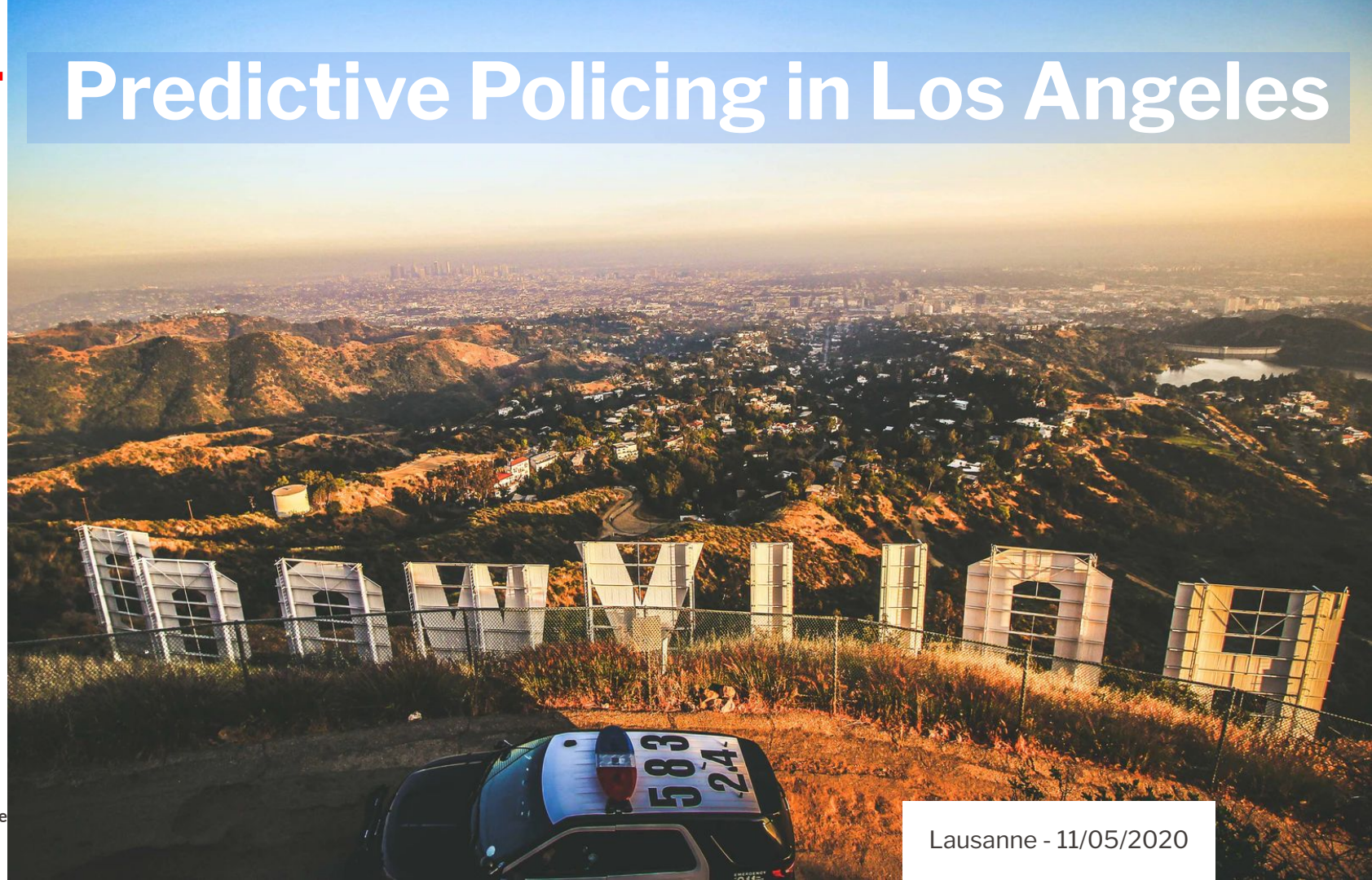
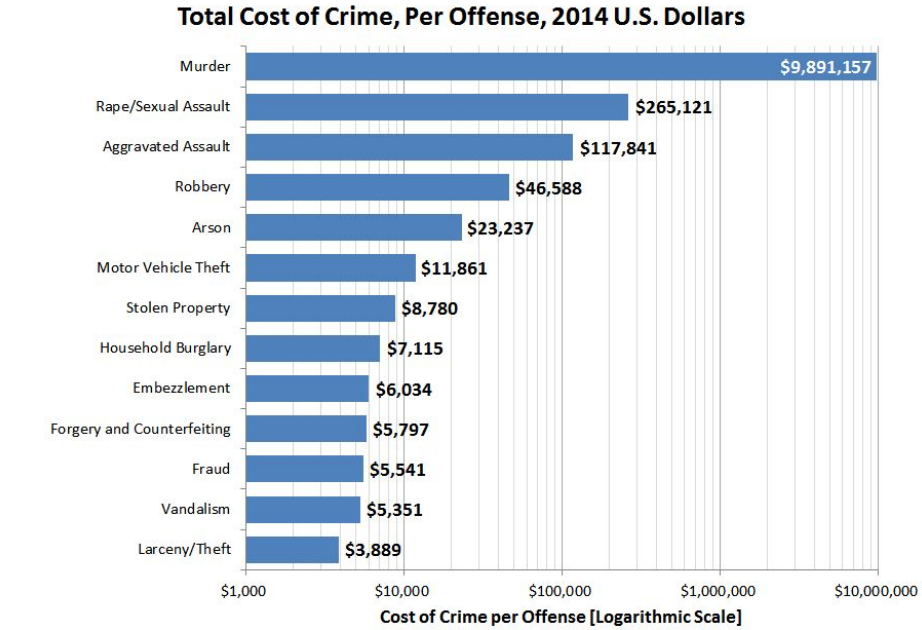
Predictive Policing in Los Angeles



Tristan Trébaol
Léopold Bouraux
Alfonso Villegas
Gaspard Debains
Jean-Baptiste de la Fage
Gabriel Méhaignerie

Lausanne - 11/05/2020



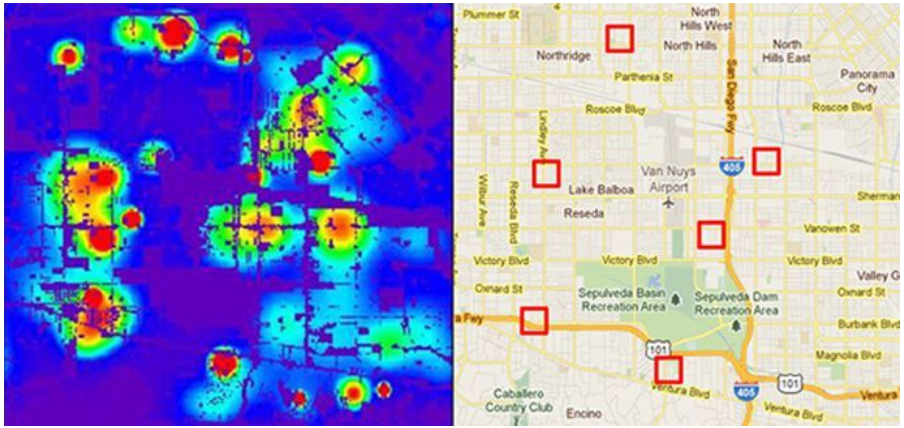
- Burglary – 1.9 hours
- Auto theft – 1.8 hours
- Assault – 2.6 hours
- Robbery – 2.3 hours

Average time to clear call for on duty officers for different crimes

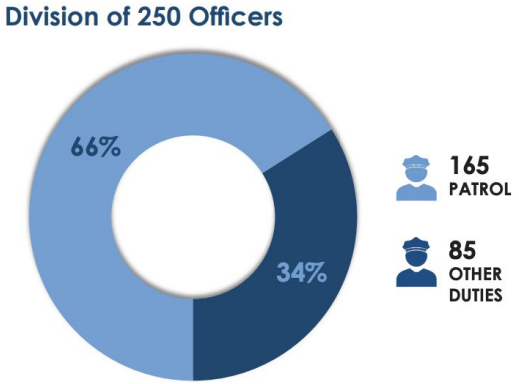
The Cost of Crime

- **It costs money** : 5% of the US GDP
- **It costs time** : average time to clear a call for a reported time for a patrol officer : ~2h

Our Predictive Policing for a patrolling



Crime Heat Map with predictive policing

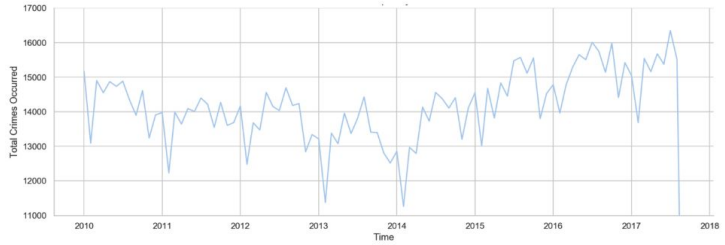


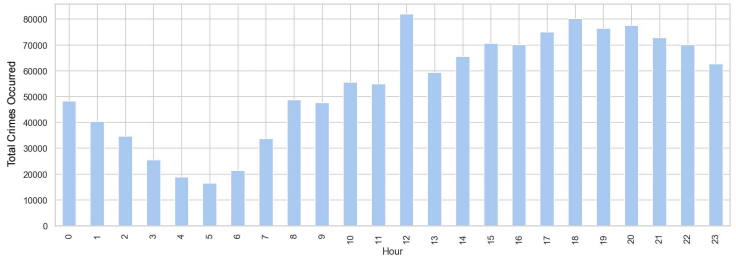
"Officers Allocated to Patrol vs Other Duties" (BJA, 2003)

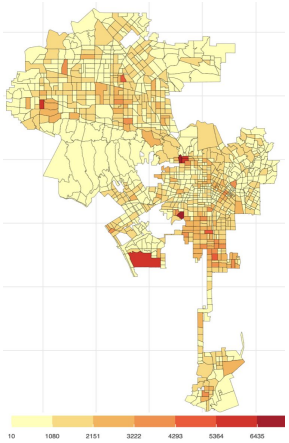
Reliable and Reactive

- Long term Goal
- Weekly schedule
- Shift-to-Shift reactivity

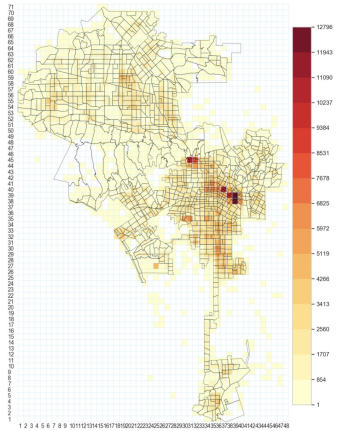
No ethical biases







Total Crimes Occurred by Districts



Total Crimes Occurred by Cell Grid

Data analysis

- From 2010 to September 2017
- 26 features to 9 features
- Date and Time Stats
- Different Types Of Crimes
- Most Affected Districts
- Advantage of Grid Mapping

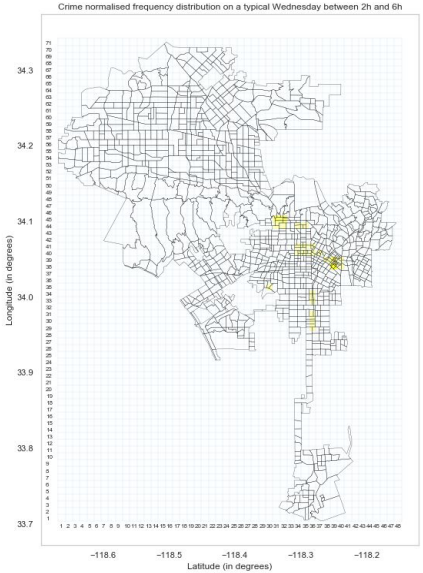
Prediction of a typical weekly schedule

- One map per shift of the week
- Frequency density distribution of the crime within each cell
- Regression performed using eight years of crime records

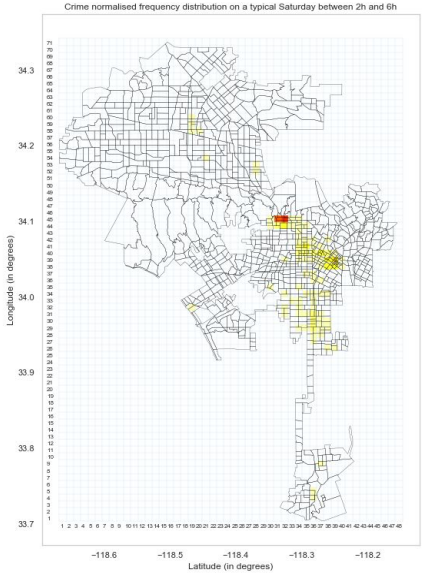
- Base model for each shift of each day
- Static maps which could be retrained each month with newest data

- Could give more importance to recent data
- Each crime is important: here one addresses only the majority of them

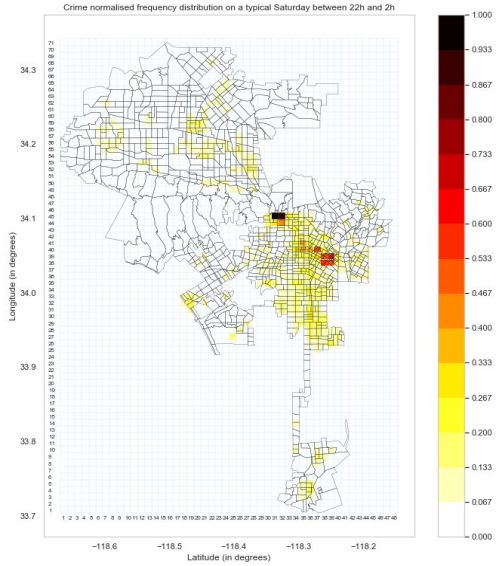
Wednesday 2h-6h



Sunday 2h-6h



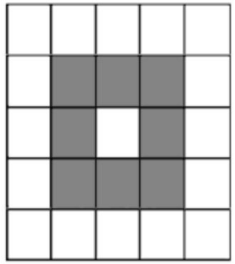
Sunday 18h-22h



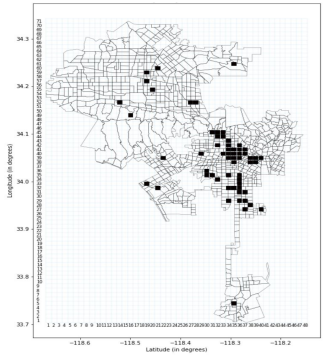
Monthly target Model

		Crime type 1	Crime type 2	Crime type 3
Jan	Cell #1	4	2	7
	Cell #2	3	1	8
	Cell #3	2	0	4
Fev	Cell #1	1	4	1
	Cell #2	2	1	3
	Cell #3	3	4	0
Mar	Cell #1	0	1	6
	Cell #2	0	0	7
	Cell #3	2	3	1

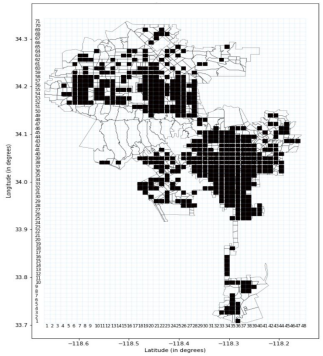
t-month method



Moore Neighborhood



Hotspot map for burglaries - Mar 2016



Hotspot map for burglaries - Sep 2016

Predict hotspots for a specifc crime for the next month

Advantages:

- Time dependant
- Very adjustable:
  - type of crime
  - number of hotspots
  - interest period
- Overall good metrics performances

	Decision Tree	KNN	Log Regression
Accuracy	83 %	82 %	78 %
Recall	84 %	88 %	72 %
Precision	87 %	83 %	89 %

Shift-to-Shift Model

Arson	Assault	Burglary	Homicide	Motor Vehicle	Others	Robbery	Theft	Vice	Violence	y
0	0	0	0	0	0	0	0	0	1	1

- Time step t = patrol shift of 4h
- Complementary model
- Reactive and easy to use

- Don't take into account the variation through the day/week/month of the number of crime
- It is a naive model in term of forecasting

metrics performance for "perilous" patrol model

	Decision Tree	KNN	Log Regression
Accuracy	77 %	76 %	70 %
Recall	100 %	80 %	69 %
Precision	72 %	76 %	78 %

metrics performance for "deadly" patrol model

	Decision Tree	KNN	Log Regression
Accuracy	72 %	71 %	67 %
Recall	61 %	58 %	65 %
Precision	66 %	65 %	59 %

Deployment and improvements

The implementation to the LAPD

- Explain how it works
- Set the goals
- Fit and assess the first results
- Assist and help the Police Department in every steps

The tool

- three complementary models
- work as a unit

Steps further

- Location management and mission planning
- day-to-day crime reports in a analytic module

Financial perspective

Basic estimation for Burglary

- Estimated cost for each is $13,000
- 2,1 Burglaries could be prevented per week
- Savings per year of $1,400,00

The dollar value of crime saving

- difficult to assess
- Cost per type of crime is estimated

What could be also stated

- Time saving in organisation and repartition for the police units
- higher reactivity and efficiency when intervening
- But, does not replace experience and intuition of police officers

Conclusion

Efficient tool to predict crime in LA

- both in terms of occurrence and localisation
- Easy to implement and to test

Room for improvement

- Could be apply with more datas to different cities
- Could be developed with more advanced techniques

Mettre ici le nom de l'orateur
(technique identique au titre; voir explications en face)