

# Segmenting and Clustering Neighborhoods in Novi, MI

*Applied Data Science Capstone Project Report*

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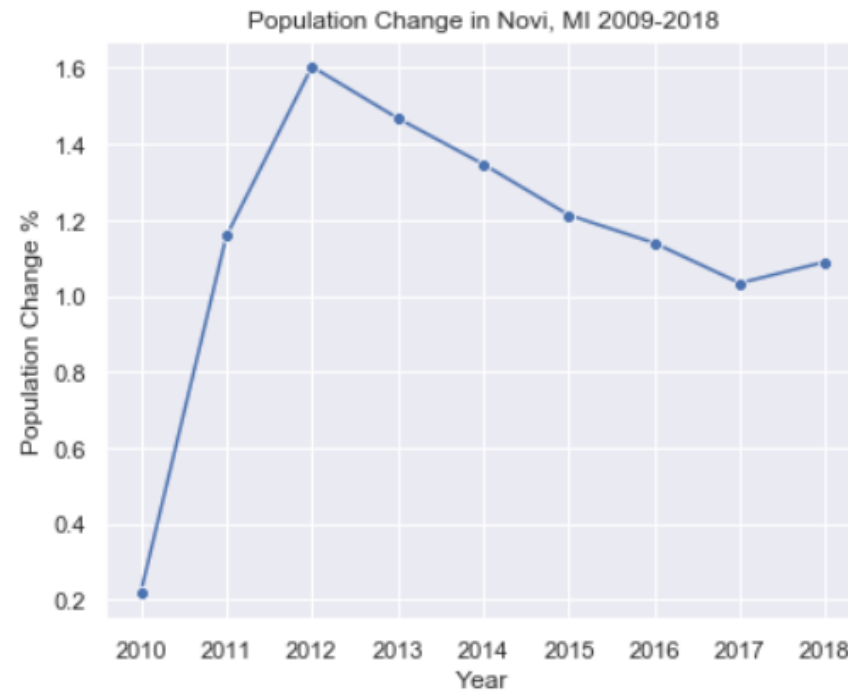
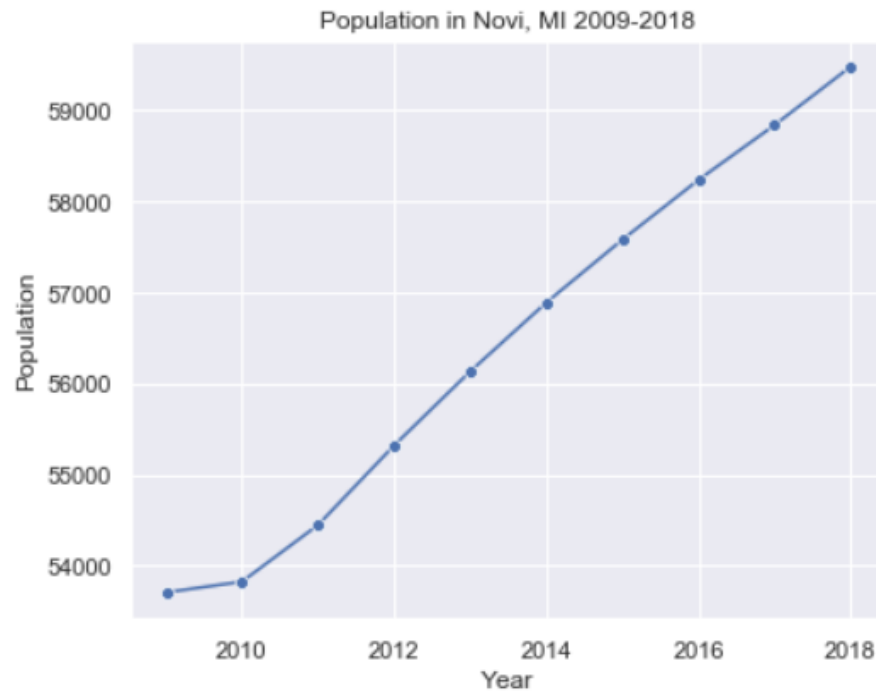
# Good Opportunity to Live in Novi

- ❖ Novi is a city in Oakland County in the U.S. state of Michigan. The city is located approximately 25 miles northwest of the center of Detroit.
- ❖ The location of Novi is great in Michigan, it is close to all Big-3 companies, and it also commutes easily to all other major companies in Michigan.
- ❖ Novi is the one of the fastest growing cities in Michigan today

# Data Acquisition and Cleaning

- ❖ Most data and information about the City of Novi can be found in the City of Novi Open Data Center:
  - [https://www.opendatanetwork.com/entity/16000000US2659440/Novi\\_MI/](https://www.opendatanetwork.com/entity/16000000US2659440/Novi_MI/)
- ❖ Use BeautifulSoup to pull data out of HTML and XML files, and parse data to find ways of navigating and searching the useful information.
- ❖ Use json library to convert parsed data into lists or dictionaries
- ❖ Combine all related lists and dictionaries into different DataFrames by using Pandas library.
- ❖ Drop all missing values in the DataFrame and reorganize some DataFrame

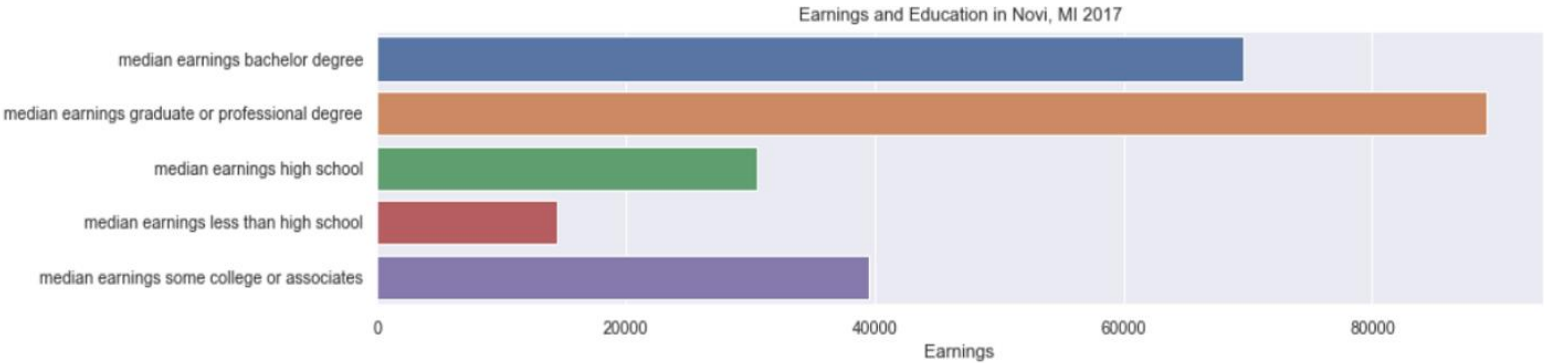
# Population Increases Continuously While the City Is Growing



# More People with High Income and Education Move to Novi

	Earning
female median earnings	36142
male median earnings	72766
median earnings	52249

	Education	Earnings
0	median earnings bachelor degree	69651
1	median earnings graduate or professional degree	89234
2	median earnings high school	30475
3	median earnings less than high school	14514
4	median earnings some college or associates	39578



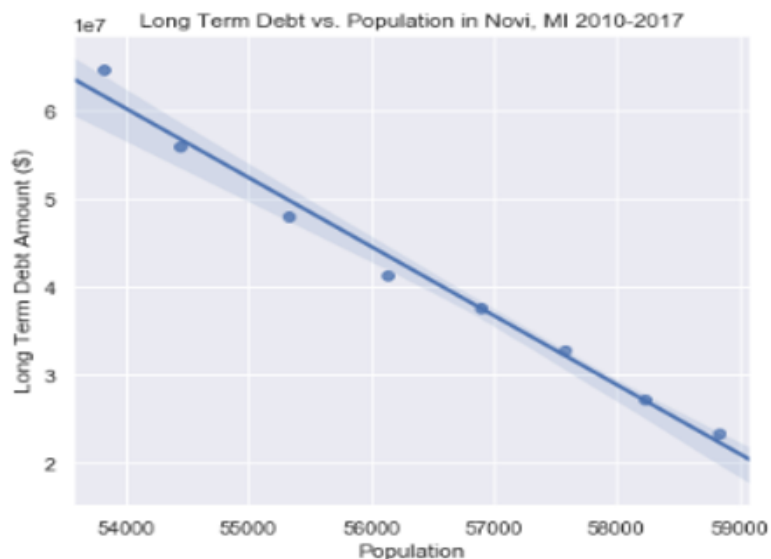
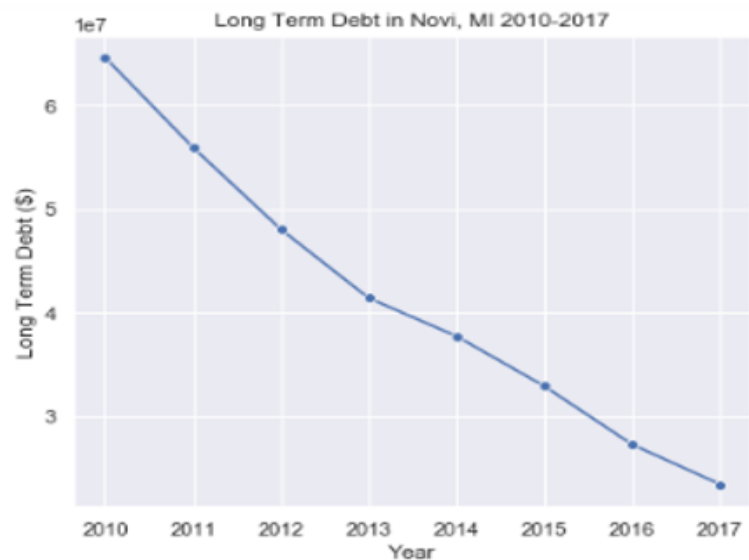
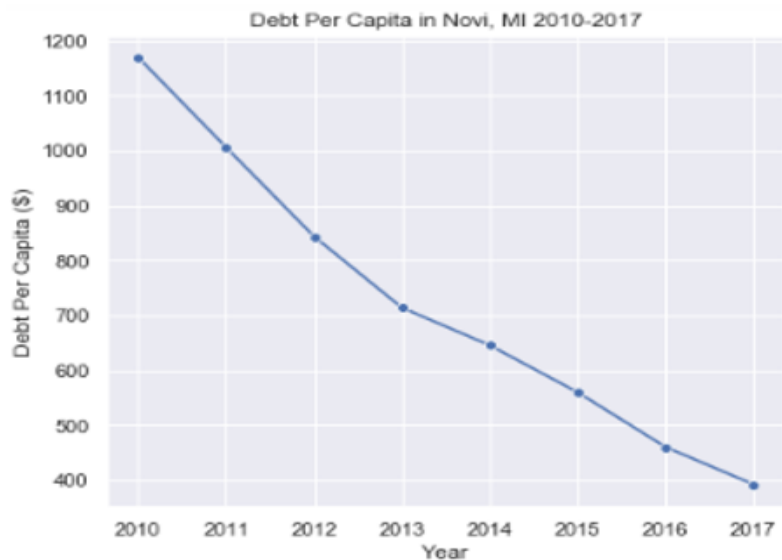
# City Debt VS. Revenue (1)

- ❖ Debt refers to the total amount of outstanding dollars owed by a government entity.
- ❖ Debt Per Capita is the amount of outstanding debt per resident.
- ❖ Long Term Debt is the unmatured principal of bonds, or other forms of noncurrent or long-term obligation indebtedness.
- ❖ Debt Service Ratio is the percentage of annual revenues committed to paying back debts.
- ❖ Debt as a Percentage of Taxable Value is the amount of long term debt compared to taxable value.
- ❖ Long Term Debt Revenue is the ratio of outstanding long term debts to revenues.

# City Debt VS. Revenue (2)

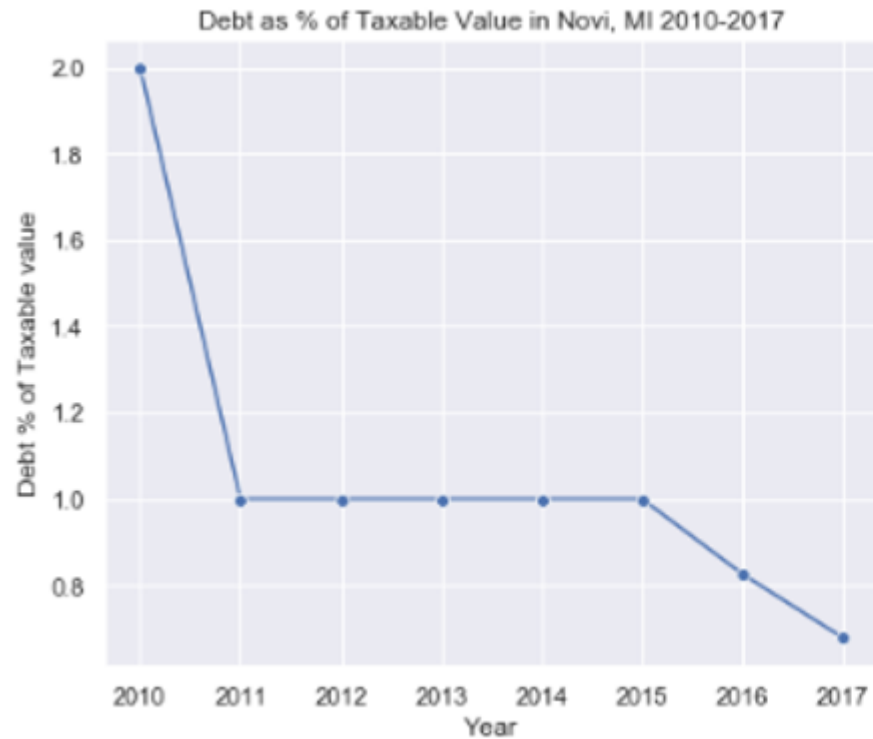
	Year	Long Term Debt	Population	Debt Per Capita	Debt Service %	Debt % of Taxable value	Debt % Revenue
0	2010	64613290	53823.0	1170.02	12.0	2.000000	76.0
1	2011	55925472	54446.0	1006.16	12.0	1.000000	66.0
2	2012	48022654	55319.0	843.80	11.0	1.000000	60.0
3	2013	41379833	56131.0	713.93	8.0	1.000000	49.0
4	2014	37695000	56887.0	645.28	5.0	1.000000	40.0
5	2015	32870000	57577.0	559.74	5.0	1.000000	32.0
6	2016	27235000	58233.0	459.96	13.0	0.825766	23.0
7	2017	23400000	58835.0	391.86	3.0	0.678238	24.0

# City Debt VS. Revenue (3)



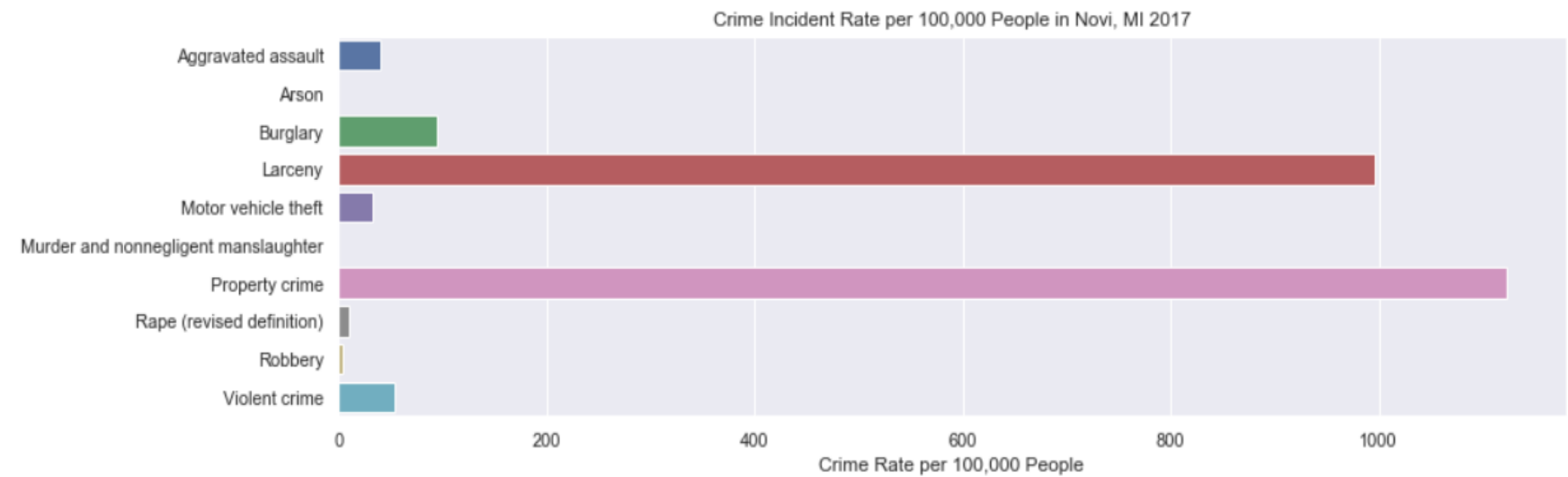


# City Debt VS. Revenue (4)

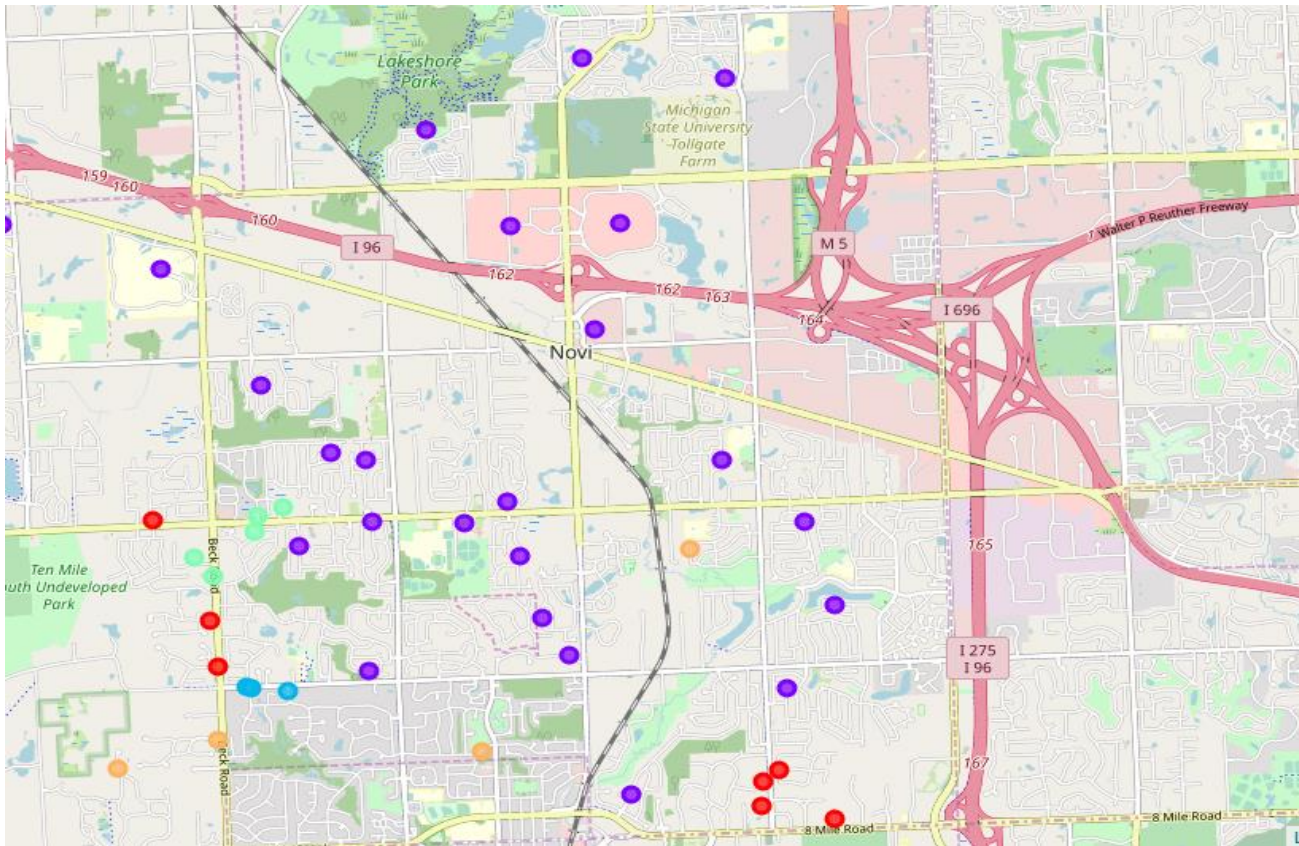


# Crime Incident Rate Is Low

	Crime	Count
0	Aggravated assault	24
1	Arson	0
2	Burglary	56
3	Larceny	586
4	Motor vehicle theft	19
5	Murder and nonnegligent manslaughter	0
6	Property crime	661
7	Rape (revised definition)	6
8	Robbery	2
9	Violent crime	32



# Explore and Cluster the Neighborhoods in Novi



- ❖ Use the *k-means clustering algorithm* to group the neighborhoods into clusters
- ❖ Use the *Folium library* to visualize the neighborhoods in Novi

# Result

- ▶ Data shows more and more high income and education population come and live in Novi in the past 10 years. At the same time, more and more business opportunities occurs, and the city has more revenue and less debt while the city is growing. Also, the high population does not increase the crime incident significantly. The crime incident per population density is still very low.
- ▶ Overall, Novi is the one of the best city to live in Michigan and it is also the one of the fastest growing city. Better living condition, school district and safety will attract more high income and education people move to Novi, then those people will bring more benefit and opportunities to the city. It is a great virtuous cycle.

# Discussion

There are more and more business opportunities in Novi. Based on the data analysis, machine learning and cluster visualization, we can see that maybe the best place to open a coffee shop will be at the section of Ten Mile Rd and Novi Rd.

The reason is:

- ❖ The center of the city.
- ❖ A lot of subdivisions locate around that section.
- ❖ Close to the entry of the heavily used highway in Novi.