

Smart recommendation system based on personal preferences profile and data about venues

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Introduction and problem

In my project I consider such case: Policeman wants to choose Police department where he will work considering his hierarchical profile of preferences. This problem can be scaled and used as worker distribution system for different professions. System will separate them into different offices or into their work departments in town. It is important optimisation problem which will result in higher level of worker satisfaction and as a result higher work efficiency.



Locations of police departments in Toronto



Data acquisition and cleaning

Data Source:

<https://open.toronto.ca/dataset/police-facility-locations/> (Toronto first Open Data Portal launched in 2009)

Foursquare API (I used Foursquare API to get venue categories near police departments)

Firstly police facility location database is downloaded and processed. Only Police Departments containing “Division” are used.

	Facility Name	Latitude	Longitude	Venue
0	11 Division	43.671071	-79.460825	The Den Toronto : Workshops, Bench Rentals and...
1	11 Division	43.671071	-79.460825	Sabor Brasil Restaurant
2	11 Division	43.671071	-79.460825	Organic Garage
3	11 Division	43.671071	-79.460825	Pho Xua
4	11 Division	43.671071	-79.460825	Cầu Long Miên Tây
5	11 Division	43.671071	-79.460825	Toronto Weston Flea Market
6	11 Division	43.671071	-79.460825	Golden Star Variety
7	11 Division	43.671071	-79.460825	Pizza Pita Pan
8	11 Division	43.671071	-79.460825	Bánh Cuốn Phở Gà
9	11 Division	43.671071	-79.460825	Wadsworth Park
10	11 Division	43.671071	-79.460825	El Rancherito Asados Restaurant
11	12 Division	43.694571	-79.486873	Tim Hortons
12	12 Division	43.694571	-79.486873	Trethewey Park
13	12 Division	43.694571	-79.486873	StorageMart
14	13 Division	43.698319	-79.436680	Randy's Take-Out
15	13 Division	43.698319	-79.436680	Rap's
16	13 Division	43.698319	-79.436680	TD Canada Trust
17	13 Division	43.698319	-79.436680	Starbucks
18	13 Division	43.698319	-79.436680	TTC Stop #14679
19	13 Division	43.698319	-79.436680	109 Marlee Bus
20	13 Division	43.698319	-79.436680	Eglinton West Subway Station

Methodology

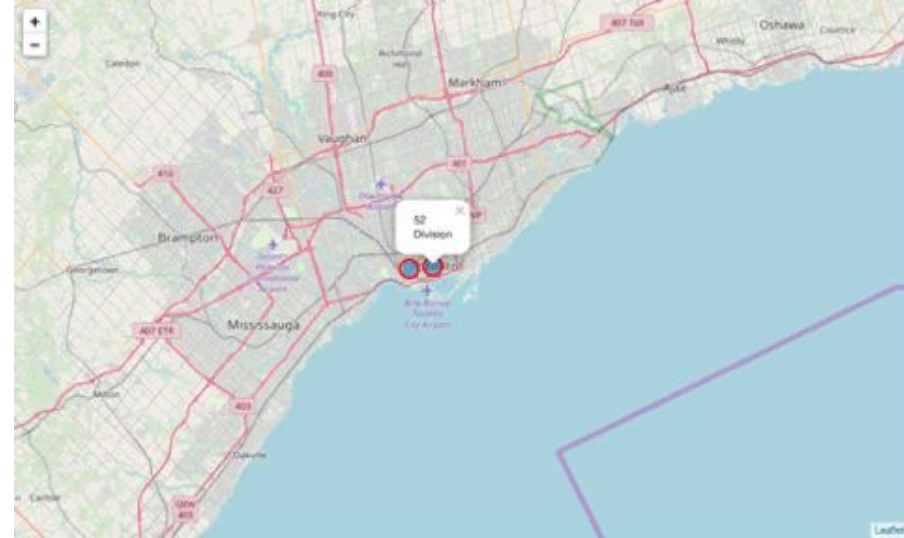
Subsequently locations of the venues near the Police Divisions are requested via Foursquare API. Then top 10 venues are generated for each Police Division.

After that user preferences are determined by asking user to input top five important for him venues that should be located near Police Division. Then algorithm counts weighted sum of venues which present near the Police Division for every Police Division. Then Police Division with higher score are recommended to user.

	Facility Name	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	11 Division	Vietnamese Restaurant	Jewelry Store	Brazilian Restaurant	Latin American Restaurant	Organic Grocery	Flea Market	Park	Pizza Place	Delicatessen / Bodega	BBQ Joint
1	12 Division	Storage Facility	Coffee Shop	Playground	Farmers Market	French Restaurant	Food & Drink Shop	Food	Flea Market	Fish & Chips Shop	Fast Food Restaurant
2	13 Division	Coffee Shop	Caribbean Restaurant	Yoga Studio	Food & Drink Shop	Park	Metro Station	Men's Store	Bus Stop	Bank	Pizza Place
3	14 Division	Bar	Restaurant	Coffee Shop	Portuguese Restaurant	Bakery	Cocktail Bar	Café	Italian Restaurant	Vegetarian / Vegan Restaurant	Fast Food Restaurant
4	22 Division	Sushi Restaurant	Korean Restaurant	Café	Beer Store	Fish & Chips Shop	Thrift / Vintage Store	Convenience Store	Bakery	Pizza Place	Playground
5	23 Division	Japanese Restaurant	Beer Store	Video Store	Grocery Store	Pizza Place	Pharmacy	Park	Fried Chicken Joint	Hardware Store	Fast Food Restaurant
6	31 Division	Hotel	American Restaurant	Road	Coffee Shop	Farmers Market	French Restaurant	Food & Drink Shop	Food	Flea Market	Fish & Chips Shop
7	32 Division	Korean Restaurant	Coffee Shop	Pizza Place	Sushi Restaurant	Bubble Tea Shop	Ramen Restaurant	Sandwich Place	Dessert Shop	Café	Shopping Mall
8	33 Division	Pizza Place	Burger Joint	Coffee Shop	Japanese Restaurant	Asian Restaurant	Fried Chicken Joint	Mobile Phone Shop	Mediterranean Restaurant	Cafeteria	Middle Eastern Restaurant
9	41 Division	Rental Car Location	Bank	Pizza Place	Coffee Shop	Pet Store	Chinese Restaurant	Sporting Goods Shop	Furniture / Home Store	Greek Restaurant	Delicatessen / Bodega
10	42 Division	American Restaurant	Chinese Restaurant	Diner	Sandwich Place	Fast Food Restaurant	Coffee Shop	Gym	Pharmacy	Food	Flea Market
11	43 Division	Bus Stop	Motel	Park	Martial Arts Dojo	Gym / Fitness Center	Yoga Studio	Fish & Chips Shop	French Restaurant	Food & Drink Shop	Food
12	51 Division	Coffee Shop	Bakery	Theater	Mexican Restaurant	Gym / Fitness Center	Breakfast Spot	Café	Park	Chocolate Shop	Restaurant
13	52 Division	Café	Chinese Restaurant	Coffee Shop	Japanese Restaurant	Art Gallery	French Restaurant	Ice Cream Shop	Bar	Ramen Restaurant	Bubble Tea Shop
14	53 Division	Coffee Shop	Fast Food Restaurant	Italian Restaurant	Pub	Movie Theater	Bookstore	Gym	Burger Joint	Restaurant	Caribbean Restaurant

Recommendations

Then algorithm counts weighted sum of venues which present near the Police Division for every Police Division. Then Police Division with higher score are recommended to user. If there are more than one Police Divisions with same score they both are recommended. Recommended Police Divisions are visualised on the map.



Conclusions

During this project recommendation system was built. It performed well in taking user preferences and generating recommended place of work, but it still need to have some improvements. This model can be scaled to fit similar kinds of problems for workers in other spheres.