Aetna CVS Health Hub Case

Yu-Ting Shen

About myself

- Name: Yu-Ting Shen
  - From Taiwan
- Degree: Ph.D in Physics
  - University of Oklahoma (2018)
- Experience:
  - TSMC, Academia Sinica, CERN, Seeloz
- Skills:
  - Python, C/C++, SQL, Bash shell script
  - Machine learning, reinforcement learning
  - Time series analysis & forecasting
  - Visualization & dashboard

What's the difference?

- **MinuteClinic**
  - Offers professional and personalized care for a wide variety of health needs
  - Provides patients with easy-to-access, affordable care from professional providers (nurse practitioners and physician associates).

- **Services**
  - COVID-19 services
  - Immunizations
  - Screenings
  - Physicals
  - Minor illnesses
  - Minor injuries
  - Women and Men services
  - Pre-travel health

What's the difference?

- **HealthHub**
  - **MinuteClinic and CVS Pharmacy**
  - **Has expanded wellness support and access to a wider variety of health products.**
  - **Nurse practitioners (NPs), physician associates (PAs), pharmacists and other professionals such as licensed therapists**
  - **Wellness room**
    - **Health classes**
    - **Educational seminars**

Objective

CVS Health wants to expand the “HealthHub” store format to Atlanta and would like a recommendation on which 3 of the potential 38 current CVS stores to convert

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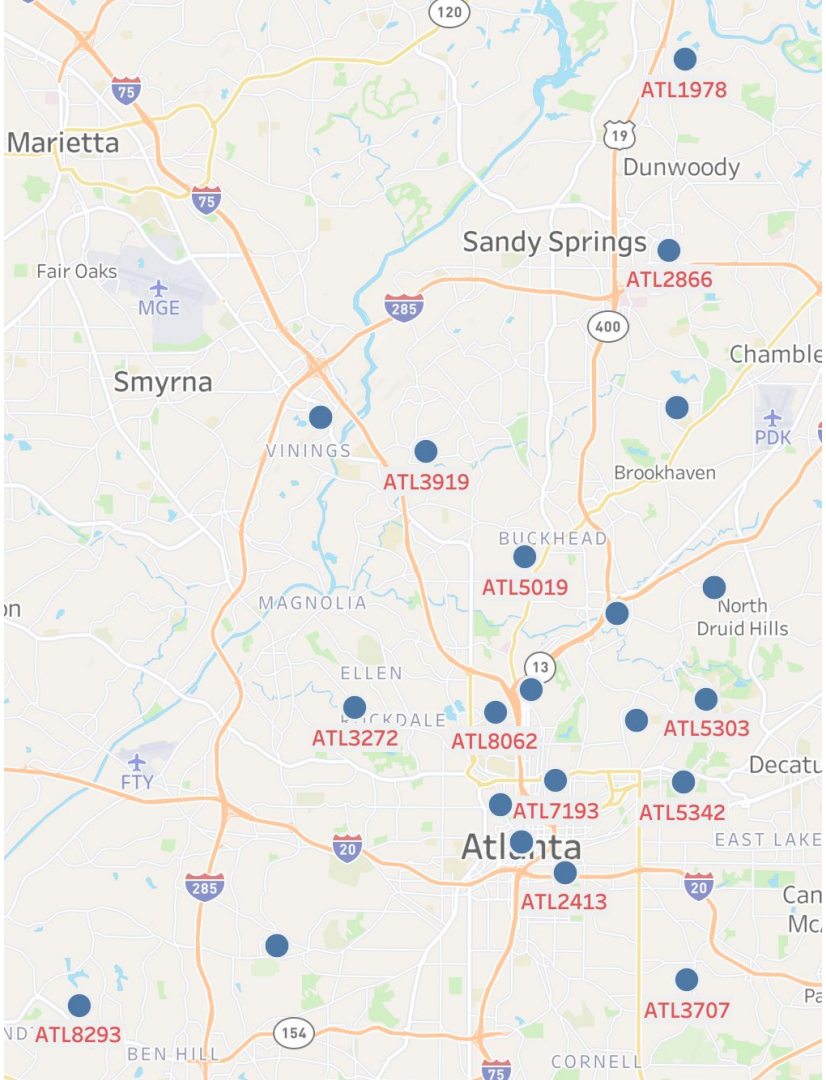
Data

- 38 Stores with 25 variables
  - 21 zip code
  - 21 (latitude, longitude)
    - This info could be wrong
    - See backup slides

Variable	Description	Level
store_num	Unique store number	Store
address_1	Address line one	Store
address_2	Address line two	Store
city	City	Store
state	State	Store
zip	Zip	Store
lat	Latitude	Store
lng	Longitude	Store
population	Population size	Zip Code
density	Population density	Zip Code
county_fips	County FIPS code	Zip Code
county_name	County Name	Zip Code
income	Median annual household income	Zip Code
med_age	Median age	Zip Code
age_65p	Percentage of population 65+	Zip Code
pct_female	Percentage of the population female	Zip Code
unemp_rate	Unemployment rate	Zip Code
comm_pen	Aetna commercial member penetration rate	Zip Code
mdcr_pen	Aetna Medicare member penetration rate	Zip Code
uninsured	Percentage of the population uninsured	Zip Code
poverty_pct	Percentage of the population at or below federal poverty line	Zip Code
foot_traffic_ind	External data giving index for level of foot traffic around store	Store
store_age	Number of years store has been operating	Store
sales_cagr	Compound Annual Growth Rate of sales over last three years	Store
pharm_pct	Percentage of sale from pharmacy section	Store
comp_density_ind	External data giving index for competitor presence around store	Store

Map

- Use the (latitude, longitude) in the data
- Dots without store num mean Multiple stores share the same (latitude, longitude)

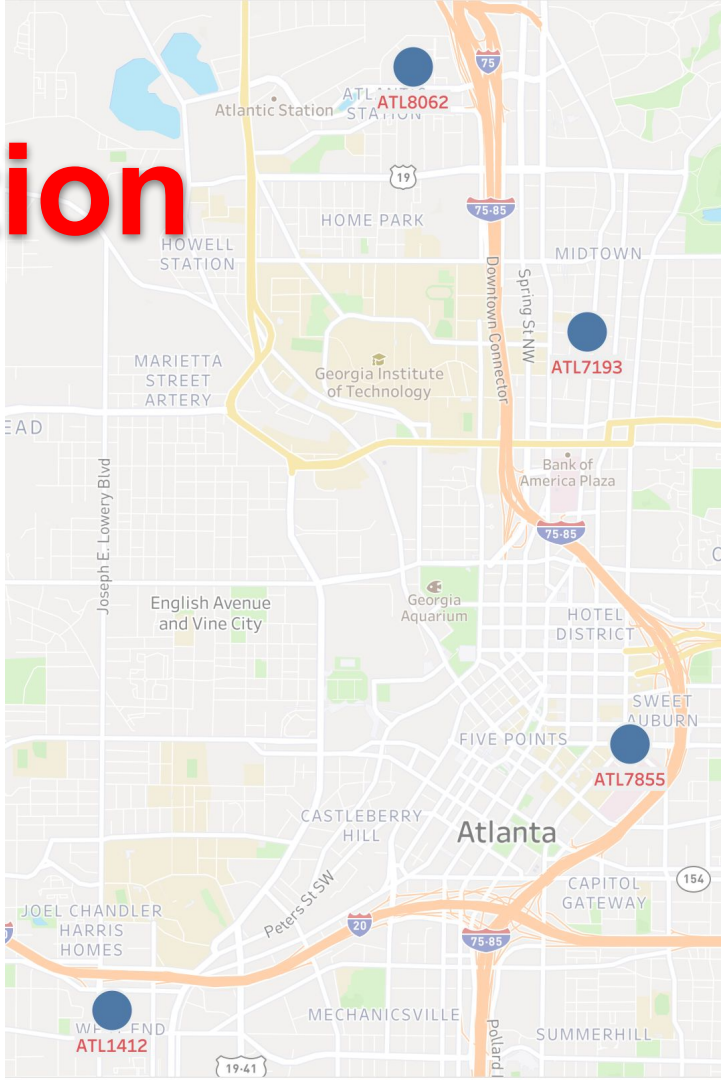


Health HUB

Recommendation

- ATL7193
- ATL1412
- ATL7855 (or ATL8062)

store_num	address	city	state	zip
ATL7193	842 Peachtree Street	Atlanta	GA	30308
ATL1412	895 Ralph David Abernathy Boulevard	Atlanta	GA	30313
ATL7855	1 Coca-cola Plaza	Atlanta	GA	30313
ATL8062	375 18th St	Atlanta	GA	30363



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Analysis

- Potential customers:
  - Aetna members
    - Commercial
    - Medicare
  - Aged people, family with kids
  - Who wants easy-to-access services
    - Community based
  - Who wants affordable care

- Potential area (zip code level):
  - High population
  - 65+ population
  - More Aetna members
- Potential store (store level):
  - More customers
  - More revenue
    - Store
    - Pharmacy
  - Less competitors

Analysis

- Model
  - Recency, Frequency, Monetary Value (RFM)
    - Recency: How recently a customer has made a purchase
    - Frequency: How often a customer makes a purchase
    - Monetary Value: How much money a customer spends on purchases

Analysis

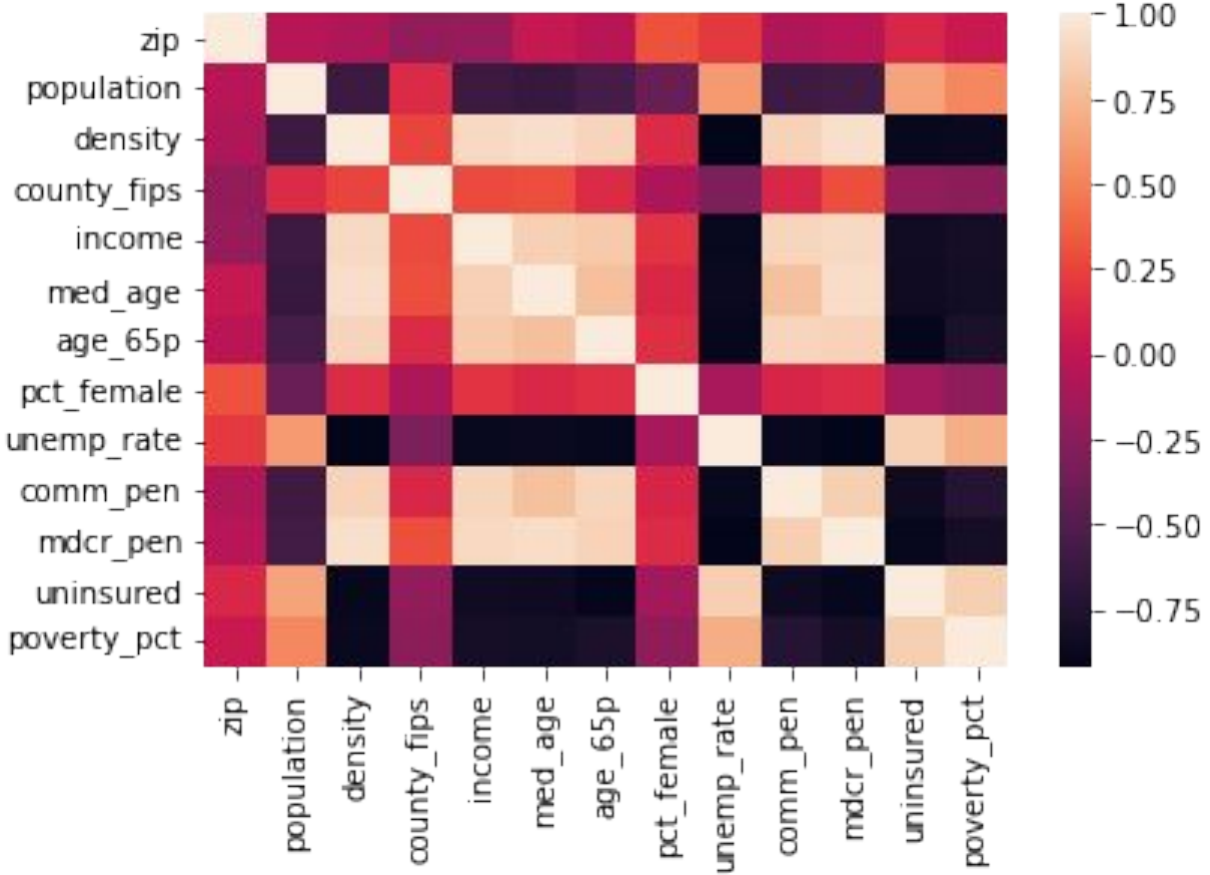
- Zip code level
  - Population, density, county_fips, county_name, income, med_age, age_65p, pct_female, unemp_rate, comm_pen, mdcr_pen, uninsured, Poverty_pct

Not very useful

Analysis

- **Correlation**
  - **Lighter: higher**
  - **Red: lower**
  - **Darker: higher**

- **Ignore variables**
  - **county_fips**
  - **pct_female**



Analysis

- Top zip level
  - 30308
  - 30313
  - 30363
- Score = sum of the rank
  - The smaller, the better

zip	rank_population	rank_density	rank_income	rank_age_65p	rank_unemp_rate	rank_comm_pen	rank_mdcr_pen	rank_uninsured	rank_poverty_pct	
30303		6.0	3.0	6.0		4.0	4.0			Score = 23
30305									2.0	
30306							6.0	5.0		
30307								5.0	2.0	
30308		1.0	2.0	2.0		1.0	1.0			Score = 7
30309		4.0	5.0	3.0		5.0				
30311	5.0				3.0			1.0	2.0	
30312		5.0		3.0			4.0			
30313		2.0	1.0	3.0		1.0	1.0			Score = 8
30316	6.0				3.0					
30318	2.0								1.0	
30319	3.0									
30322			5.0			5.0				
30324									2.0	
30327					1.0					
30329										
30331	1.0				3.0			2.0		
30339					1.0			4.0		
30346										
30350	4.0				3.0			2.0	2.0	
30363		3.0	3.0	1.0		1.0	1.0			Score = 9

Analysis

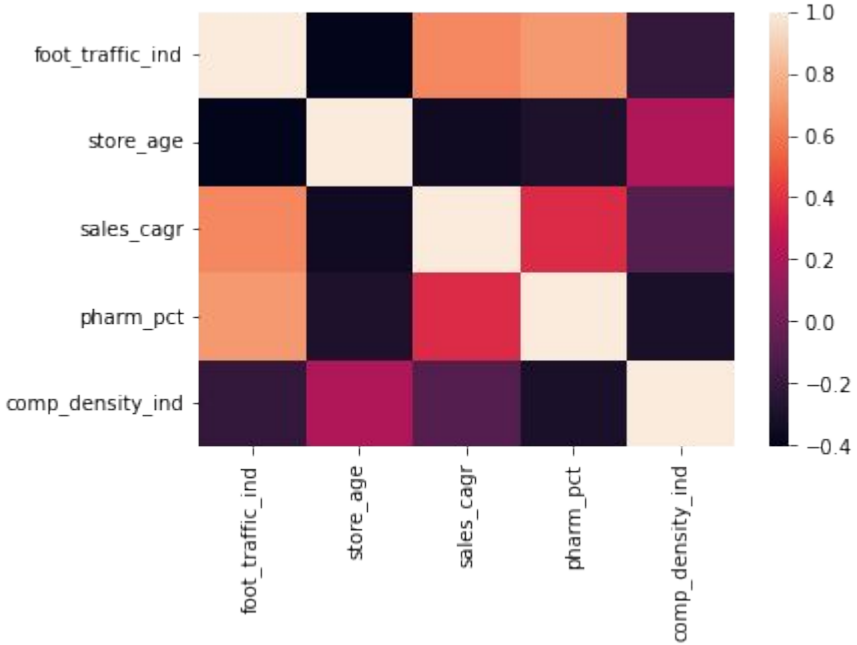
- Store level
  - Store_num,
    Address,
    City,
    State,
    Lat,
    Lng,
    Foot_traffic_ind,
    Store_age,
    Sales_cagr,
    Pharm_pct,
    Comp_density_ind

Powerful variables

Analysis

- **Correlation**
  - **Lighter: higher**
  - **Red & darker: lower**

- **Ignored variable**
  - **comp_density_ind**



Analysis

- Top store level
  - ATL7193
  - ATL1412
  - ATL7855
  - ATL8062
- Score = sum of the rank
  - The smaller, the better

	store_num	rank_foot_traffic_ind	rank_store_age	rank_sales_cagr	rank_pharm_pct	rank_comp_density_ind
5	ATL7193	1.0		1.0	3.0	
7	ATL1412	2.0		1.0	4.0	
7	ATL7855	3.0		3.0	1.0	
8	ATL8062	3.0		3.0	2.0	
9	ATL6901			3.0	6.0	6.0
	ATL8409	6.0				
	ATL4248			3.0		
	ATL2413	3.0			5.0	1.0
	ATL5019		6.0			1.0
	ATL5342		3.0			
	ATL2678		4.0			
	ATL6283					1.0
	ATL7871		1.0			
	ATL3919		4.0			1.0
	ATL4585					1.0
	ATL1574		2.0			

We can ignore comp_density_ind

Conclusion

- Top zip code level
  - 30308
  - 30313
  - 30363
- Top store level
  - ATL7193
  - ATL1412
  - ATL7855

store_num	zip
ATL7193	30308
ATL1412	30313
ATL7855	30313
ATL8062	30363

- CVS can consider to convert these 3 stores into Health Hub

- If CVS doesn't want to have 2 Health Hub in the same zip code, then the ATL8062 can replace ATL7855
- See backup slide

Bakeup

Data

- **Stores with the same (latitude, longitude)**

store_num	address_1	lat	lng
ATL8907	2237 Cascade Road	33.72333	-84.47488
ATL6404	3030 Headland Drive	33.72333	-84.47488
ATL7871	2429 Martin Luther King Jr Drive	33.72333	-84.47488

store_num	address_1	lat	lng
ATL2413	439 Highland Avenue	33.74478	-84.37513
ATL8140	520 Boulevard	33.74478	-84.37513

store_num	address_1	lat	lng
ATL6901	133 Peachtree Street	33.75332	-84.38986
ATL8409	12-j Broad Street	33.75332	-84.38986
ATL4248	235 Peachtree Street	33.75332	-84.38986

store_num	address_1	lat	lng
ATL1412	895 Ralph David Abernathy Boulevard	33.76447	-84.39729
ATL7855	1 Coca-cola Plaza	33.76447	-84.39729

store_num	address_1	lat	lng
ATL5342	1275 Caroline St	33.77068	-84.33402
ATL6375	1554 North Decatur Road	33.77068	-84.33402

store_num	address_1	lat	lng
ATL8700	865 North Highland Avenue	33.7887	-84.35026
ATL7101	680 Ponce De Leon Avenue	33.7887	-84.35026

store_num	address_1	lat	lng
ATL2678	2539 Piedmont Rd	33.81961	-84.35707
ATL3162	1544 Piedmont Avenue	33.81961	-84.35707
ATL2235	2350 Cheshire Bridge Road	33.81961	-84.35707

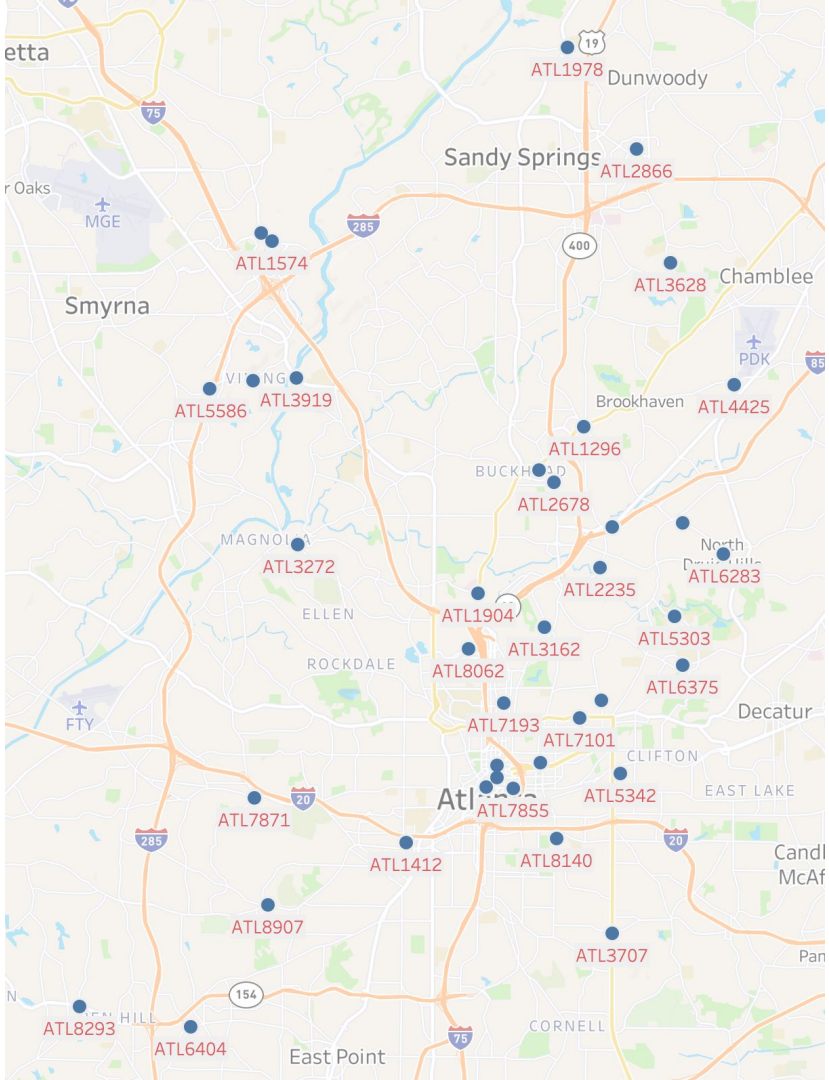
store_num	address_1	lat	lng
ATL5600	2400 N Druid Hills Rd	33.82695	-84.32297
ATL5061	2910 Buford Highway	33.82695	-84.32297
ATL6283	2830 North Druid Hill Road	33.82695	-84.32297

store_num	address_1	lat	lng
ATL2014	6370 Powers Ferry Road	33.8761	-84.46015
ATL5586	2455 Paces Ferry Road	33.8761	-84.46015
ATL4585	4300 Paces Ferry Road	33.8761	-84.46015
ATL1574	2014 Powers Ferry Road	33.8761	-84.46015

store_num	address_1	lat	lng
ATL3628	3439 Ashford Dunwoody Road	33.87897	-84.33619
ATL4425	3615 Clairmont Road	33.87897	-84.33619
ATL1296	3637 Peachtree Road	33.87897	-84.33619

Map

- Use Google Map to get correct (latitude, longitude) for all stores
  - 38 stores



Health HUB

Latitude, longitude

store_num	address	city	state	zip	lat	lng
ATL7193	842 Peachtree Street	Atlanta	GA	30308	33.777560	-84.384820
ATL1412	895 Ralph David Abernathy Boulevard	Atlanta	GA	30313	33.739510	-84.416870
ATL7855	1 Coca-cola Plaza	Atlanta	GA	30313	33.754433	-84.381907
ATL8062	375 18th St	Atlanta	GA	30363	33.792403	-84.396529
ATL6901	133 Peachtree Street	Atlanta	GA	30303	33.757441	-84.387065
ATL8409	12-j Broad Street	Atlanta	GA	30303	33.754802	-84.390553
ATL4248	235 Peachtree Street	Atlanta	GA	30303	33.760529	-84.387054
ATL1904	1943 Peachtree Road	Atlanta	GA	30309	33.807713	-84.393382
ATL2413	439 Highland Avenue	Atlanta	GA	30312	33.761287	-84.372970
ATL8140	520 Boulevard	Atlanta	GA	30312	33.740654	-84.367606
ATL5019	3221 Peachtree Road	Atlanta	GA	30305	33.841072	-84.373311
ATL8700	865 North Highland Avenue	Atlanta	GA	30306	33.778580	-84.352921
ATL7101	680 Ponce De Leon Avenue	Atlanta	GA	30306	33.773789	-84.359873
ATL5342	1275 Caroline St	Atlanta	GA	30307	33.758355	-84.346544
ATL6375	1554 North Decatur Road	Atlanta	GA	30307	33.788151	-84.326172
ATL3628	3439 Ashford Dunwoody Road	Atlanta	GA	30319	33.897438	-84.330307
ATL4425	3615 Clairmont Road	Atlanta	GA	30319	33.864449	-84.309528
ATL1296	3637 Peachtree Road	Atlanta	GA	30319	33.852759	-84.358461
ATL5303	1520 Avenue Place	Atlanta	GA	30322	33.801246	-84.328867
ATL2678	2539 Piedmont Rd	Atlanta	GA	30324	33.837927	-84.368433
ATL3162	1544 Piedmont Avenue	Atlanta	GA	30324	33.798318	-84.371470

store_num	address	city	state	zip	lat	lng
ATL2235	2350 Cheshire Bridge Road	Atlanta	GA	30324	33.814720	-84.353203
ATL5600	2400 N Druid Hills Rd	Atlanta	GA	30329	33.826867	-84.326113
ATL5061	2910 Buford Highway	Atlanta	GA	30329	33.825621	-84.349524
ATL6283	2830 North Druid Hill Road	Atlanta	GA	30329	33.818359	-84.312720
ATL2866	100 Perimeter Center Pl	Atlanta	GA	30346	33.928494	-84.341355
ATL8907	2237 Cascade Road	Atlanta	GA	30311	33.722610	-84.462092
ATL6404	3030 Headland Drive	Atlanta	GA	30311	33.689491	-84.487292
ATL7871	2429 Martin Luther King Jr Drive	Atlanta	GA	30311	33.751755	-84.466599
ATL3707	1455 Moreland Avenue	Atlanta	GA	30316	33.714951	-84.349525
ATL3272	2555 Bolton Road	Atlanta	GA	30318	33.820778	-84.452080
ATL3919	3401 Northside Parkway	Atlanta	GA	30327	33.866190	-84.452591
ATL8293	5815 Campbellton Road	Atlanta	GA	30331	33.695119	-84.523600
ATL2014	6370 Powers Ferry Road	Atlanta	GA	30339	33.905680	-84.464216
ATL5586	2455 Paces Ferry Road	Atlanta	GA	30339	33.863344	-84.480972
ATL4585	4300 Paces Ferry Road	Atlanta	GA	30339	33.865557	-84.467071
ATL1574	2014 Powers Ferry Road	Atlanta	GA	30339	33.903394	-84.460641
ATL1978	7355 Roswell Road	Atlanta	GA	30350	33.956019	-84.364044

Figure of merit

- A figure of merit is a quantity used to characterize the performance of a device, system or method, relative to its alternatives.
- For example, in High Energy Physics
  - Signal significance = signal / sqrt(signal + background)

Analysis

- **Use columns**
  - Population, density, income, med_age, age_65p, pct_femal, unemp_rate, comm_pen, mdcr_pen, uninsured, poverty_pct, foot_traffic_ind, store_age, sales_cagr, pharm_pct, comp_density_ind
- **Normalize each column**
  - Min-Max normalization

```
X_std = (X - X.min(axis=0)) / (X.max(axis=0) - X.min(axis=0))
X_scaled = X_std * (max - min) + min
```

- **Significance**
  - Signal = sum of columns for a store_num
  - background = sum of columns for other store_num

store_num	population	density	income	med_age	age_65p	pct_female
ATL7193	0.247417	1.000000	0.916667	1.000000	0.875	0.0
ATL1412	0.140839	0.867076	1.000000	1.000000	0.750	1.0
ATL7855	0.140839	0.867076	1.000000	1.000000	0.750	1.0
ATL8062	0.011550	0.849165	0.694444	1.000000	1.000	1.0
ATL6901	0.062811	0.523033	0.694444	0.714286	0.500	1.0

signal

Background

Analysis

- Significance shows the same 4 stores as RFM model
  - But difference ranking

store_num	significance	rank
ATL8062	0.580537	1
ATL7855	0.569846	2
ATL1412	0.567078	3
ATL7193	0.562837	4