506275997	b'other'
37.78640961281089	-122.40803623744476	b'other'
37.75683373380551	-122.40669900268833	b'violent'
37.784006612420036	-122.40486479517743	b'property'
37.80019018537176	-122.44117737724194	b'other'

SF Police Data: Allowed to identify and parse crimes based on incident_type values (Violence, Property, and Other)



National Centers for Environmental Information: Weather Dataset also used to see if crime activity corresponds to weather.

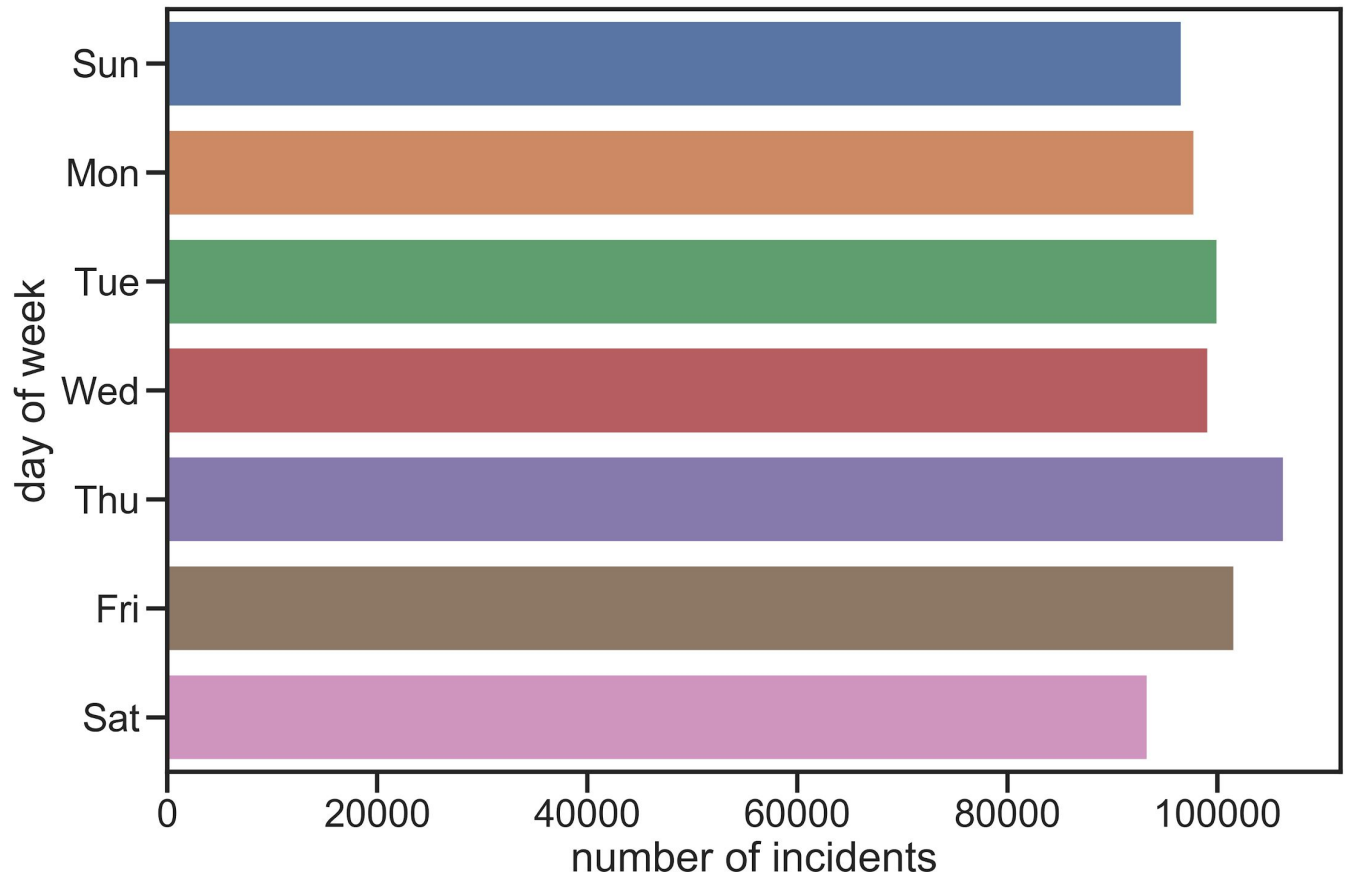
Map of Police Department Incident Reports



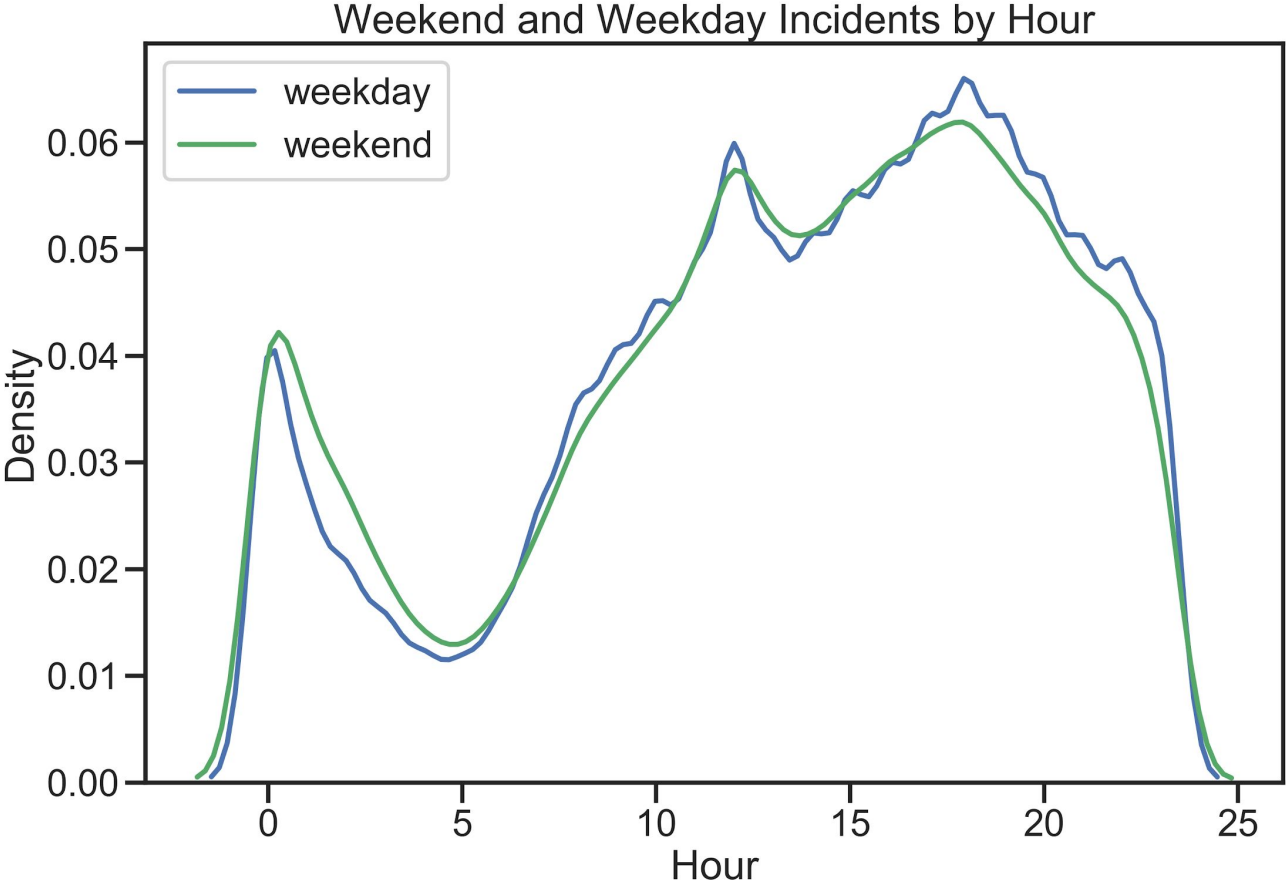
We can use these data to predict next day's location and types of police incidents.

<https://datasf.org/opendata/>

Exploratory Data Analysis - Day of Week



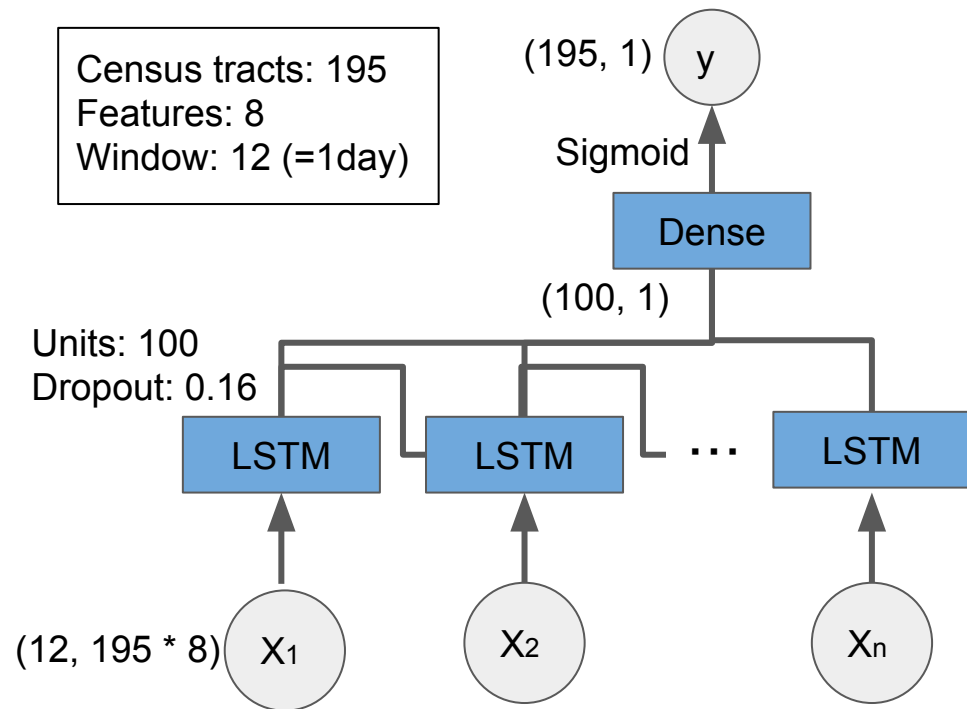
Exploratory Data Analysis - Hour



Method

- Predict a crime within **2 hours ahead** as **binary** in all of **census tract in SF**
- Feature engineering: **Day of week, Hour, Precipitation** etc
- Model: Single-layer **LSTM**

Network structure of LSTM



Model Tuning: Bayesian Optimization

- Tuned Params:
 - dropout: 0.159961594635
 - lr: 1.77547438185e-05
- Tuning Process:
 - 100 trials, 200 epochs each
 - Number of pruned trials: 90
 - Number of complete trials: 10



Results

- **Binary cross-entropy improves** from baseline by **-2,897**
- Could **dispatch police** to locations with **higher crime probability**
- Could model how algorithm might **target** specific communities
- For real-world: **Higher accuracy, Multi-class classification, # of crimes output**

Test score of baseline and LSTM
based on time-series cross-validation

	Baseline*	LSTM	Difference
Accuracy	0.9082	0.9083	0.0001
Binary cross-entropy	3.170	0.273	- 2.897

* return 0 (no crim) for all of the predictions

Example of predicted probability of each tract
(2019/3/31 10p.m.~0.a.m.)

