[Question 1] How will you decide which branches are profitable and which branches are under-performing using the overall performance index score? Describe the spatial pattern of under-performing banks. Are there any clusters of under-performing banks that could be consolidate?
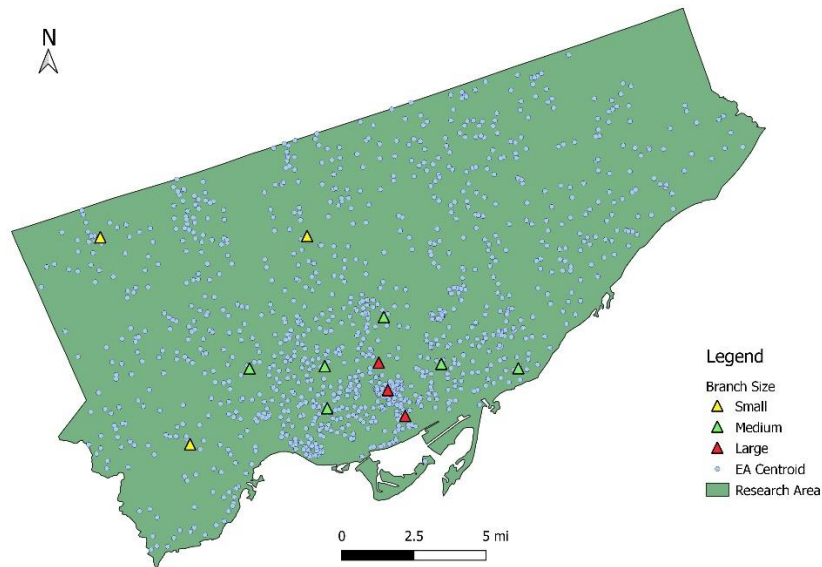[Answer 1]

Bank Branches and Customer EAs

Fig.1

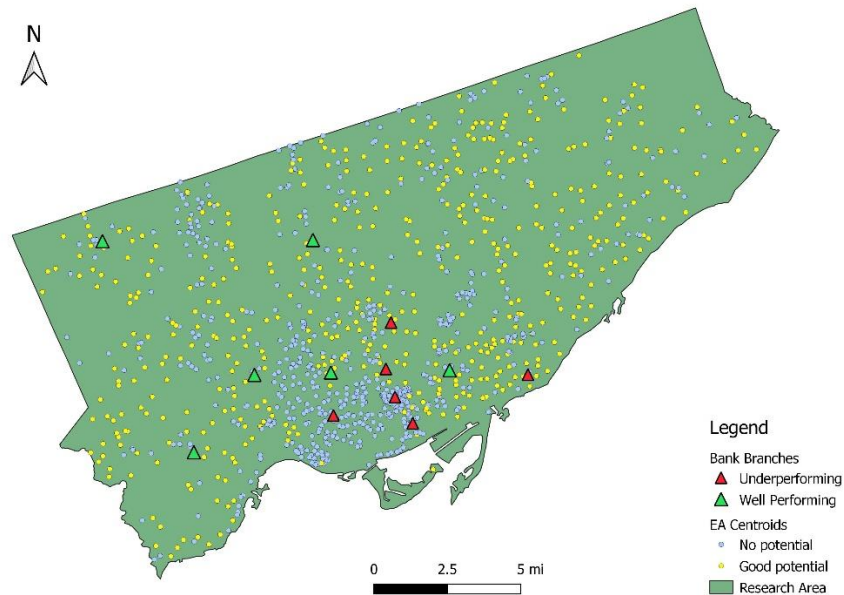## Bank Branch Performance and Customer Distribution

Fig.2

Overall Performance Index:

Mean = 9.49

I calculated the mean value of the overall performance index of the 12 bank branches first. If the overall performance index of a branch is lower than the mean value, I define it as an underperforming branch. According to Fig.1 and Fig.2, the underperforming bank branches are located in the mid-south part of our research area. Three of the five underperforming branches are large branches. Therefore, I would suggest consolidating the underperforming one medium branch on the left and the three large branches into nearby existing branches.

[Question 2] How will you calculate the average value for each demographic variable around each bank? How will you determine the customers for each bank? Hint: There are a lot of approaches such as nearest neighbor, Voronoi diagram, fixed radius buffer zone, interpolated surface, rasterization of variables and overlay, or even manual allocation… You are expected to explore and finish the implementation of your solution. There is no standard/best answer here. You just need to specify your strategy.

[Answer 2]
I use the "Distance Matrix" analysis tool to determine the customers for each bank because customers mostly would want to go to the nearest bank from their home. After determining the customers for each bank, I can use the "Basic Statistics for fields" analysis tool to calculate the average value for each demographic variable for bank branches.

Bank	Avg_Ea_pop	Avg_C91family	Avg_C9134child	Avg_C915child	Avg_C91totdwlg
1	725.11	192.26	29.21	2.44	225.30
2	731.28	205.23	16.99	0.63	289.20
3	358.98	75.53	7.55	0.96	161.81
4	255.79	44.56	2.13	0.06	146.19
5	475.58	105.21	9.38	0.42	244.38
6	630.70	164.90	15.39	0.44	263.01
7	514.95	118.19	13.05	0.90	189.14
8	692.45	181.49	19.43	0.93	261.86
9	771.14	208.94	21.80	1.11	281.48
10	748.92	200.12	20.99	1.47	273.92
11	588.51	146.52	13.66	1.16	236.34
12	593.66	143.95	16.37	0.89	238.23

Bank	Avg_C91owndwlg	Avg_C91sngresp	Avg_C91multres	Avg_C91mtengli	Avg_C91engfre
1	98.17	679.21	45.00	392.01	2.07
2	179.09	702.84	27.39	488.64	2.33
3	38.30	343.72	15.96	235.00	2.13
4	22.00	243.00	11.63	159.56	1.50
5	90.00	467.50	7.08	394.79	1.88
6	124.85	611.80	18.40	459.85	2.48
7	66.19	480.81	33.43	206.05	1.43
8	126.24	654.02	37.78	372.53	1.96
9	146.90	741.53	29.23	550.37	2.91
10	150.00	713.59	35.24	424.46	2.10
11	103.66	560.30	28.23	357.62	2.56
12	105.56	559.35	33.87	321.29	1.69

Bank	Avg_C91engnon	Avg_E90hhaggin	Overall Bank Performance	Score of Savprof	Score of Mutprof
1	39.02	10416.29	15.00	95.00	25.00
2	22.50	17530.58	17.50	50.00	90.00
3	11.70	7201.32	1.50	15.00	15.00
4	8.88	6813.34	5.50	40.00	70.00
5	4.58	25001.88	4.25	15.00	70.00
6	14.13	17341.81	9.29	25.00	105.00
7	29.19	7779.75	6.43	60.00	30.00
8	33.04	11891.07	10.71	90.00	60.00
9	23.62	13722.14	8.93	30.00	95.00
10	27.75	15394.78	11.88	45.00	50.00
11	23.23	10930.76	10.71	75.00	75.00
12	29.52	13633.35	12.14	90.00	80.00

[Question 3] Justify your general and specific recommendations. How did you determine the size of new bank branches and the consolidated branches? What information do you need to make a more accurate estimation?
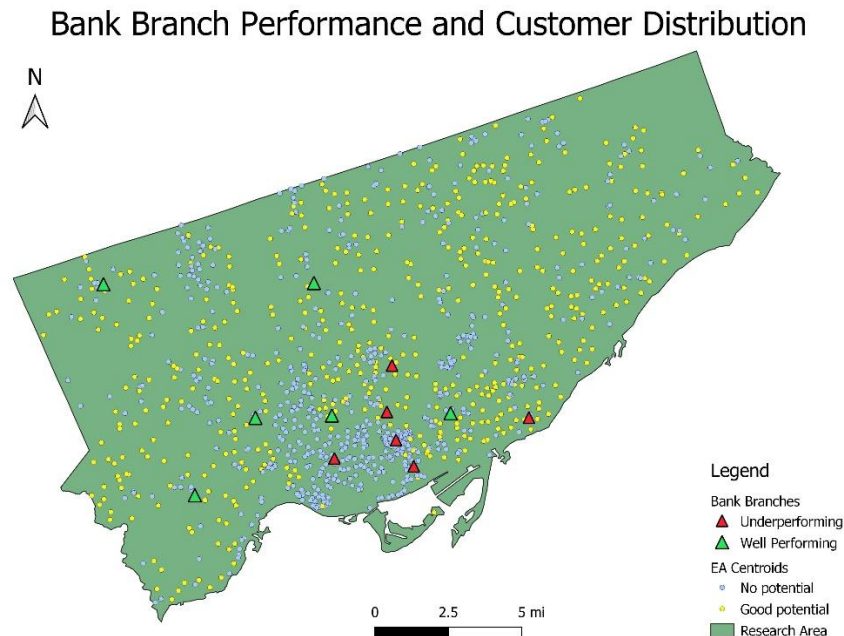[Answer 3]

Fig.2

C91mtengli:

Avg = `388.73445825932504`

The relationships between the demographic trends of the customers and branch performance

Through comparison between different fields in the EA data attribute table, I found that the average of "Population with English mother tongue" seems to have a positive correlation with mutual fund profits in the line chart. (See Fig.3)
We can tell that the mutual fund profits will increase when the population with English mother tongue increases. It seems not to have the same pattern for Branch-4, Branch-11, and Branch-12; however, it shows that sometimes the mutual fund profits can still increase even if the population with English mother tongue decrease. Thus, we can know that the bank can still have a better chance to gain good mutual fund profits when there are more EAs that have a higher population with English mother tongue. For the profit from saving accounts, it seems not to have any obvious pattern with other factors.
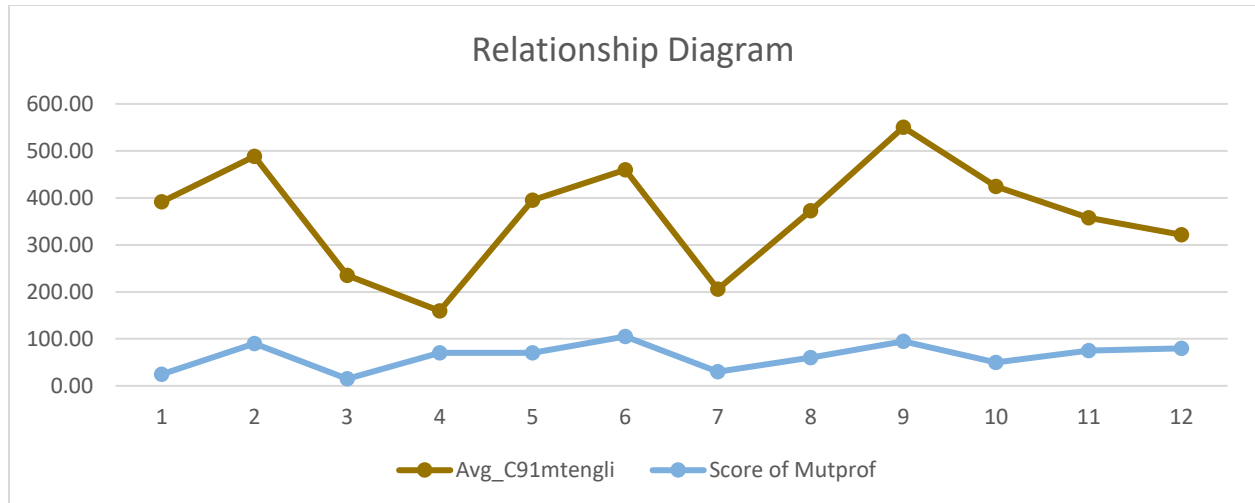
Fig.3

Recommendation:
   (1) Close all the underperforming branches.
   (2) Make the two mid-south medium branches into two large branches.
   (3) Open two medium bank branches or one large bank branch on the right part of our research area. (See Fig.4)
   (4) Doing research about the profits from saving accounts and mutual funds for EAs.
Reasons for the recommendations:
   (1) Close and consolidate branches
       I determine the size of new bank branches based on the total number of the existing tellers. We want to consolidate our bank branches, but we do not want to be lacking tellers to provide services to customers. Therefore, I recommend making the two branches into large branches.
   (2) Open new branches
       The area on the right part of our research area has lots of EAs are potential customers (See Fig.2); however, we don't have any bank branches there.
   (3) Doing research about the profits from saving accounts and mutual funds. In cust1 and cust2, saving amount sometimes has much larger amount of money than mutual funds.

Recommendation Schematic

N

Open new bank branches in this area

Expand these two branches.
Close all underperforming branches

Legend

Bank Branches
▲ Underperforming
▲ Well Performing
EA Centroids
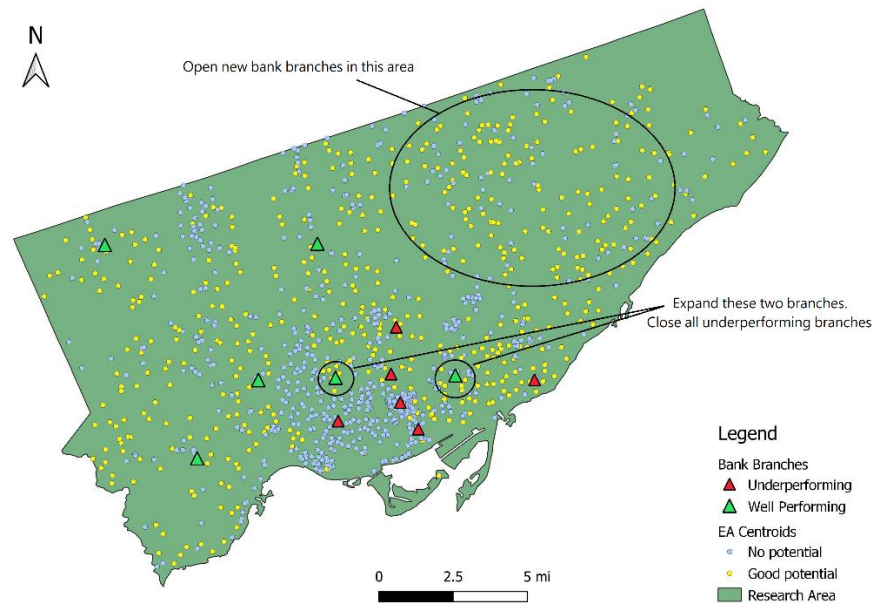· No potential
· Good potential
Research Area
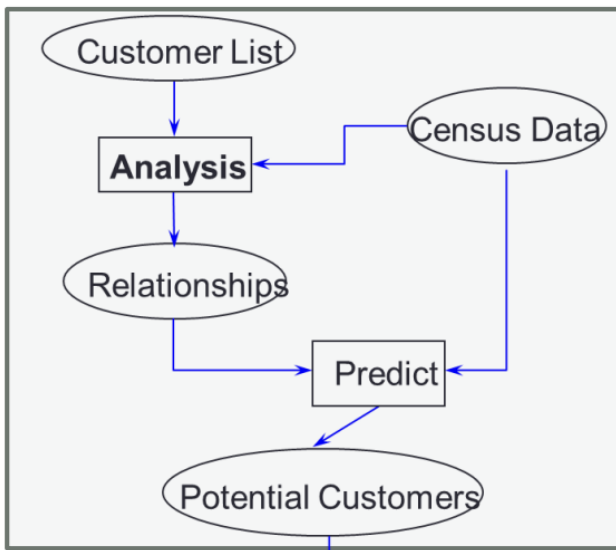
0   2.5   5 mi

Fig.4

Making a more accurate estimation:
(1) We need to estimate the new bank branch's performance in different scenarios. It means that we need to calculate the performance for two new medium branches and for one new large branch individually.
(2) We need to re-estimate the bank branch performance of existing bank branches after determining how to set up new branches.
(3) We have only customer data for Bank-1 and Bank-2, it does not have some clear pattern to see if the saving account will give more profits or the mutual funds will grant more money for the bank. Also, we cannot make a confident conclusion from just 2 samples. Therefore, the bank should have done some survey or research on the saving account and mutual funds. If one of them can dominate the other, then maybe we can just open a new bank that specializes in saving accounts in our potential customer area.

[Question 4] How do you feel about using the conditions in 3) of 4.2 for representing the relationship(s) between the performance of the branches and the customer demographic data? What is your suggestion?
[Answer 4]
I think the method that we use in this is ok but may not be the best way. The reason is that the relationship between the performance of the branches and the customer demographic data is sometimes hard to find. Also, if we just use the trend to predict, it will sometimes have some bias. I think we may need to have some domain knowledge or research method from financial or economic fields. Otherwise, it seems like I do not know how much confidence I can have in my prediction.

Customer List

Analysis ← Census Data

Relationships

Predict

Potential Customers

From Geog578 Lab4 Instruction Material

Pseudo Coding Flow Chart(below):

Cust 1
Data Average

Cust 2
Data Average

EA Data

Compare Pattern
(If EA data has the same
pattern as Customer Data)

Yes

No

Make Line Chart for
Fields in EA Data

Make Line Chart for Fields
in Customer Data
And EA Data

EA Data
Line Chart

Customer Data
Line Chart

Pick the curve that has positive correlation with
total profit(saving and mutual)

Potential Customer Field Name
(Such as Eapop)