



# DANGERS

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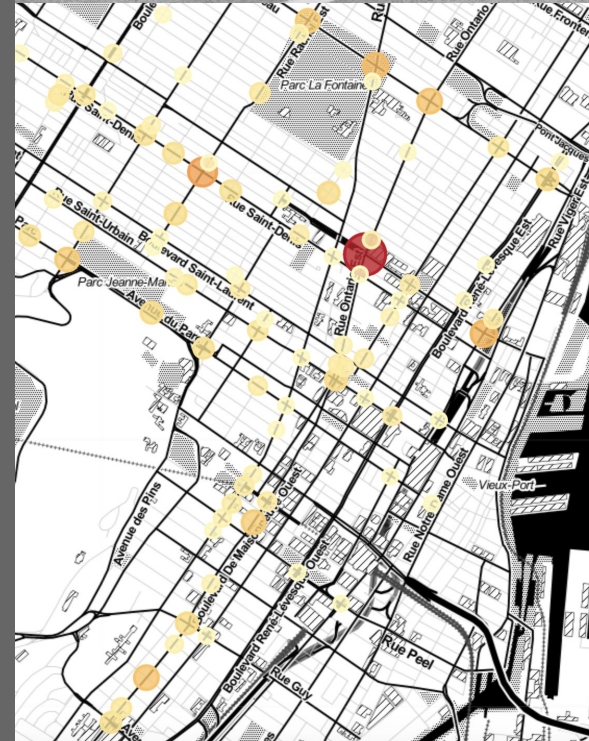
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# PROBLEMATIC



With the number of frequent bikers on the rise in Montreal, there is now an incentive for cyclists and cyclist owners to seek protection. Unfortunately, very few bike traffic data is available for the city of Montreal as there are only 23 bike traffic monitors through the city.



# TRAFFIC MAP



**Member name:** 1210 Drummond (account holder)

**Account number:** 39XJEMMG-1

**Start date:** April 14, 2018

**End date:** November 15, 2018

**Total number of trips:** 297

## Trip information

<b>Start:</b> 11/15/2018 7:11:40 PM	du President-Kennedy / Robert Bourassa
<b>End:</b> 11/15/2018 7:13:36 PM	McTavish / Sherbrooke



Fortunately, bikeshare companies such as Bixi collect data about their users' trips which are publicly available. We are provided with information about the start and end station of each ride, not the exact route taken.

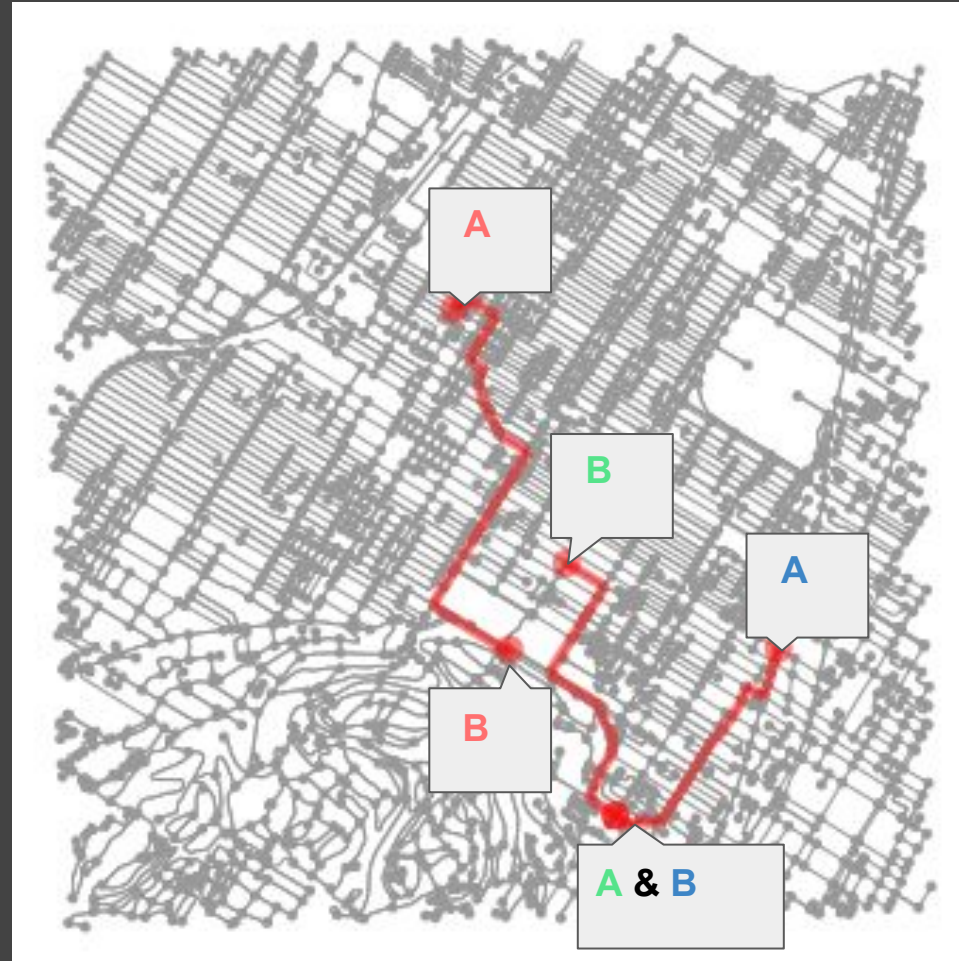
**Ultimately, we wish to assess the collision risk index for each BIXI users based on their BIXI usage.**

# FINDING BIKE RIDES PATH



## Challenge 1:

Computing the most likely path a biker will take to get from **station A** to **station B**. We used Open Street Map to obtain road map of the Plateau (intersections and streets). We computed the shortest path from all to all BIXI stations in the Plateau.





# COLLISION MAP

## Challenge 2:

Computing the clustered collision map from publicly available data. We used unsupervised machine learning algorithms (DBSCAN, Gaussian Mixture Models) from the sklearn library. Red and big circles correspond to more accidents and higher severity (unfortunately even deaths)



# TOTAL DANGER

## Assessing Danger Index for Users:

Using each user's profile, we compute a risk index their rides which is directly depending of how much often they are located in one of the danger zones described by the collision map.

## Challenge 3:

### from Absolute Risk to Relative Risk

One limitation of this is that what we calculate is not **WEIGHTED** by bike traffic. This is not (yet) useful for the bike riders but is still useful information: it allows BIXI to estimate how much BIXI damage they could expect.



17.03



14.69



6.0



14.87



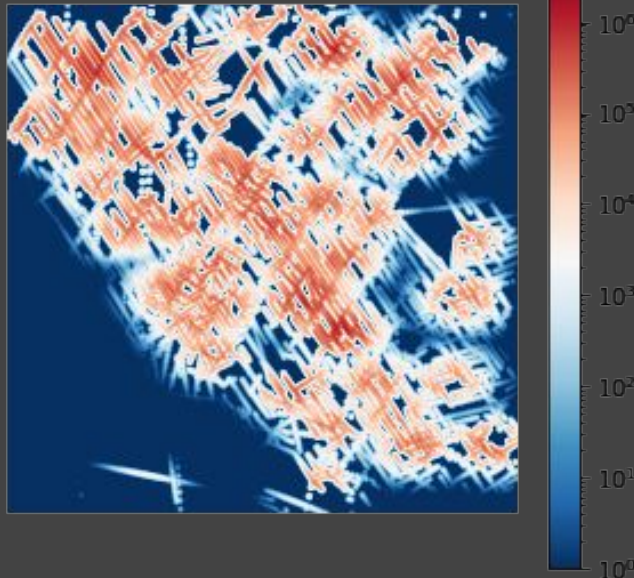
# DANGER PROFILES: ABSOLUTE TO RELATIVE



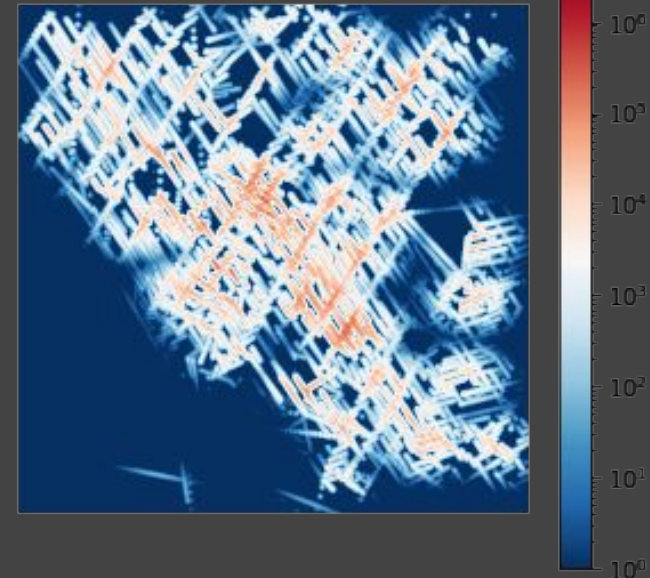
Focusing on the user safety:

We wish to provide information for bike commuters and insurance company about the collision of each individual. **What is the individual's probability of being in the middle of a collision?**

ABSOLUTE RISK MAP



NORMALIZED RISK MAP



# NORMALIZED DANGER

## Assessing Danger Index for Users:

With the normalized risk maps, we are now able to estimate more realistic risk index for each users.



**Thomas**  
**20.03**



**Lisa**  
**10.59**



**Jamie**  
**8.02**



**Saad**  
**15.87**



# APPLICATION



## **BIXI:**

- 1) Predict the amount and cost of the damages they should expect based on their users' BIXI usage.
- 2) Identify danger zone and allow to strategically place BIXI stations to prevent users from passing high-risk zones

## **Insurance companies:**

Allows to compute a personalized insurance fee based on the collision risk index and bike route habits.

## **City and community:**

- 1) Allows to identify problematic intersections that need restructuring because of high collision risks and high bikers traffic.
- 2) Build awareness about the dangers and risk on the road (and bike lanes)

# ACHIEVEMENTS

Parsed Bixi data (public and private)

Used machine learning (DBSCAN, GMM) to create a map of dangerous intersections

Designed a risk index for bike rides and computed danger profiles for Bixi users

Applications for

- Bixi users
- Bike-share companies (Bixi, Citi bike, Sobi, Mobi, etc.)
- Insurance companies



# FUTURE POSSIBLE IMPROVEMENTS

- Complete our pipeline to automatically compute danger indices and danger profiles from GPS data (like from My Bixi Space)
- Add time-dependent danger assessment, as risks often differ throughout the day
- Visualize with an interactive website
- Improve the algorithm for storing and accessing the database

*code.jam*(2018)





# References

[http://www.montrealgazette.com/news/road-safety/map/map\\_page.html](http://www.montrealgazette.com/news/road-safety/map/map_page.html)

<http://www.montrealgazette.com/news/bike-accidents/index.html>

<https://www.bixi.com/en/open-data>