

Identify the Safety Level of Precincts in NYC

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Introduction

- Identify the safety level of each precinct and borough according to past complaints records
- Explore the relationship between offense-level, time and precincts in New York City.

Data Understanding

- New York Police Department Public Data
- The origin dataset contains 23 columns, we only use 7 of them
- 2,714,699 complaints in total, from 2012 to 2015

date	type	level	borough	precinct	Latitude	Longitude
12/31/2015	COMPLETED	FELONY	BRONX	44	40.82884833	-73.91666114
12/31/2015	COMPLETED	FELONY	QUEENS	103	40.69733814	-73.78455674
12/31/2015	COMPLETED	FELONY	MANHATTAN	28	40.80260661	-73.94505191
12/31/2015	COMPLETED	MISDEMEANOR	QUEENS	105	40.65454944	-73.72633879
12/31/2015	COMPLETED	MISDEMEANOR	MANHATTAN	13	40.7380024	-73.98789129

- New York City Population (CITY POPULATION)

	2010/4/1	2017/7/1	average
Bronx	1,384,794	1,471,160	1,427,977
Brooklyn (Kings County)	2,504,706	2,648,771	2,576,739
Manhattan (New York County)	1,586,184	1,664,727	1,625,456
Queens	2,230,545	2,358,582	2,294,564
Staten Island (Richmond County)	468,730	479,458	474,094

Data Preparation

Network Construction

- For each precinct, calculate the number of complaints base on different type (attempted / completed) and offense level (misdemeanor / violation / felony).
- Assign the scores base on type, level and number of complaints.
- Calculate the average longitude and latitude of each precinct.
- Compute the pair-wise Euclidean distance of precincts base on standardized scores, longitude and latitude.

Sum of complaints to score							
precinct	type	level	sum	precinct	score	Longitude	Latitude
1	ATTEMPTED	FELONY	13	1	146628	-74.0072	40.71467
1	ATTEMPTED	MISDEMEANOR	13	5	109821.5	-73.9945	40.71974
1	COMPLETED	FELONY	387	6	149168	-74.0003	40.73396
1	COMPLETED	MISDEMEANOR	738	7	97597	-73.9856	40.71675
1	COMPLETED	VIOLATION	138	9	151915.5	-73.985	40.72701

Adjacent Matrix to Edge

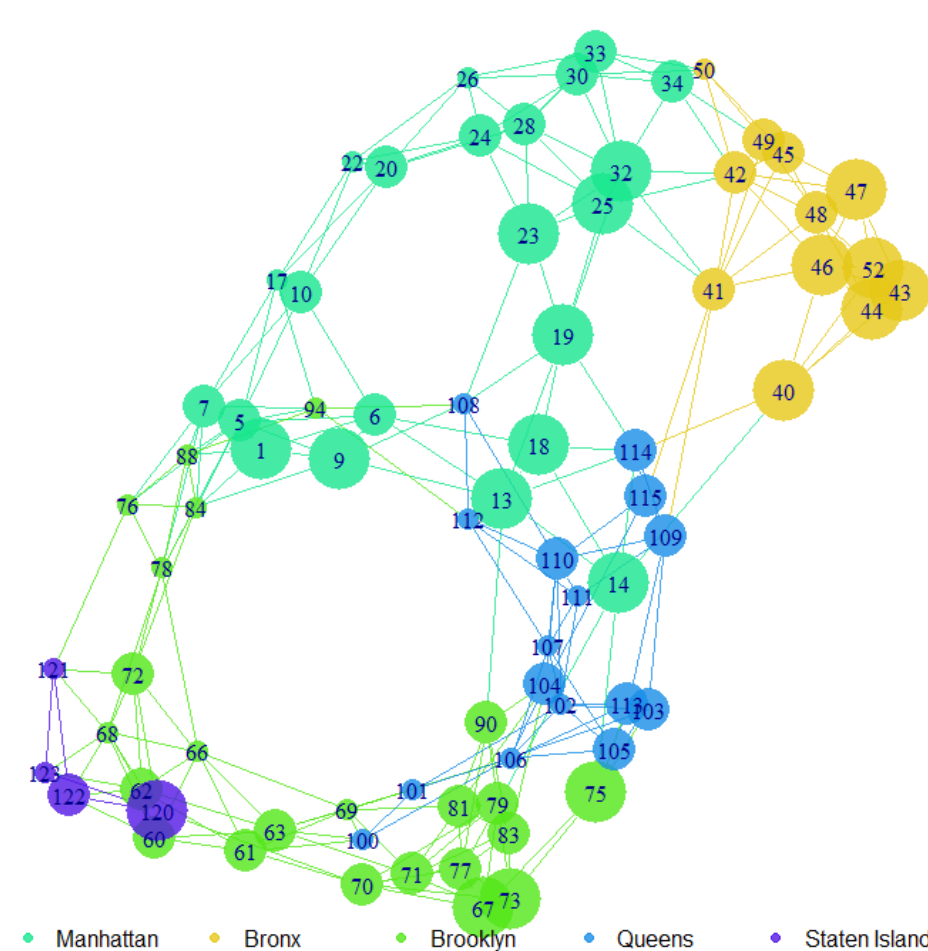
	1	5	6	7	9		1	5	6	7	9
1	0	0.10193	0.064265	0.119148	0.059535	1	0	0	0.935735	0	0.940465
5	0.10193	0	0.0798	0.024324	0.096966	5	0.89807	0	0.9202	0.975676	0.903034
6	0.064265	0.0798	0	0.099073	0.045841	6	0.935735	0.9202	0	0	0.954159
7	0.119148	0.024324	0.099073	0	0.108979	7	0.880852	0.975676	0.900927	0	0
9	0.059535	0.096966	0.045841	0.108979	0	9	0.940465	0.903034	0.954159	0	0

- Compute the similarity and reserve top 5 of each precinct.

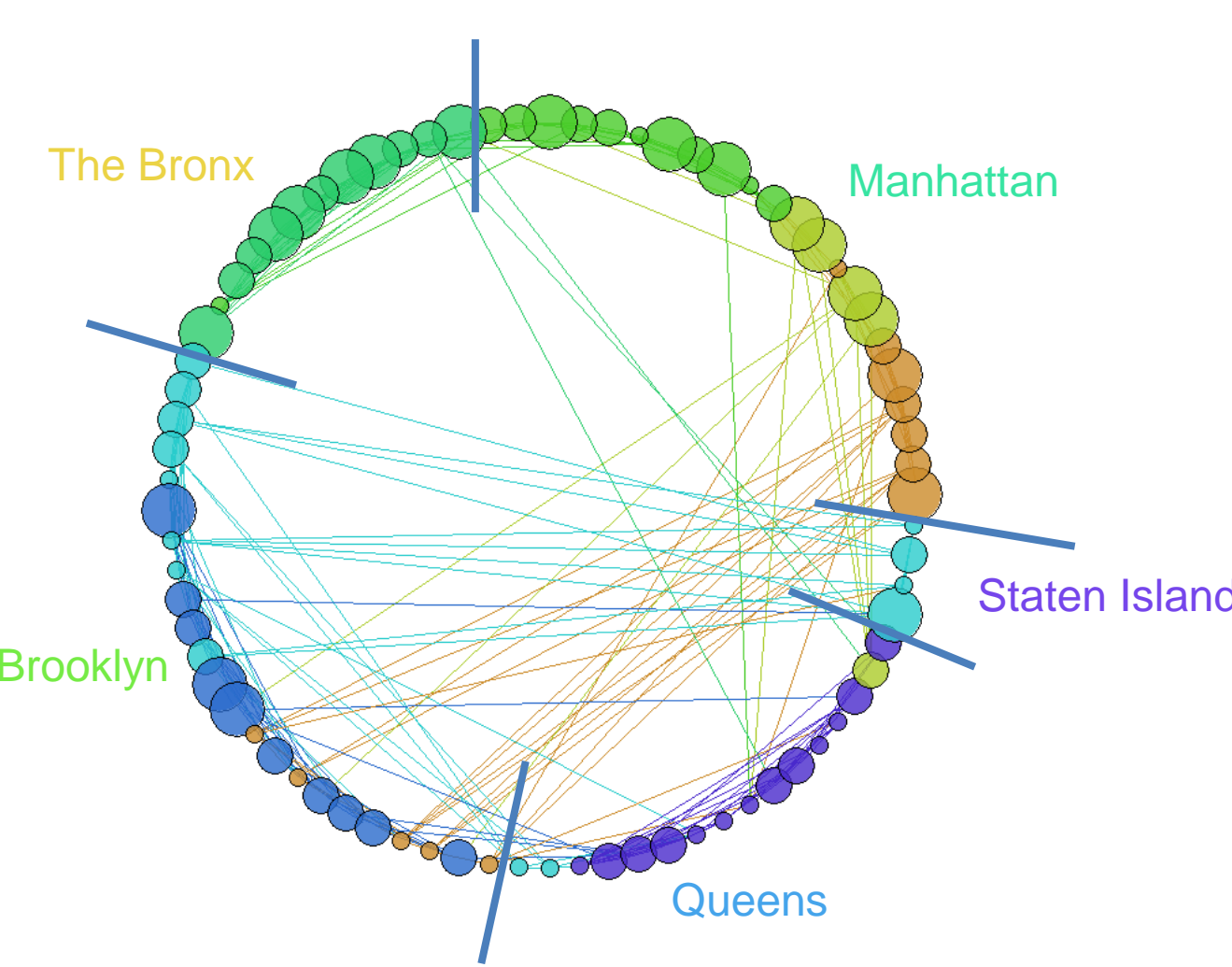
Networks and Analysis

Overall view

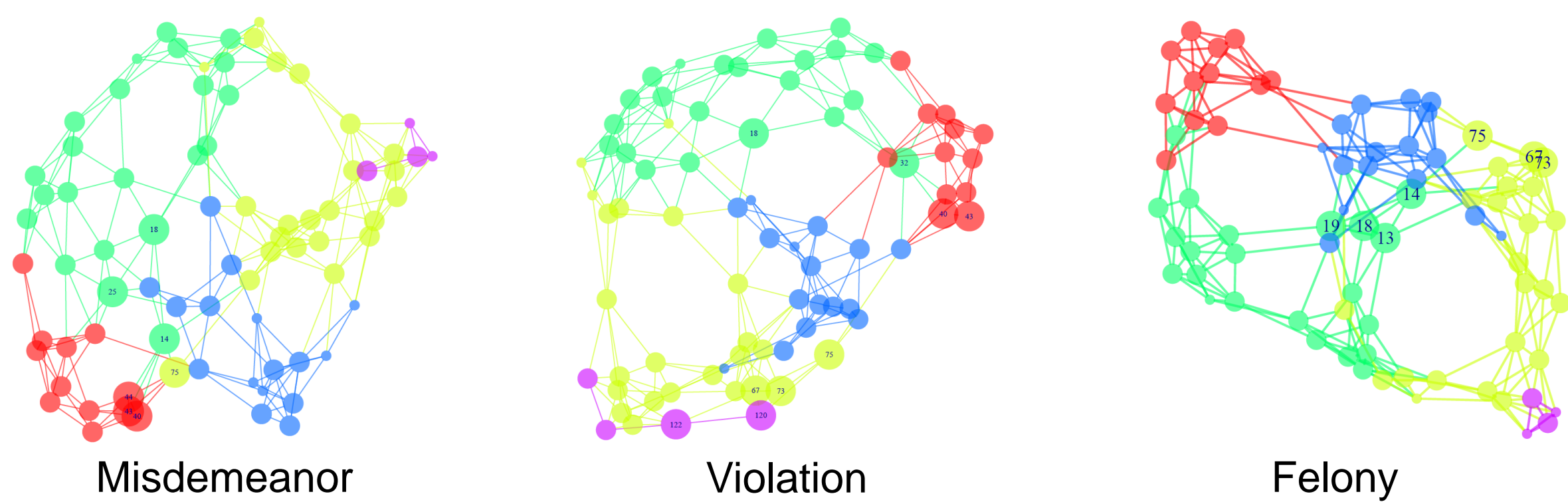
Overall Network



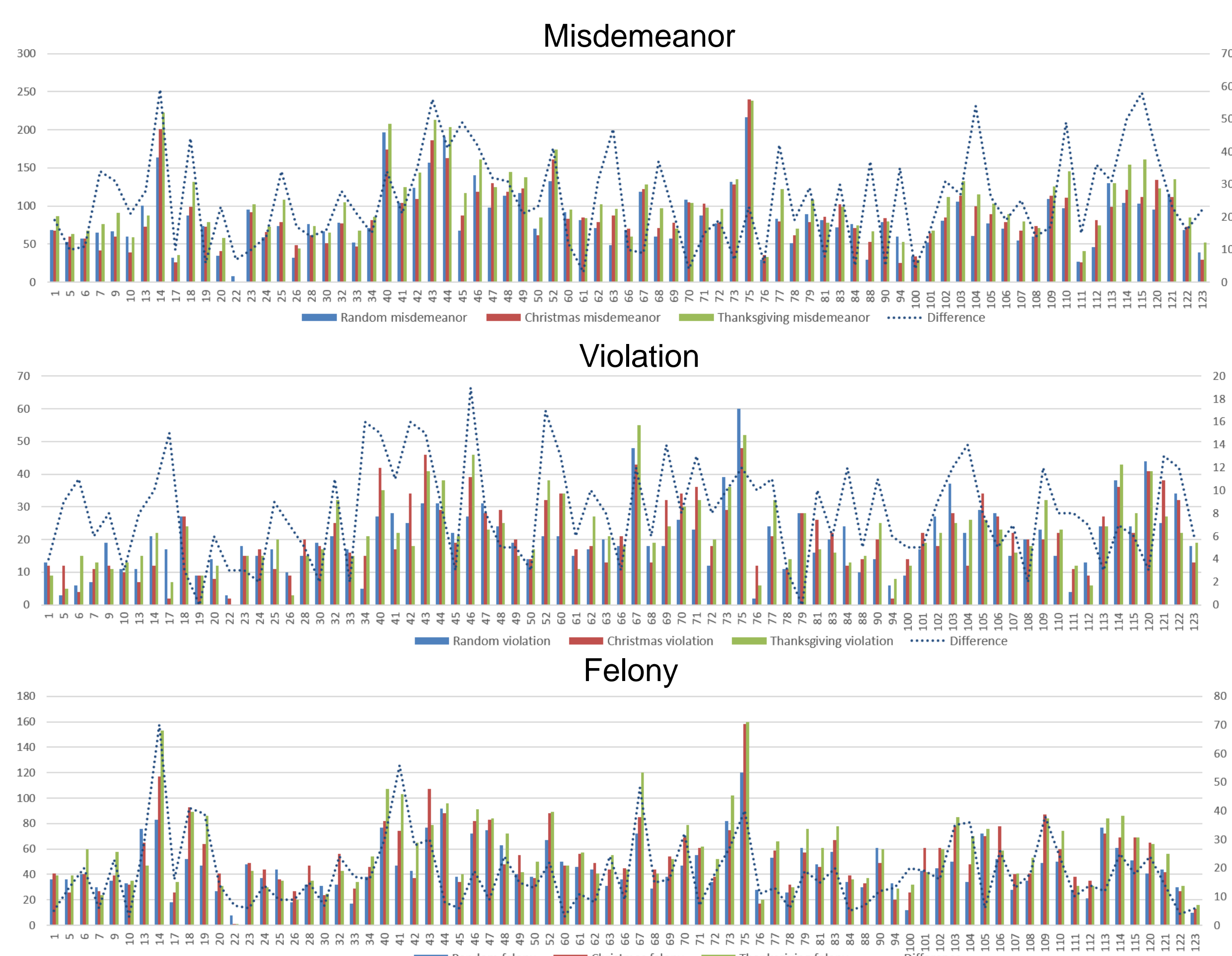
Communities



Networks Based on Different Offense Level

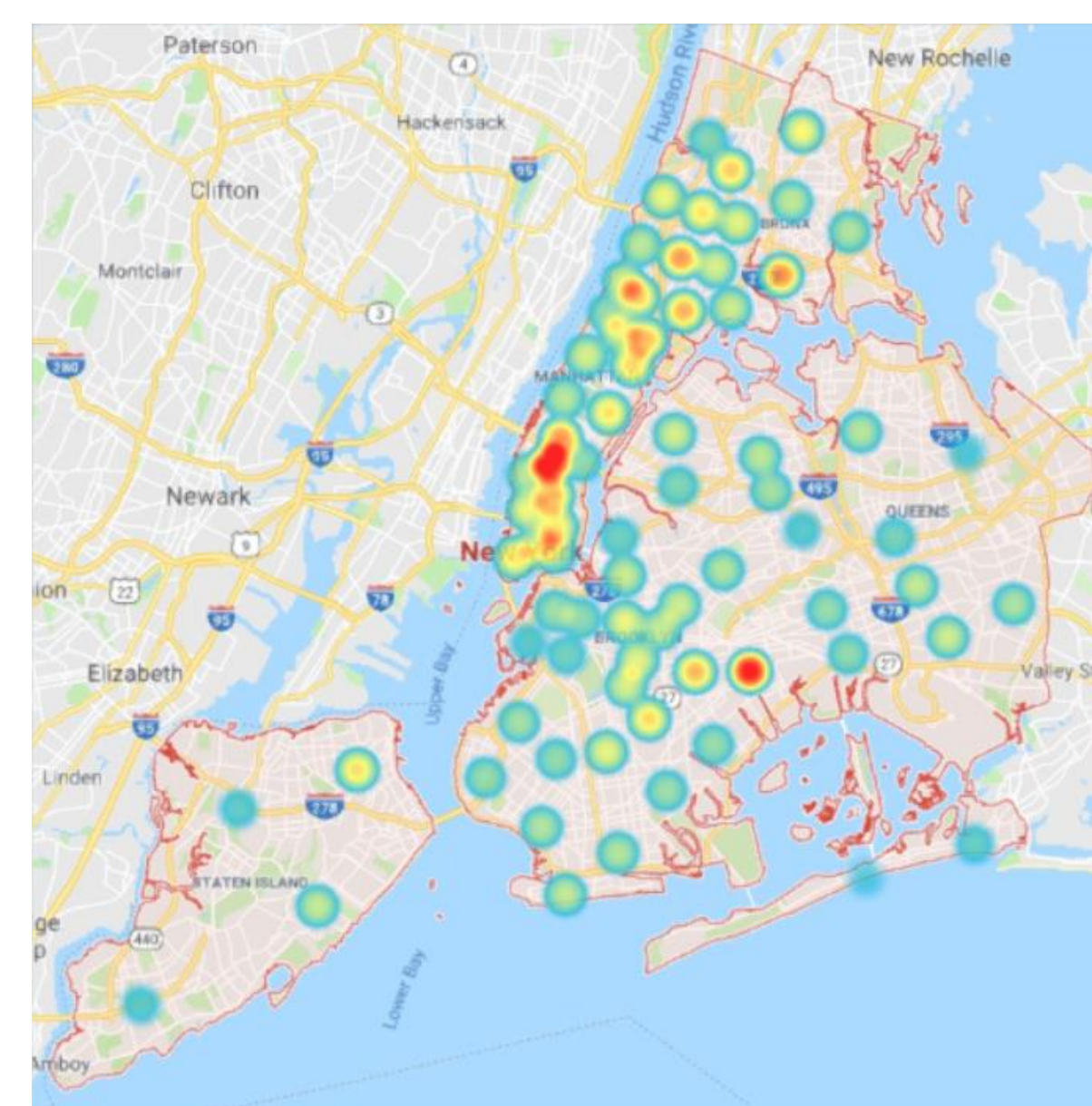


Number of Crimes vs Special Days

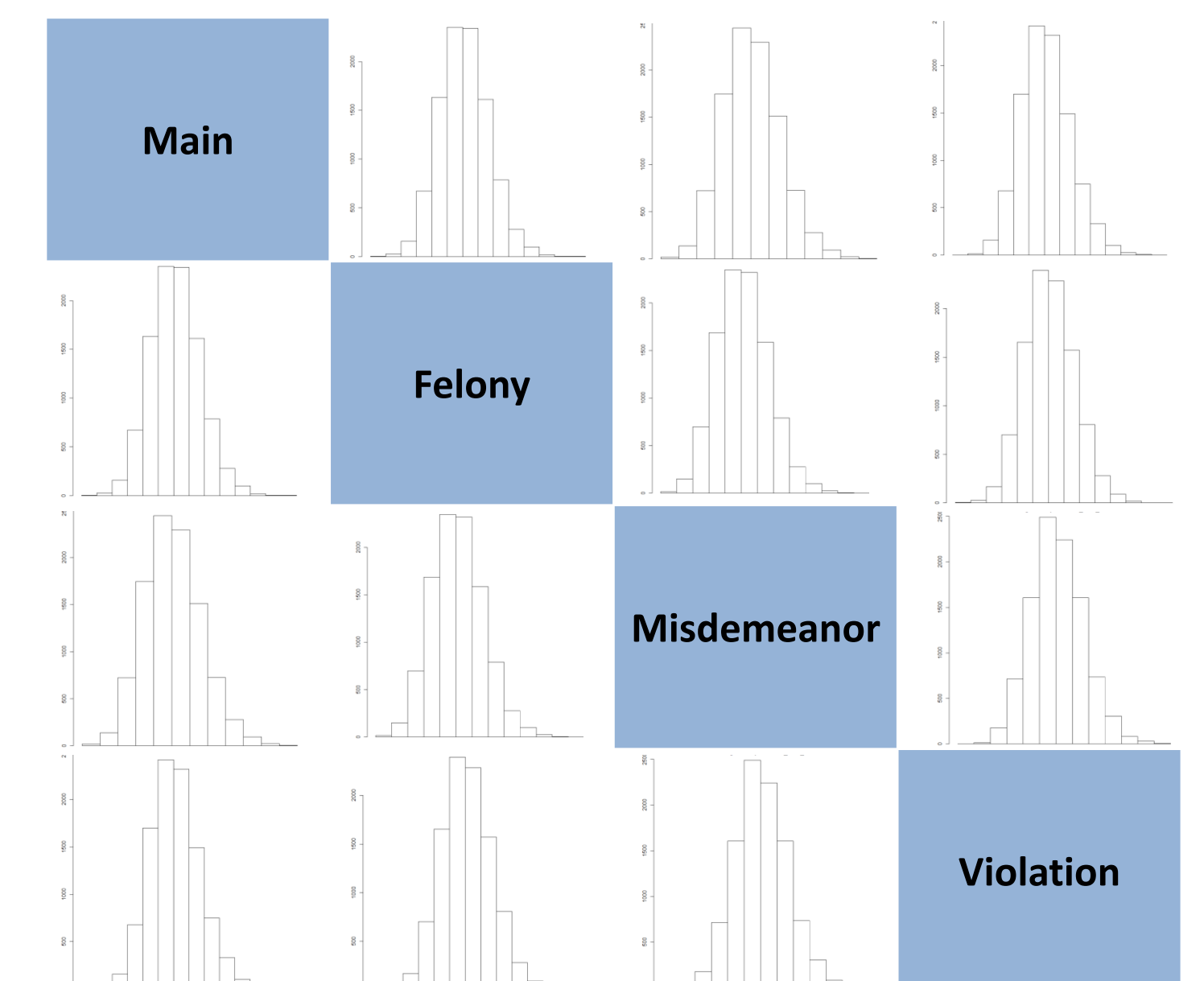


Analysis

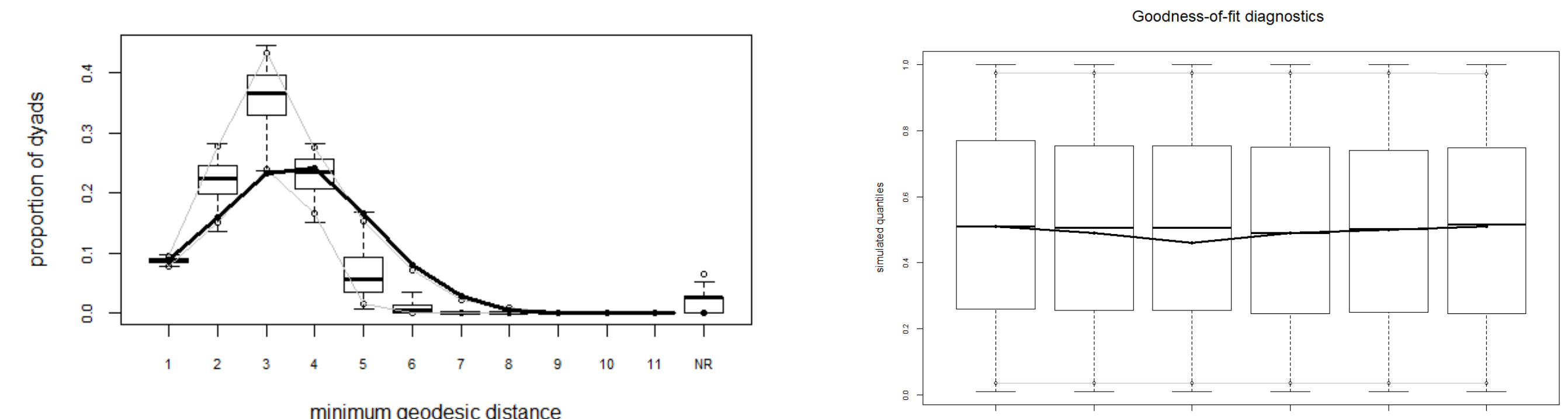
Crime Rate vs Precinct



QAP Tests(Quadratic Assignment Procedure)



ERGM(Exponential random graph model)



The ERGM plots above show the vital variables which can affect the network connection most.

Conclusion

- Precinct 14 in Manhattan and precinct 75 in Brooklyn has the highest crime rate and number of complaints.
- During Christmas and Thanksgiving, more misdemeanor and felony type of crimes, but less violation type of crimes than normal days in most precincts.
- According to QAP tests, precincts have almost the same probability of crime occurrence.
- The ERGM plots illustrates that the boroughs, the communities and the transitivity contributes the most to the network connection.
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