A low-angle, upward-looking photograph of several modern skyscrapers in a city, likely New York City. The sun is setting or rising behind the buildings, creating a strong orange and yellow glow that reflects off the glass facades. The sky is a mix of blue and orange. A white curved line separates the image from the text on the right.

Spatial- Temporal Pattern of Drug Related Crime in New York City: A Comprehensive Data Analysis

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- Stephen Dong
- Kai Lu
- Xuehai Yan
- Ali Hussain

Significance

Drug-related crime is a persistent issue in NYC, New York.

Understanding the dynamics of drug-related crime can have significant implications for law enforcement and policymakers.

Research in this field can provide insights into underlying factors of drug-related crime.

Investigate the correlation between crime and factors such as: geography, population, race, etc.

Dataset Overview

	C MPLNT_NUM	C MPLNT_FR_DT	C MPLNT_FR_TM	C MPLNT_TO_DT	C MPLNT_TO_TM	ADDR_PCT_CD	RPT_DT	KY_CD	OFNS_DESC	PD_CD	...	LOC_OF_OCCUR_DESC	PREM_TYP_DESC	JURIS_DESC	PARKS_NM
0	80488152	08/27/2011	02:00:00	NaN	(null)	41.0	08/27/2011	117	DANGEROUS DRUGS	503	...	(null)	STREET	N.Y. POLICE DEPT	(null)
1	25436757	11/21/2000	19:10:00	11/21/2006	19:15:00	75.0	11/21/2006	235	DANGEROUS DRUGS	511	...	(null)	STREET	N.Y. POLICE DEPT	(null)
2	10354189	02/09/2005	21:25:00	02/09/2006	21:30:00	113.0	02/09/2006	117	DANGEROUS DRUGS	503	...	INSIDE	RESIDENCE-HOUSE	N.Y. POLICE DEPT	(null)
3	10049866	01/10/2005	21:50:00	NaN	(null)	42.0	01/10/2006	117	DANGEROUS DRUGS	503	...	(null)	STREET	N.Y. POLICE DEPT	(null)
4	26116195	01/04/2005	19:18:00	NaN	(null)	48.0	01/04/2007	235	DANGEROUS DRUGS	511	...	INSIDE	RESIDENCE - APT. HOUSE	N.Y. POLICE DEPT	(null)
...
443490	261180996	12/31/2022	22:59:00	12/31/2022	23:42:00	48.0	12/31/2022	117	DANGEROUS DRUGS	503	...	FRONT OF	STREET	N.Y. POLICE DEPT	(null)
443491	261166565	12/31/2022	11:53:00	12/31/2022	11:55:00	28.0	12/31/2022	117	DANGEROUS DRUGS	501	...	INSIDE	STREET	N.Y. POLICE DEPT	(null)

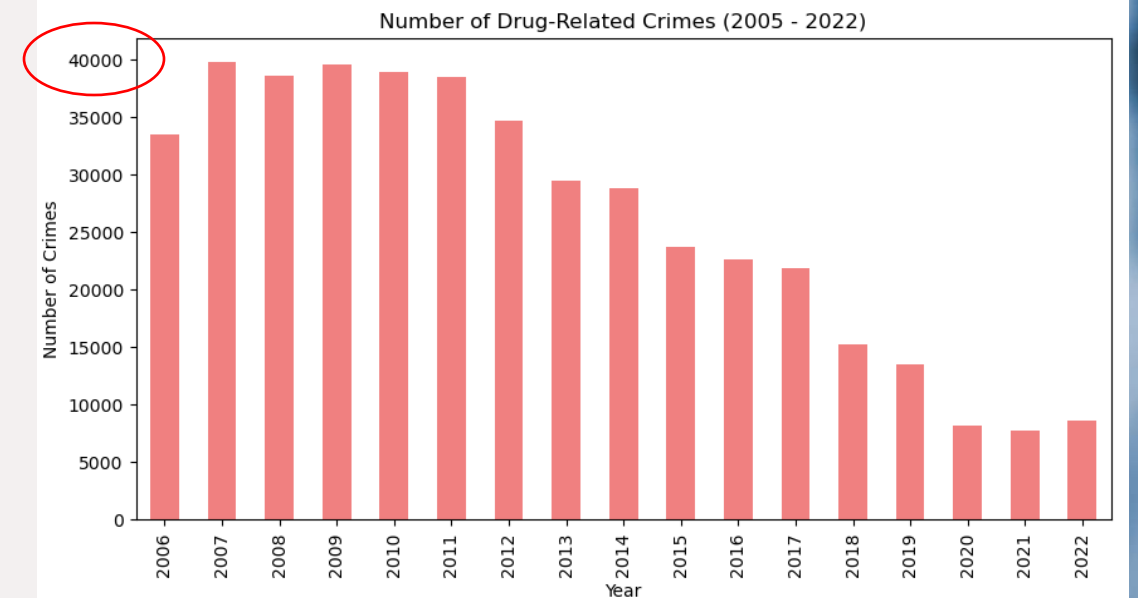
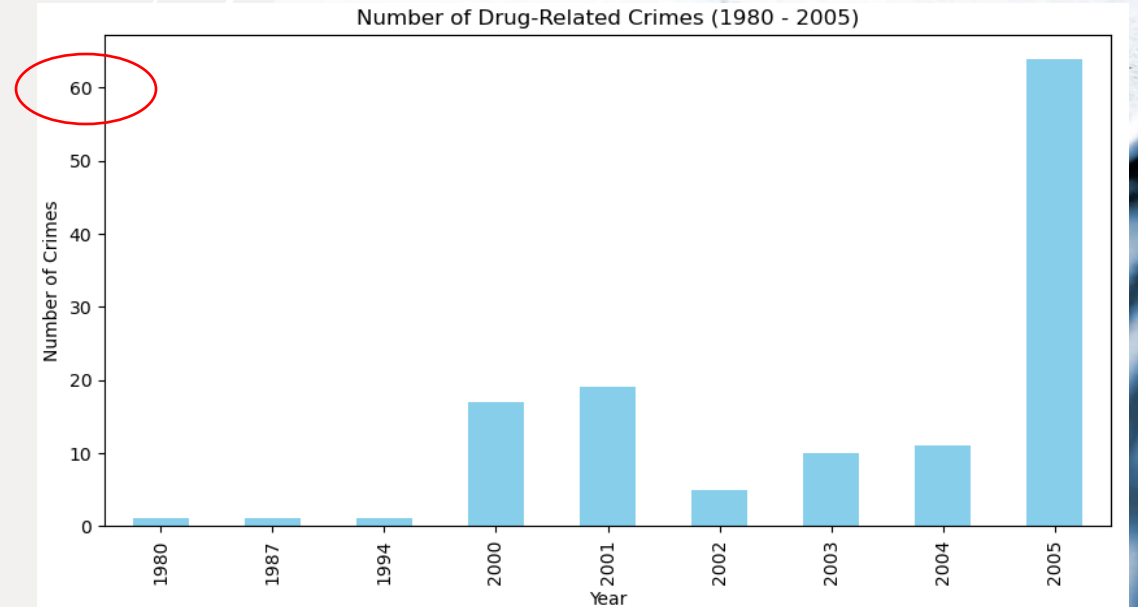
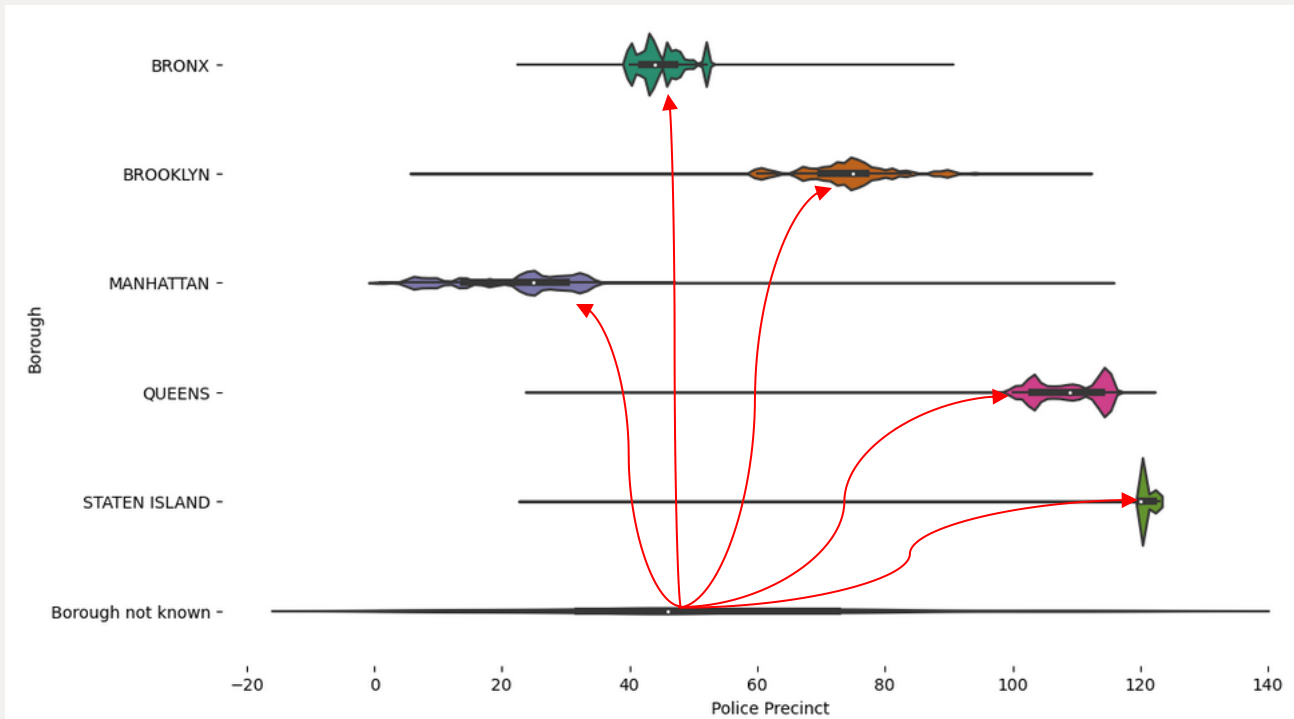
Orig	Order	GeoType	Borough	GeoID	Name	NTA	Type	Pop_10	Pop_20	Pop Change	Natural Change	Net Migration
0	1	NYC	New York City	0	NYC (adjusted for citywide total population in...		NaN	8,242,624	8,804,190	561,566	612,638	-51,072
1	2	Boro	Manhattan	1	Manhattan		NaN	1,585,873	1,694,251	108,378	81,949	26,429
2	3	Boro	Bronx	2	Bronx		NaN	1,385,108	1,472,654	87,546	114,402	-26,856
3	4	Boro	Brooklyn	3	Brooklyn		NaN	2,504,700	2,736,074	231,374	246,479	-15,105
4	5	Boro	Queens	4	Queens		NaN	2,230,722	2,405,464	174,742	152,976	21,766
...
263	264	NTA2020	Staten Island	SI0391	Freshkills Park (South)		9.0	97	95	-2	9	-11
264	265	NTA2020	Staten Island	SI9561	Fort Wadsworth		6.0	731	495	-236	120	-356
265	266	NTA2020	Staten Island	SI9591	Hoffman & Swinburne Islands		9.0	0	0	0	0	0
266	267	NTA2020	Staten Island	SI9592	Miller Field		9.0	31	46	15	-1	16
267	268	NTA2020	Staten Island	SI9593	Great Kills Park		9.0	0	5	5	0	5

Data Preprocessing and Cleaning

- Excluded less insightful/redundant features (e.g. latitude, longitude with (latitude, longitude)) to research.
- Removed NaNs and transformed null values.
- Renamed columns for interpretability.
- Parsed date and time data to focus on year and hour of the crime committed.
- Performed web scraping to map precinct numbers to addresses.



Using Visualizations for Preprocessing



1

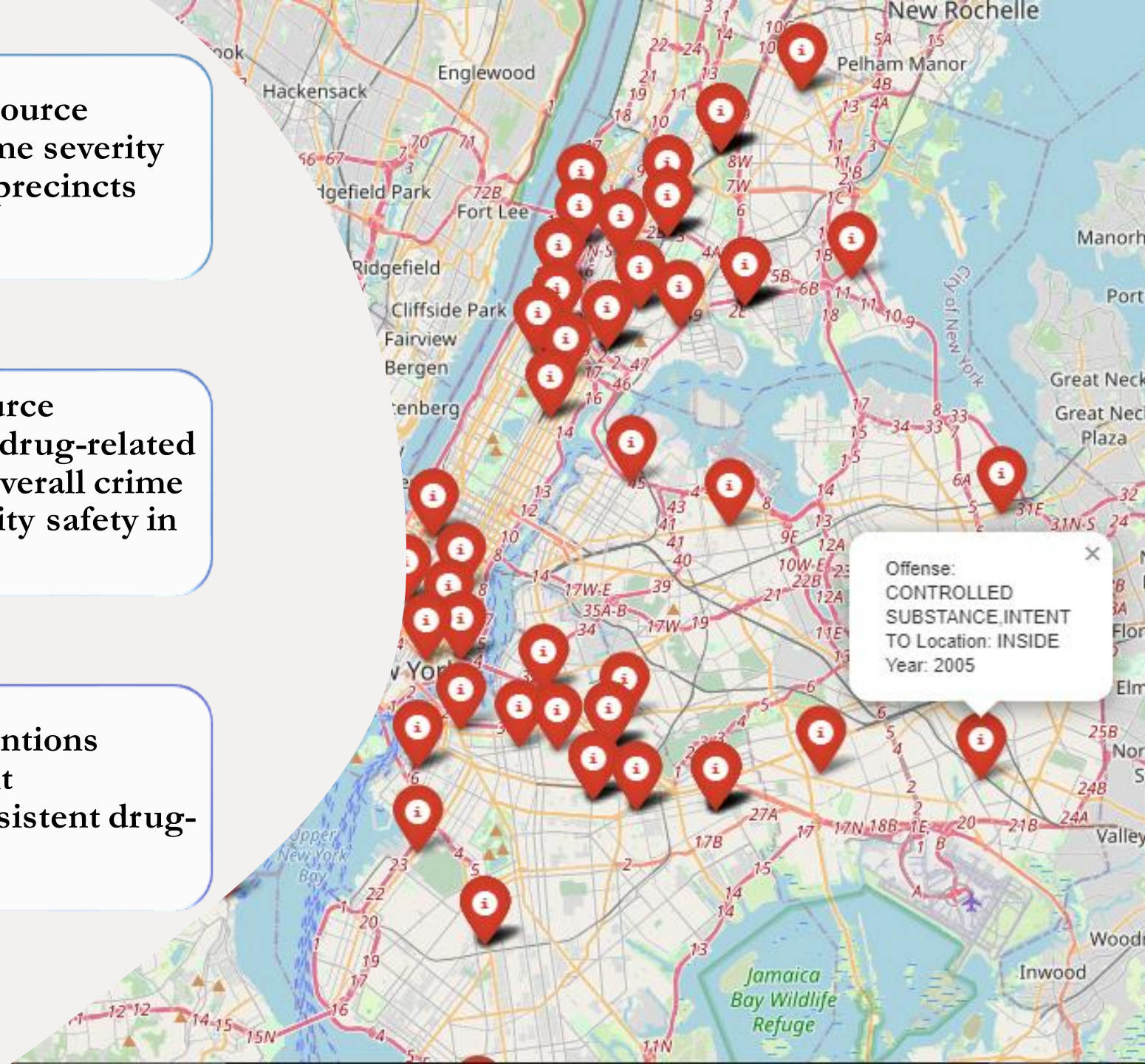
- How can we improve resource allocation to address crime severity differences across NYC precincts and boroughs?

2

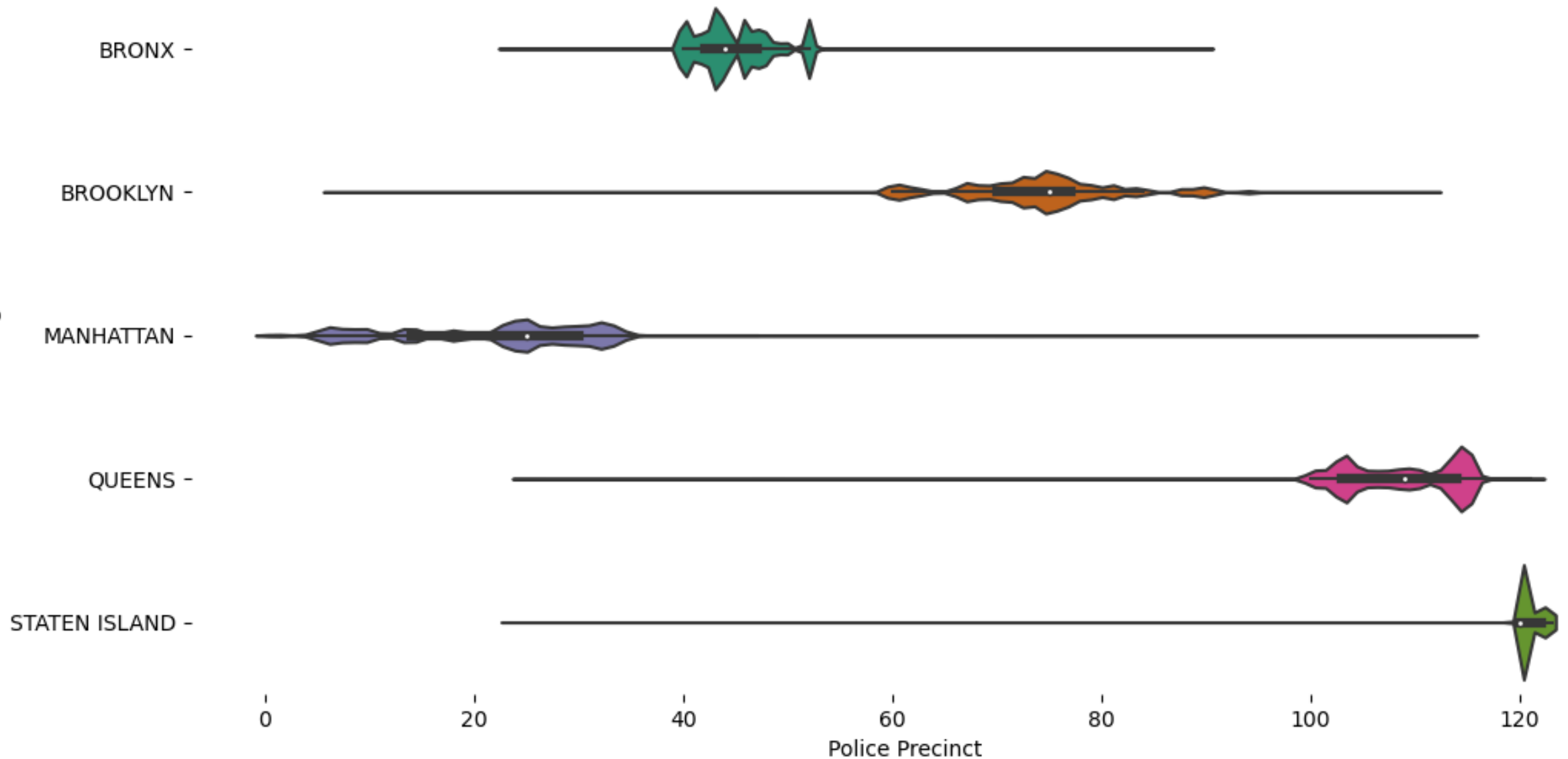
- How does targeted resource deployment in high-risk drug-related incident areas enhance overall crime deterrence and community safety in NYC?

3

- How can specific interventions enhance law enforcement effectiveness against persistent drug-related crimes in NYC?



Borough



Detecting Discrepancies in the Severity of Drug-Related Criminal Incidents via Violin Plot Analysis

Location of Occurrence

FRONT OF

INSIDE

Location not known

OPPOSITE OF

REAR OF

BRONX

BROOKLYN

MANHATTAN

QUEENS

STATEN ISLAND

Borough

60000

50000

40000

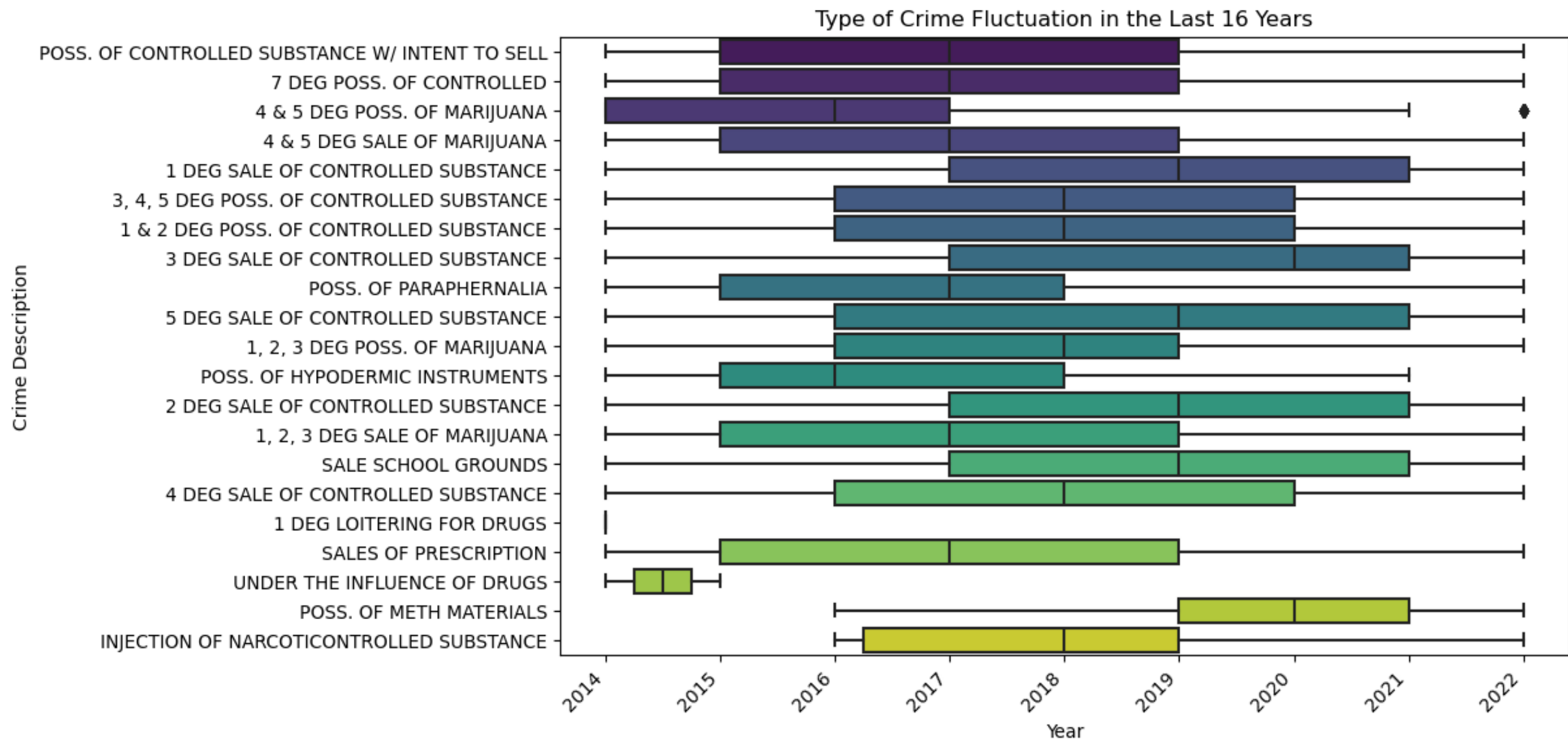
30000

20000

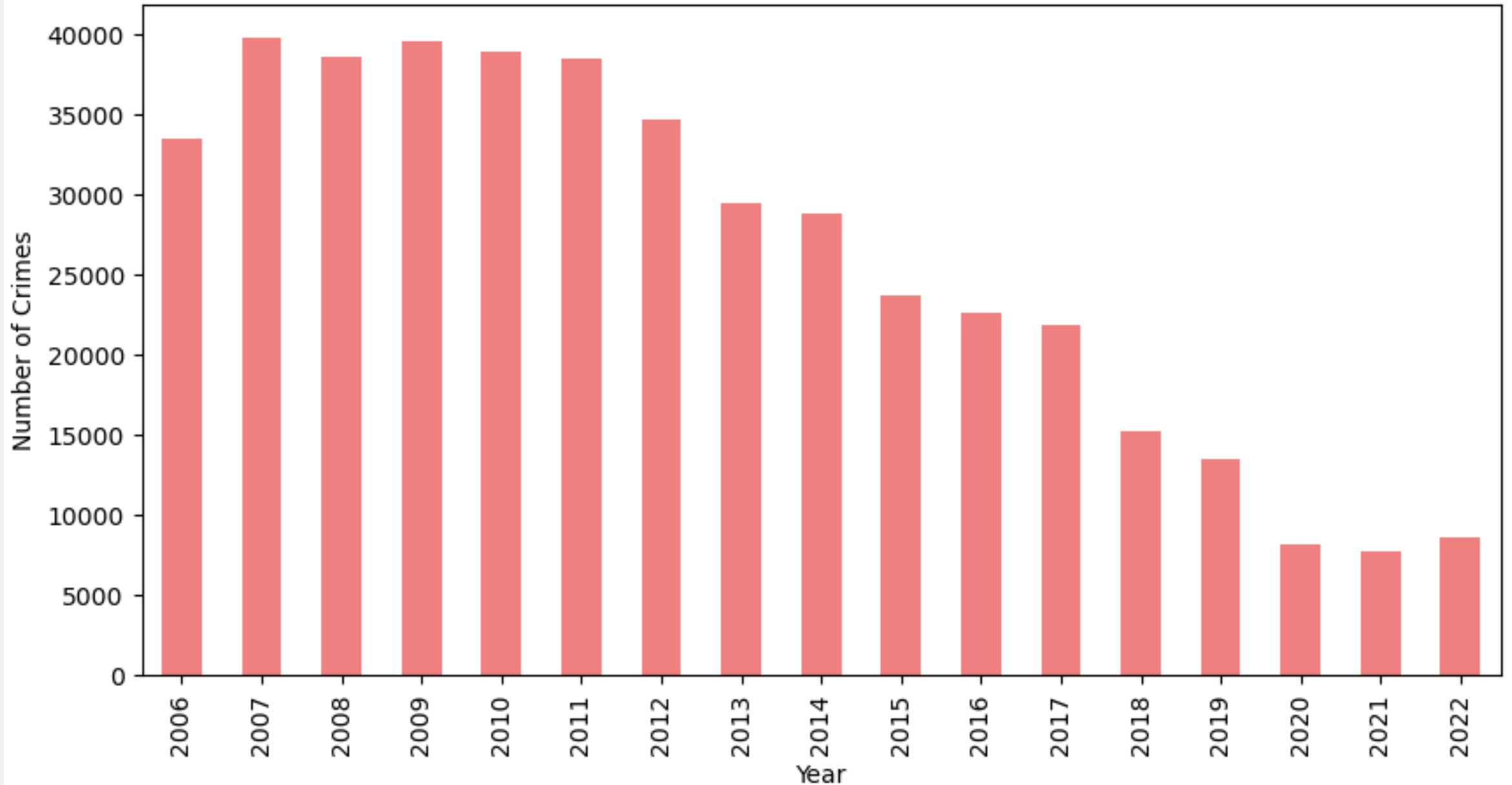
10000

Identifying
High-Risk
Areas
for
Drug Related
Incidents
in
NYC
through
Heat Map

Temporal Trends: Analyzing 16 Years of NYC Drug-Related Crimes through Box Plots

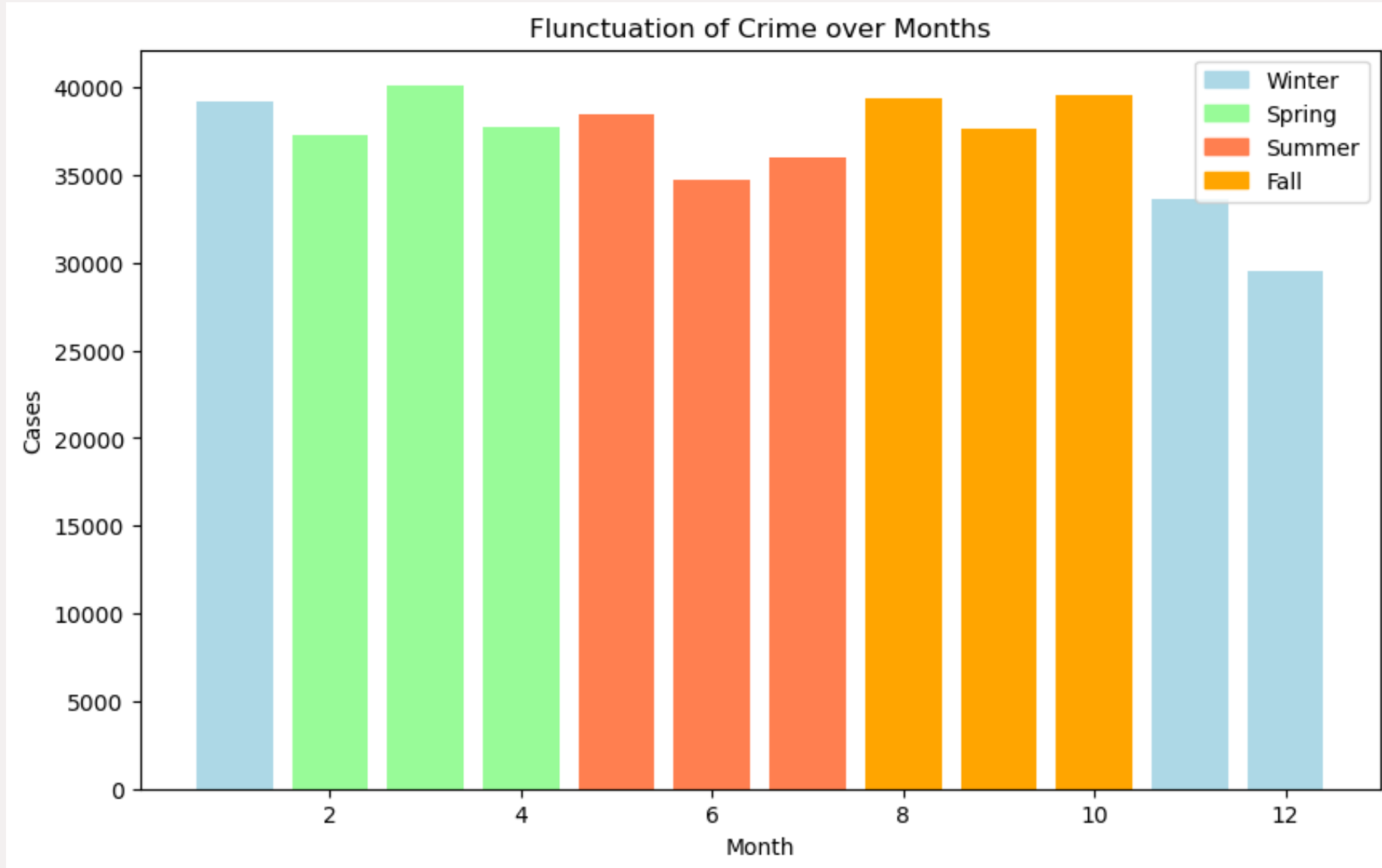


Number of Drug-Related Crimes (2005 - 2022)

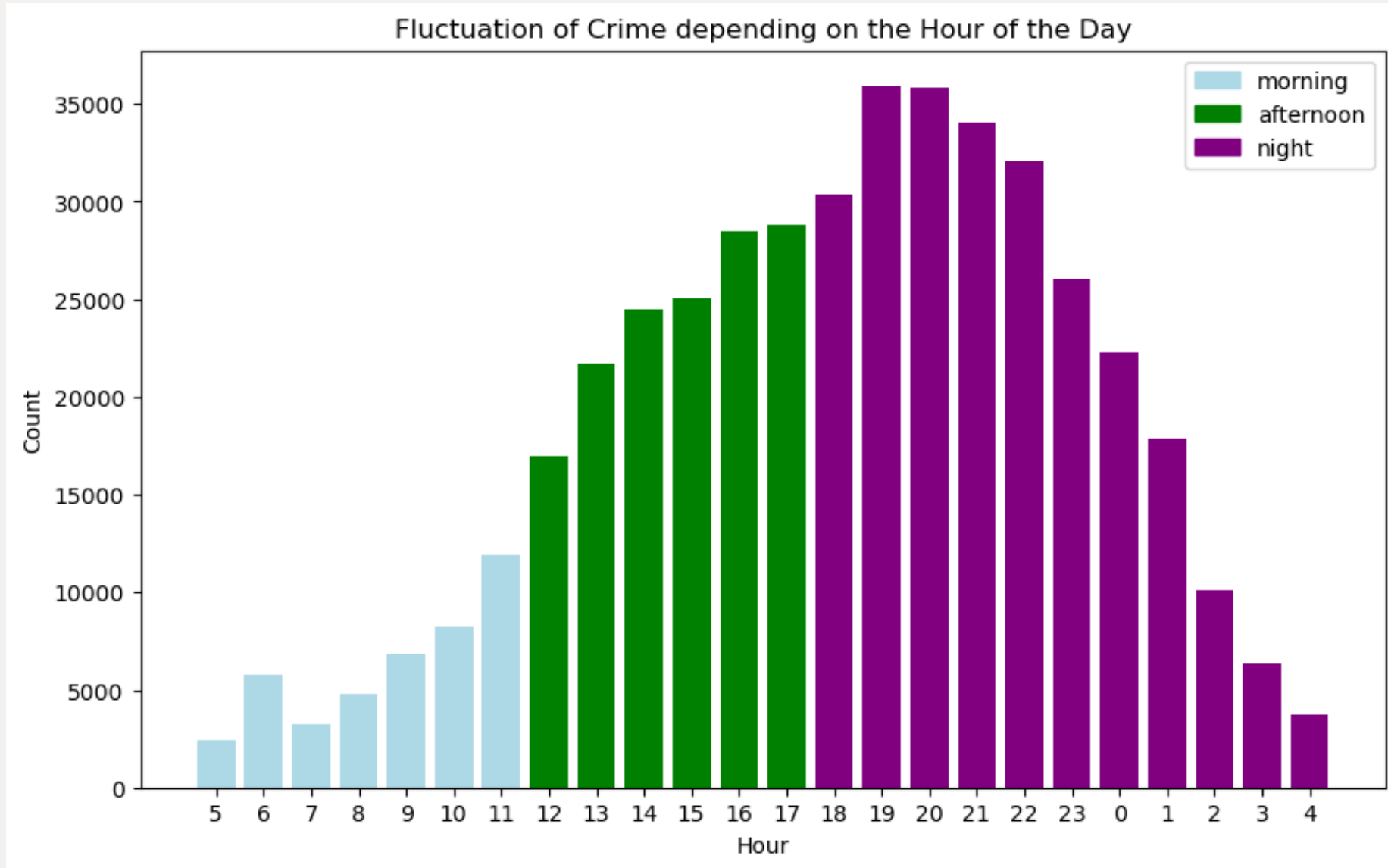


Change in the Number of Crimes Between 2006 - 2022

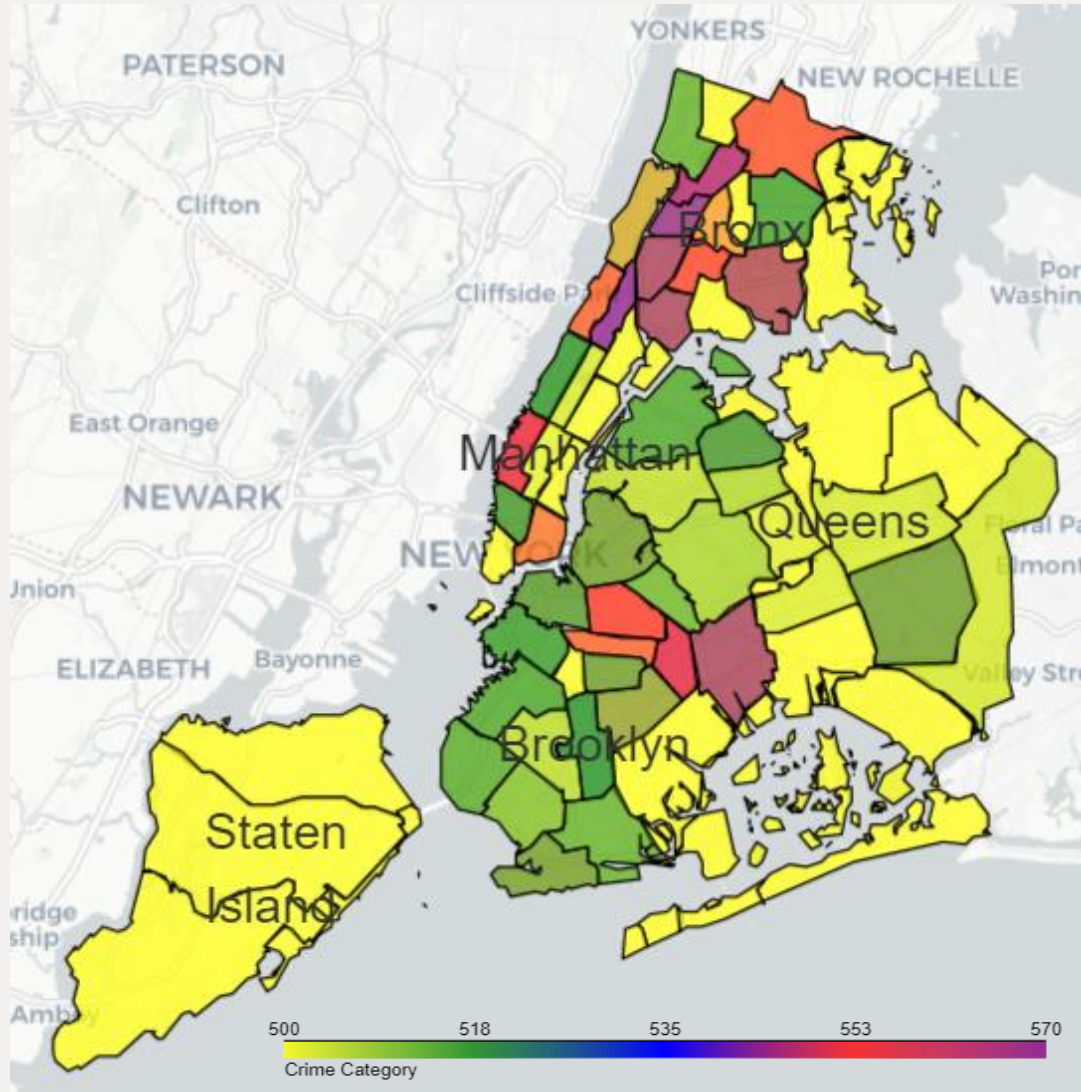
Temporal Trends: Analyzing the Month of the Year in which Drug-Related Crimes Take Place



Temporal Trends: Analyzing the Hour of the Day in which Drug-Related Crimes Take Place

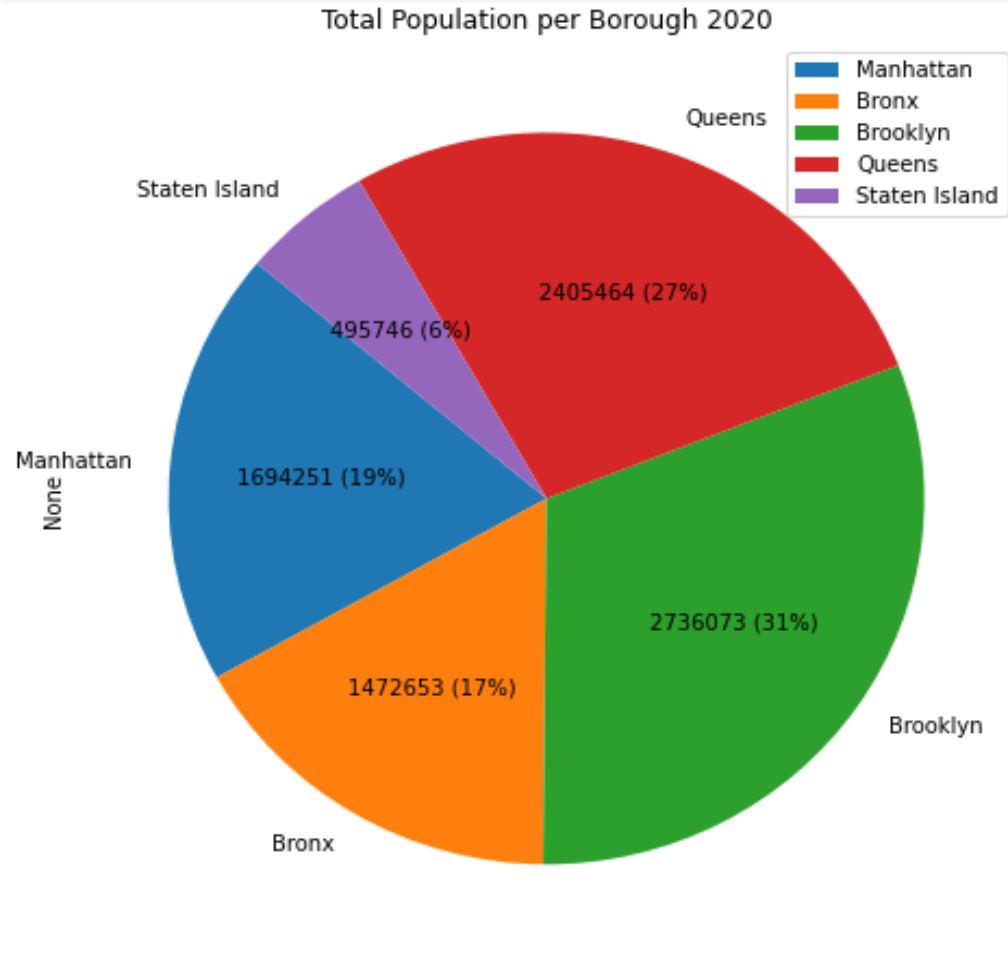


Spatial Distribution over Community District



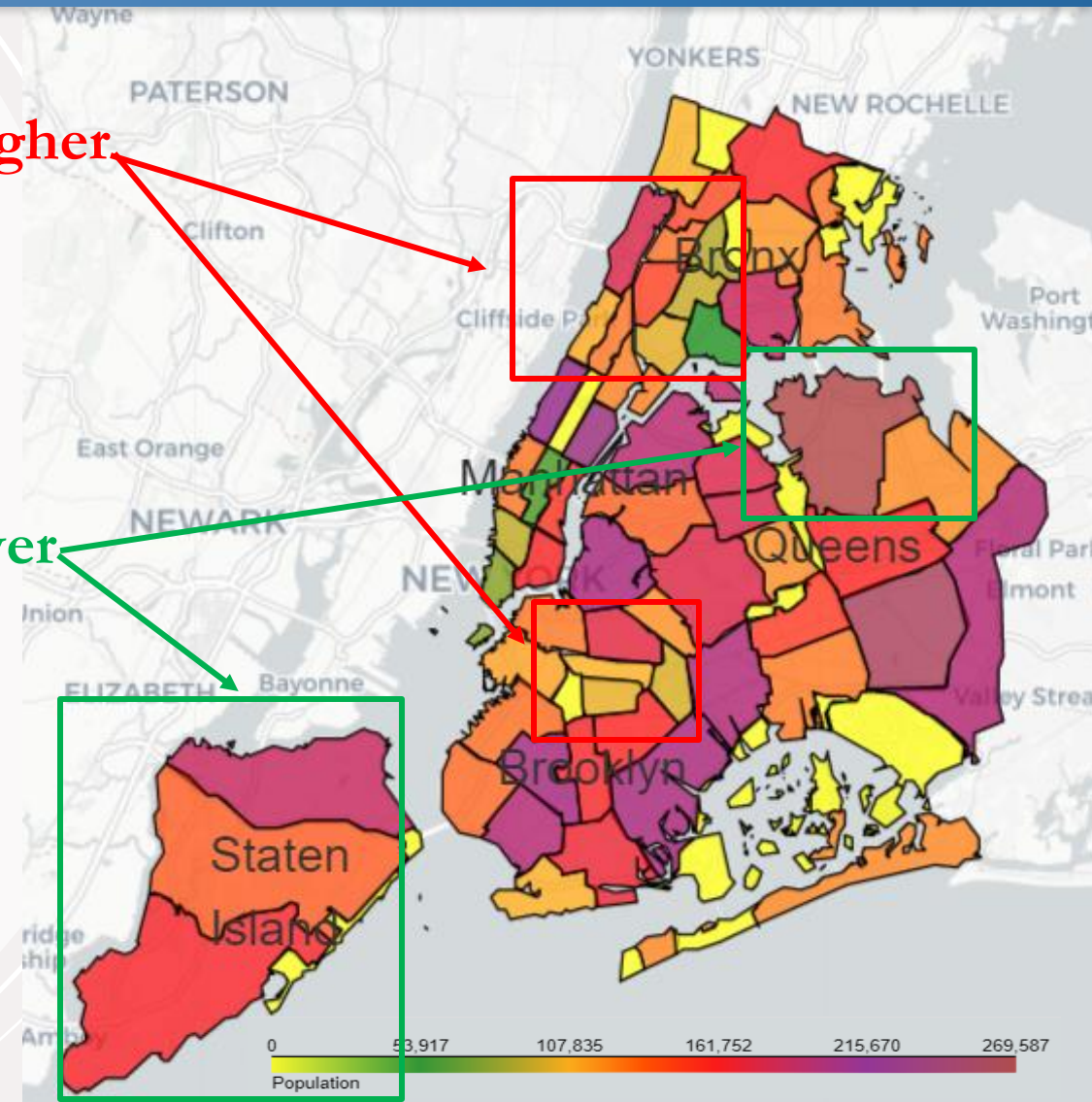
1. Crime CDs are mainly concentrated in:
 - South-West Bronx
 - West Manhattan
 - North Brooklyn
2. Areas with high crime rates show geographical connectivity
3. Majority CDs in NYC are relatively safe, crime rate below average (Blue)

Population



Higher

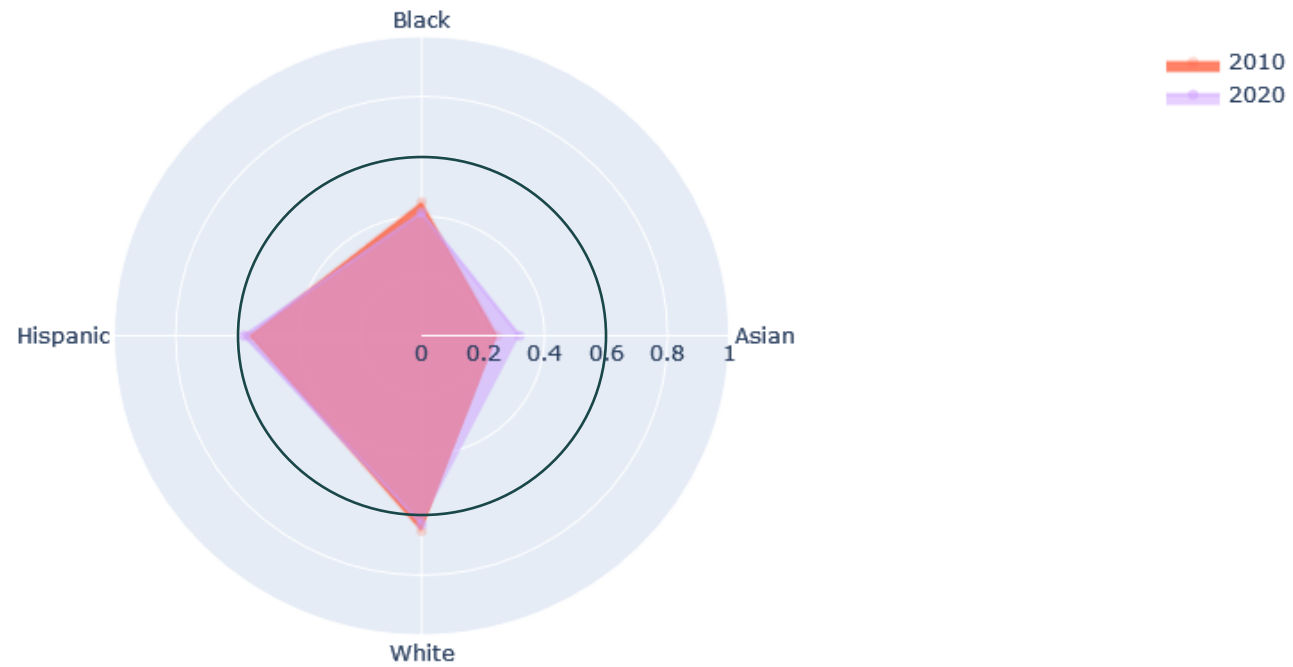
Lower



1. Most CDs conform to the rule
2. Exception CDs:
 - Lower Crime Rate: 2 areas, indicated by **Green**
 - Higher Crime Rate: 2 areas, indicated by **Red**

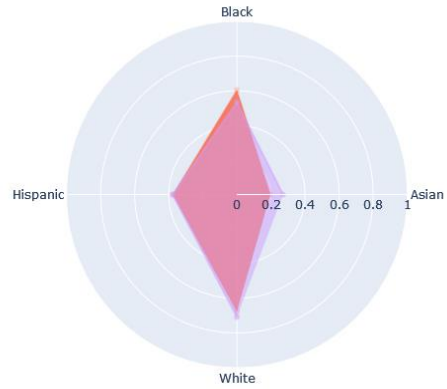
Race Distribution in NYC

Pop. Density by Race (Euclidean Normalized) - New York City

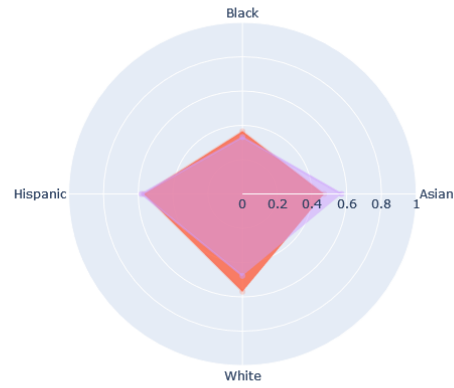


Race Density by Boroughs

Pop. Density by Race (Euclidean Normalized) - Brooklyn



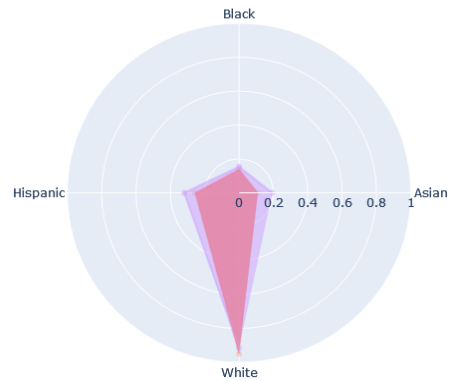
Pop. Density by Race (Euclidean Normalized) - Queens



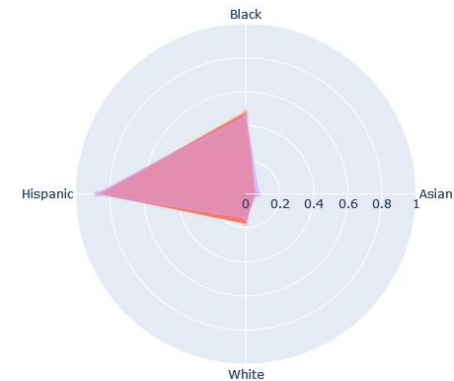
Pop. Density by Race (Euclidean Normalized) - Manhattan



Pop. Density by Race (Euclidean Normalized) - Staten Island



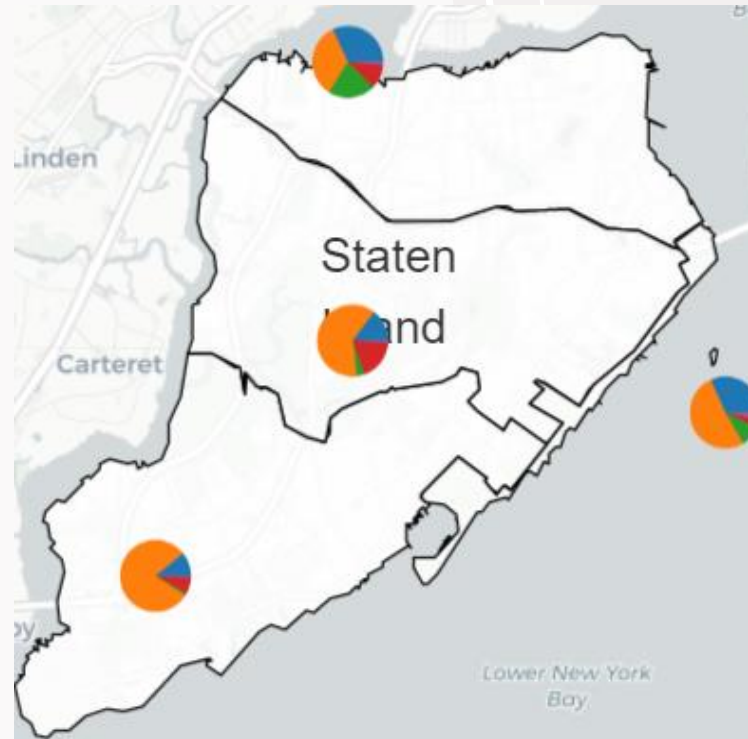
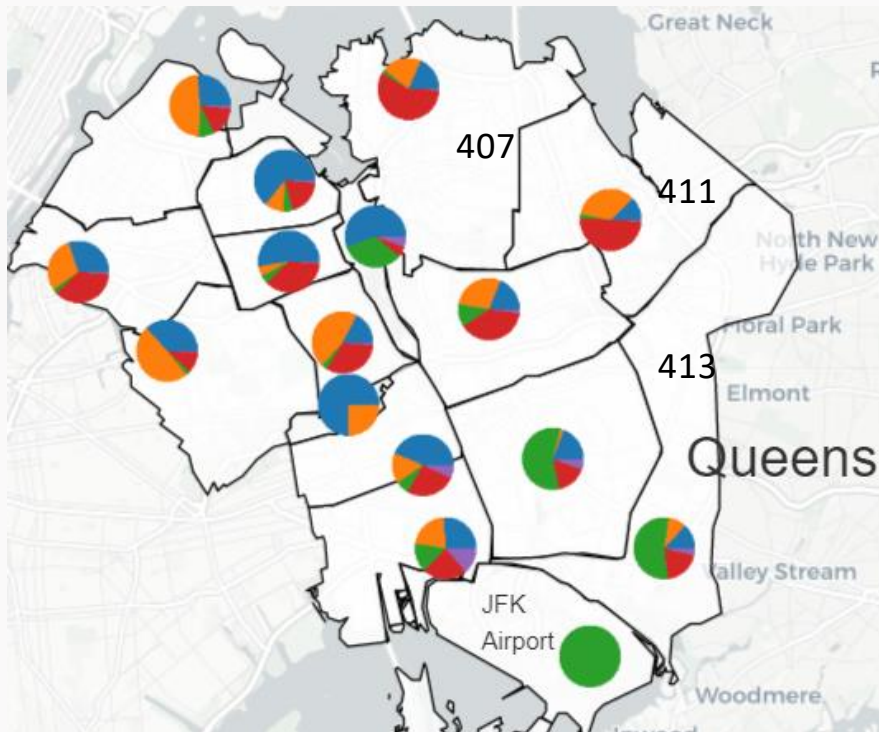
Pop. Density by Race (Euclidean Normalized) - Bronx



Lower Crime Rate Higher Crime Rate

Lower Crime Rate Districts

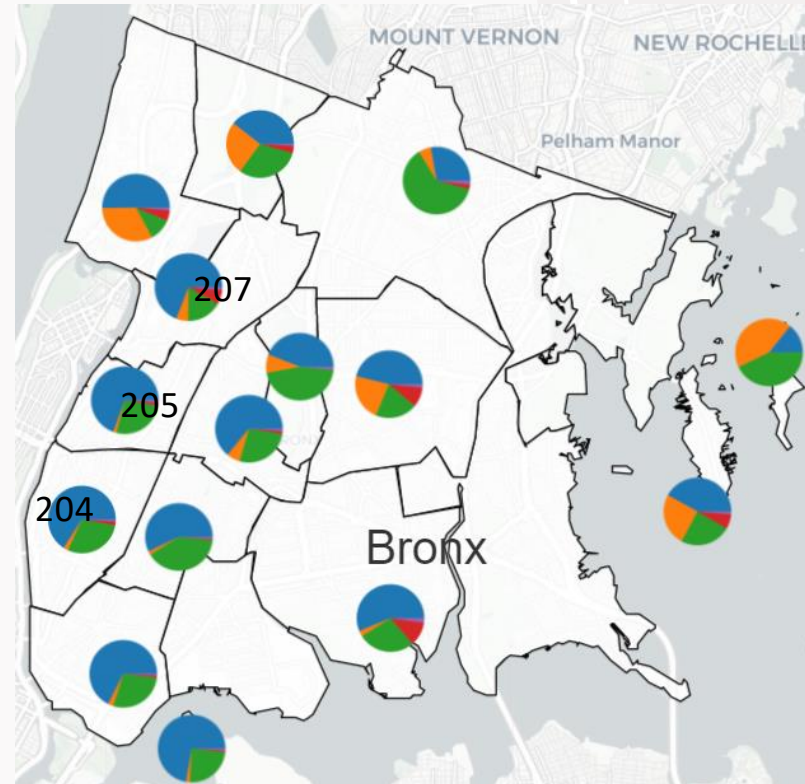
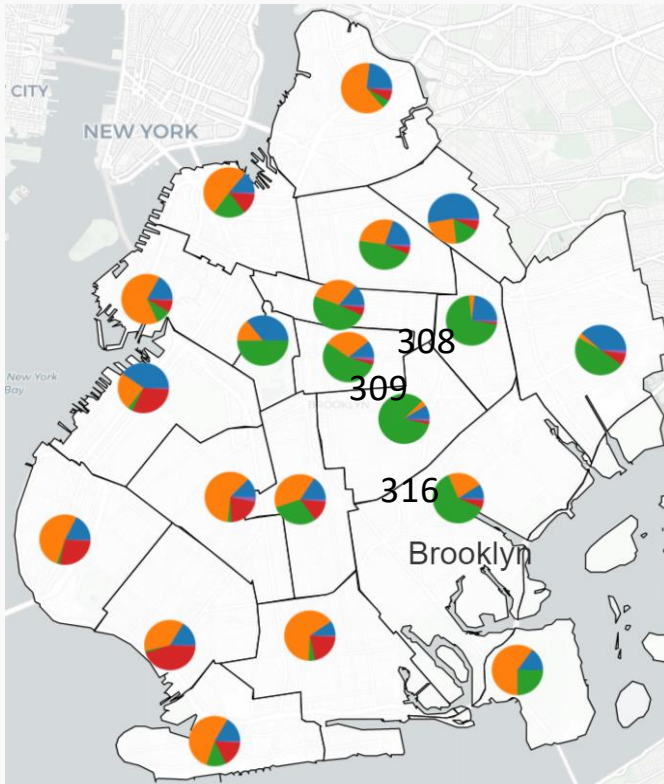
- ***North Queens:*** District 407, 411, 413
Asian: 58.0%; White: 21.0%; Hispanic:18.4%; Black:2.0%; Other Race: 0.6%
- ***Staten Island:*** All four districts
White: 62.3%; Asian: 18.8%; Hispanic:14.6%; Black:3.6%; Other Race: 0.8%



Racial Composition of
Bronx & Brooklyn

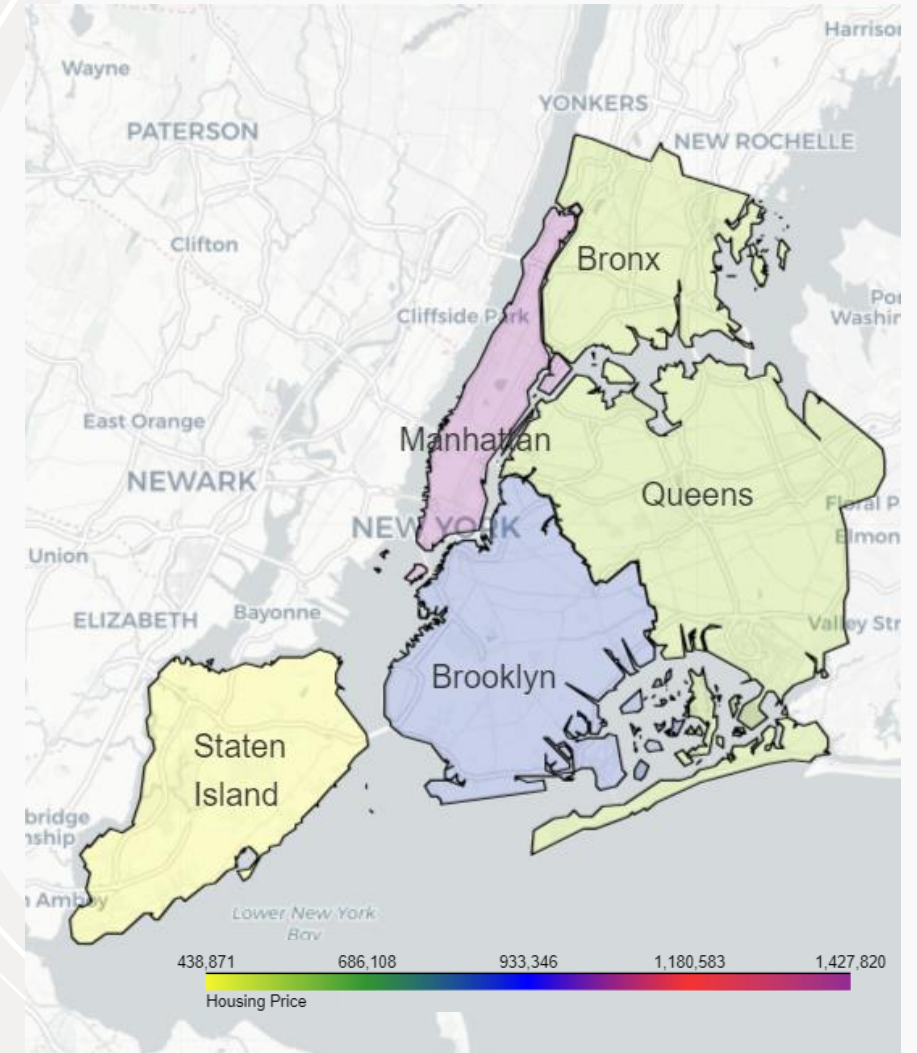
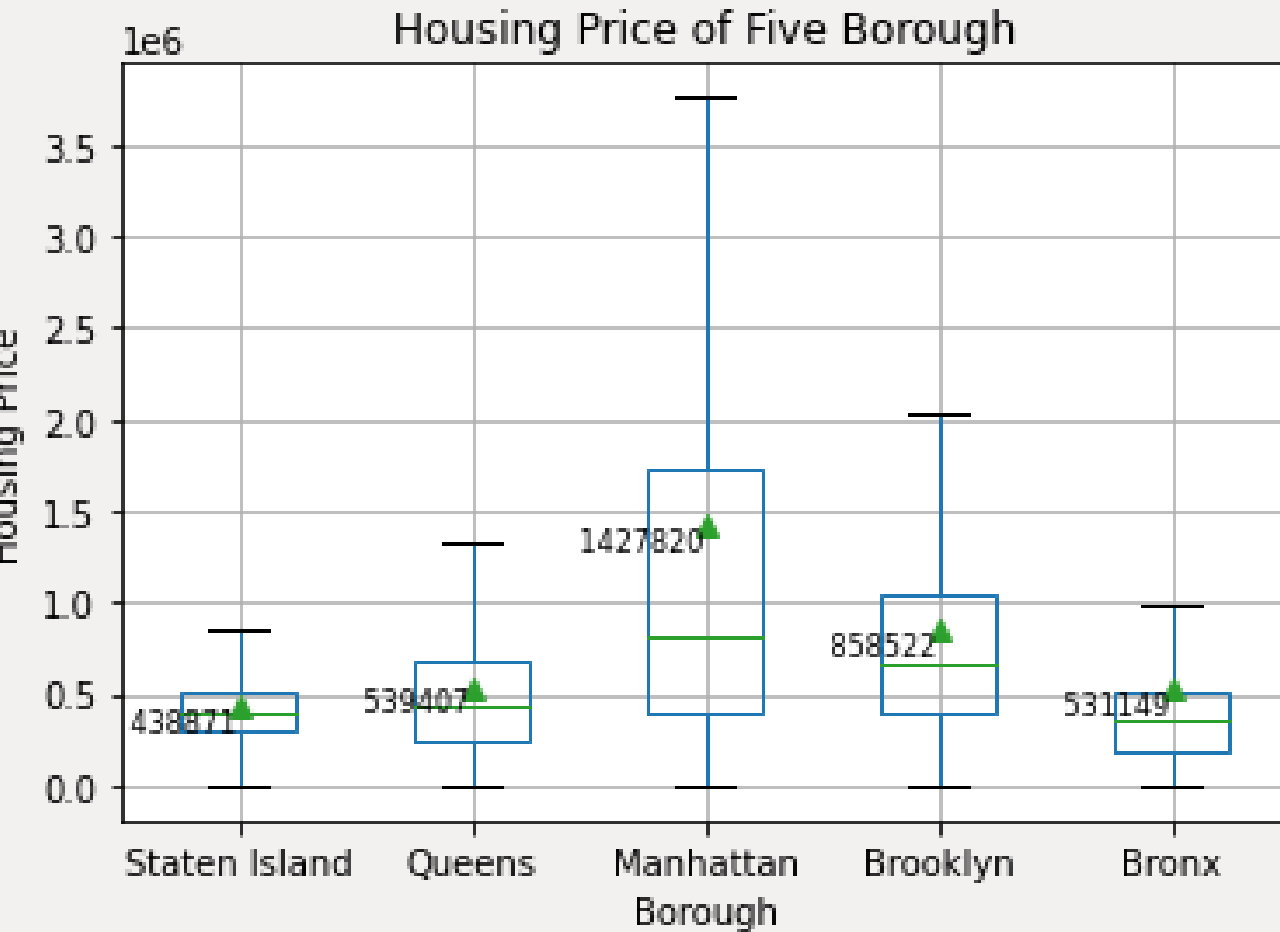
Higher Crime Rate Districts

- ***South-East Bronx:*** District 204, 205,
Hispanic: 65.9%; Black: 29.1%; White: 2.2%; Asian: 1.8%; Other Race: 1.0%
- ***Center Brooklyn:*** District 316, 308,
Black: 54.6%; White: 29.5%; Hispanic: 10.8%; Asian: 2.7%; Other Race: 2.4%



Racial Composition of
Bronx & Brooklyn

Incoming and Housing Price





THANK
YOU!!