Where to Place the Shelters?

line 1: 1st Given Name Surname
line 2: *dept. name of organization (of Affiliation)*
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line 4: City, Country
line 5: email address

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***Abstract*—This electronic document is a "live" template and already defines the components of your paper [title, text, heads, etc.] in its style sheet. **CRITICAL: Do Not Use Symbols, Special Characters, Footnotes, or Math in Paper Title or Abstract.* (*Abstract*)**

Keywords—homeless, shelters, New York City

I. Introduction (*Heading 1*) *** REFORMAT THIS SECTION***

1.1 Background

One of the many problems that New York City is facing is the homeless population. New York City has one of the highest homeless populations in the United States. In the past year, New York City has over 60,000 homeless people sleeping in shelters each night. Thousands of more are sleeping on the city's streets, subway systems, or public spaces (**Coalition for the homeless).** In New York City, homelessness has reached some of the highest numbers since the Great Depressions in the 1930's. According to Coalition for the Homeless, the number of people sleeping in shelters in New York City is 77% higher than it was 10 years ago (**Cite?**). There are many different factors to consider on why a person has become homeless. Some are due to the person losing their job, the person was evicted from their home, or the person was unable to locate affordable housing, and so forth.

Some agencies in New York City are working to better accommodate the homeless, such as Department of Homeless Services (DHS), The Department of Social Services, and 311. DHS and 311, for example, have teamed up to help locate and assist the homeless that are living on the streets. The public can call or submit a report to 311 that tells the location of where they saw a homeless person. This allows for the city to better assist the homeless population and try to get them off of the streets and into shelters.

According to the OneNYC report and the Turning the Tide on Homelessness executive summary, homelessness in New York City has reached a record high. (is this to much of a repeat from the sentence that is also in this color)? The strategy to mitigate the homelessness consists of three major parts: community-based prevention, sheltering, and permanent housing.

1.2 The Homeless Challenge

New York City is one of the top cities in the United States. Because of this, there is a geographic advantage of being in a highly populated area. The city is at an advantage with being able to see more monetary rewards. This would hopefully allow for more money to be distributed to helping the homeless population in the region. However, there are some challenges to this. One of the challenges is that the homeless person you are trying to help may prefer to get actual money instead of some other form of assistance. Other assistance includes food, food stamps, coupons, etc. This could be due to some of the homeless population being addicted to drugs or having some form of health issue (physical, mental, etc.). Another challenge faced could be the quota restrictions each shelter is assigned in order to receive funding from the city. For each shelter, the maximum capacity is fixed accordingly. This could be challenging for high density areas, like Manhattan, that most likely will have higher demand from homelessness but limited supply. Under these circumstances, overcrowding may happen and will affect the safety and sanitary standard which could eventually be harmful to the people whom lives within. Additionally, in order to keep normal function, some shelters may fasten the flow of rotation. This means that having a place to stay for the night does not necessarily guarantee a place to stay for the following night. Shelter here might receive funding compared to shelter in the Bronx.

1.3 Problem: Placing the Shelters in the Right Place

February 2017, Mayor Bill de Blasio revealed a plan addressing the critical homeless issue in NYC. The executive summary five year homelessness reduction plan that would open 90 new shelters and expand 30 existing ones in the city. This will ease the stubbornly high level of homelessness and discard cluster sites and hotels. This statement aims to locate the group around the neighborhood where they originally lost their residency, jobs, and schools. However, the plan also states the long-term goal of ending the use of cluster apartments and hotels as shelters, posing potential city-wide shelter capacity concern. Furthermore, concerns from different communities started to rise regarding where to put these 90 new shelters. The fear toward exposure to potential danger and unstableness, the concerns of repugnant image of homelessness, plus the inadequate information on the placement of the shelters are the factors challenging local neighborhoods' acceptance.

1.4 Objectives

This paper will focus on conducting an optimization strategy for the 90 new shelters, focusing on keeping local communities intact, but efficiently relocating the homeless.

Homeless people have always been a concern for city officials. They could be a possible source of crime, economic instability, and eventually a liability to the city. In order to curb this, the city council has taken multiple steps to prevent homelessness, manage it, and help find people affordable permanent accommodation. They city council has been spending around $400,000 per day by paying for hotels and cluster homes to accommodate the homeless. Due to this fact, the Mayor has announced 90 new homeless shelters across the city. But now, the question is how to build these homeless shelter, and where the best place to locate them would be.

There has been discussion about where to place these shelters on social media and other platforms. some discussion has been about how the shelter home would be clusters. Would the shelter homes be clustered to certain part of the city, or would they be equally distributed across the city? By the means of this paper, we intend to render the viable locations for the 90 new shelters that the Mayor has proposed.

II. Literature Review

We examined the literature of past work to understand the city's overall strategy, the reasons for homelessness, the major concerns, and the relationship between shelters and schools as the basis for developing recommendations for the locations of upcoming shelters

2.1 Homelessness in NYC

Shortage of low cost housing, inability to maintain physical and mental integrity, as well as maintaining employment are the largest contributors to homelessness (Werner 1984). Over the past 10 years, numbers from New York City Comptroller's office prove that households has experienced the highest growth among the lowest income groups. Many lost their houses due to the inability to afford one. What's worse, based on the study conducted by Desmond and Gershenson in 2016, losing houses would likely lead to losing jobs. This study explains why most homeless people are less likely to have a job to maintain livelihood. Now, these homeless people do not choose to stay on the street, but the substandard shelter environment and lack of work skills leave them fewer choices. 87% of the total randomly investigated shelters have found safety and sanitary concerns, and more than half have rats,m rodents, and other pests (Durkin 2015).

Targeting this concerns, New York City agencies have forwarded policies in the pursuit of creating more operational reforms for homeless people; this allows recently-turned homeless people to stay in their neighborhoods and assists in preparing them for social life as soon as possible.

A more detailed plan that the New York City is working on regarding reducing homeless population is to remove the cluster apartments and hotels that are currently being used to house the homeless and build 90 new homeless shelters that will be spread throughout the city. Each year until 2021, New York City plans to open 20 shelters annually. In addition to closing the cluster apartments and hotels, the city plans on adding 60 beds to shelters that are designated to families that have children. The main goal for adding shelters is so people do not have to move away from their current neighborhood, job, school, family, friends, and so on (Palacio & Banks 2017).

2.2 Fair Share for Public Services

Fair Share is a concept of sharing the resources judiciously all across the city without being partial. It means take things out of neighborhoods with over-concentration of it and supply it to another where there's deficit. There are certain limitations to this concept. Museums and theatres can not be moved to every neighborhood in the city, but police stations and emergency medical centers can. As an obligation of the city, the fair share also considers the homeless shelter across the study. From the research article by New York City Comptroller's office (Liu, 2013) we have the information on number of homeless shelters in each borough. From the 2011 census data we know that there are 149 shelters in Bronx, 127 in Brooklyn, 74 in Manhattan, and almost negligible in Queens and Staten Island. The numbers itself tell us that the shelters are not evenly distributed across the city and therefore violates the Fair Share policy. People have different views on this distribution, some say homeless shelter should be made in the areas of homeless' neighborhood while other say it would just concentrate the shelters to the low income areas with limited access to subways, hospitals, buses, etc. Liu's study also shows that the location of homeless shelters have positive correlation with the median household income of the neighborhood. For instance, Hunts POint, Longwood neighborhood in Bronx has median income of $19,982 and has 19 homeless shelters. Similarly, Bedford-Stuyvesant in Brooklyn has a median income of $31,945 and has 25 shelters. The City of New York uses three mechanisms for sitting shelters across the city: Uniform Land Use Review Procedure (ULURP), City's procurement process and per-diem (non-contracted) arrangements.

ULURP is the city's formal public review process for making land use decisions and it is there to establish a standardized procedure where applications affecting the land use of the city would be publicly reviewed. Facilities that are under ULURP have to go through an application process for site selection and acquisition of public facilities. Agencies need to submit the application to the Department of City Planning for review and certification which then notifies the community boards about the change. The community board then notifies the public and holds a public hearing to discuss the aspects of the new application. Based on some cases, the public hearing is then by the Borough President, City Planning Commission, and City Council before relating the certification to the agency.

The procurement process of the city includes the facilities that have private contract with private providers to establish city facilities. The facilities that do not come under ULURP is subject to article 9 of Fair Share criteria which includes facilities "such as contracts with private providers that establish city facilities" (Liu, 2013). The Procurement Policy Board (PPB) states that certain type of services should be procured via the Competitive Sealed Proposal (CSP) method of procurement. While making the decision about the award of contract, the city agency can include the quoted price, proposed approach, prior experience, and organizational capacity of the company for the services it had applied for.

All of the details regarding the contract are filed in the document called Request for Proposal (RFP). DHS then analyzes these documents and awards the contract to whoever they may seem fit.

The non-contracted shelters are the private facility owners, to whom DHS pay to provide shelter. These shelter owners do not sign any agreement with the agency and is more of a handshake deal. The owners have no obligation to comply with any rule under either Fair Share Policy, ULURP Article 9, or any other policy that other shelter comply with. As they are not considered in any micro-level analysis.

2.3 Shelters and Schools

Homelessness is especially influential on children regarding education. There has been research analyzing the plight for high mobility and homeless students, in terms of school attendance, academic performance, retention, graduation rate, and social engagement. Fowler-Finn (2001) pointed out that students with higher mobility have lower achievement and are more likely to be retained a grade compared with their less mobile counterpart. Brumley et al. (2015) also identified that homeless experience will affect the academic performance and social engagement even when controlled for income and other risks. In other words, being homeless is not just being economically disadvantaged.

One dominant issue is where students should go to school. There are situations when the temporary staying place and the school are not in the same district. What is even worse is that children's education may not be top priority for parents. Through various interviews Taylor et al. (2015) found that housing stability and job opportunities are all concerns that bother the parents even more. This may lead to discontinuity of education or high school mobility for children, which not only hinder their learning experience by also interrupt their social development.

The introduction of the McKinney-Vento Act solved a part of the problem regarding residency requirement and school-based barriers (Ernst & Foscarinis, 1995) by ensuring the rights for students to access public schools regardless of where they are. The acy was the first national response to the homeless youth. It redefined the homeless population, enlarged school options, and required immediate enrollment for homeless transfers and providing more supportive facilities like school buses (miller, 2011). But that may not be sufficient since the nearest school is not necessarily the best choice for students as mentioned above. Ernst and Foscarinis (1995) saw that violation continues to exist particularly in failure to provide adequate transportation. The situation may not have been solved to date. (this doesnt make much sense). Cunningham et al. (2010) conducted a well (or wellness?) summary on the previous mentioned problems and research and move on to discuss the importance of transportation between temporary (or highly mobile) housing and school. They identify two primary purposes of transportation: improve school continuity, and attendance. Furthermore, transportation of students also affects whether or not the parents can focus on their jobs and ensure family income. However, they also pointed out that schools have disincentive to provide such services as the costs will be way beyond the funding of Mckinney-Vento grants.

It is stated on the website of New York State Technical and Education Assistance Center for Homeless Students (NYS_TEACHS) that "under the Mckinney-Vento Act and New York Education Law §3209, students in temporary housing are entitled to transportation to help students stay in school." However, in a news article by Nathanson (2017), a mother complained about how the bus ride can take up to two hours from her temporary house in the Bronx to the original school that's located in Lower Manhattan, and sometimes the bus doesn't pick up her child.

Thus, while housing stability, even as temporary as supportive housing, has continued to be emphasized as effective and essential in improving the children's educational experience (Hong & Piescher, 2012), the location of such housing and transportation method to school remain crucial. Just last year, there were more than 111,500 homeless students in New York City schools (Harris, 2017). Instead of arranging the transportation for all of them with high costs, perhaps we need to consider shelter locations that meet such needs (e.g. within walking distance or a reasonable range combines with MTA coupons) from the beginning.

2.4 Shelters and healthcare, transportation, jobs

When is comes to being homeless, healthcare is a issue. There has be researching that FINISH

Lester and Bradley (2001), conducted a study where they asked general practitioners about their experience in dealing with homeless people. In the study practitioners said that "Homeless people were deemed costly." to have in their practice. Practitioners also said that the homeless people that they treated were very appreciative in receiving care.

Menke and Wagner (1997), conducted a study that compared the health of children who were homeless either currently or were homeless vs. children that have never been homeless. In the study they studied mental and physical health of the children. They found that almost all of the children who were homeless either currently or at some point in their lives were in good health. NOT SURE IF THIS PARAGRAPH SHOULD STAY

Douglas et al. (1999) did a study on the needs of healthcare for both sheltered and unsheltered homeless people in Michigan. They discovered that people who live in shelters vs. those who do not reside in shelters have similar health problems. Those who live in shelters deal with "drug and alcohol, vision, dental, walking problems, high blood pressure, and asthma" (Douglas et al., 1999).

2.5 Shelter Location Optimization

Regarding the model for shelter location optimization, there is not much on homeless shelters. However, there are plenty of research on hurricane and disaster shelter allocation. Although they are quite different by nature, there are methods and variables we may take into account. Regarding methods, Tai et al. (2010) adopted spatial clustering and statistics, such as Moran's I to analyze road network and how people may evacuate. In our case, this may be used to evaluate adjacency to schools, transits, and employment opportunity for homeless shelters.

Other than the logistics and network aspects, other research also focused on coverage and bi-level equilibrium model. One option derived from the coverage problem is to approach the homeless shelters by looking at whether or not the shelters cover the city well. Not only is this in compliance with Fair Share, but it is especially important when it comes to issues like the school attendance of homeless children.

**Another option is to develop an equilibrium model as Li et al. (2012) worked on. They targeted the upper level problem as how shelters are placed and the lower level problem of the equilibrium model of user dynamics. But this may not be as useful due to the fact that the screening and designation process is controlled by the city agency.

III. Data and Methodology

3.1 Data

The data for this project was collected from Enigma Public Elementary and Secondary School Survey, New York State Technical and Education Assistance Center for Homeless Students (NYSTEACHS check and see if this is already defined), DHS, MTA open data, Longitudinal Employer-Household Dynamics (LEHD), PLUTO land use data and zoning data, and New York City Health and Hospitals Corporation (HHC).

Daily report from DHS provides us with the daily number of families and individuals that are residing in the DHS shelter system and the daily number of families that are applying to the DHS shelter system. According to the report, there were approximately 13,000 families with children that require allocation assistance every night throughout 2016. Our study will test the relevance of education, transportation, healthcare, and job opportunities to shelter allocation with a focus on family homelessness.

Enigma Public Data provides a listing of both public elementary and secondary schools across the United States, 9 in New York. It gives us information on school names, locations, and other statistic description on the student body. Meanwhile, NYSTEACHS delivers homeless data entry on the charter schools sector public school also?. It defines charter schools homelessness related responsibility as:

1. Requirement on appointing a McKinney-Vento liaison to identify students inability in permanent housing, assistance on school enrollment, and off campus support like transportation.
2. Distribution of a housing questionnaire to all enrolled student and requirement on in time address updates for students who change addresses

Transportation data is acquired from MTA open subway data, which provides us a variety of information on subway entrance and exits. New York City annual subway ridership increased to 1.76 billion, utilizing 22 interconnected subway routes and 472 stations.

Healthcare wise, HHC gives us a list of the eleven acute care hospitals, four skilled nursing facilities, six large diagnostic and treatment centers and community based clinics across New York City. HHC is a $6.7 billion integrated public healthcare delivery system that serves inpatient, outpatient, and in-home services to more than 1.3 million New Yorkers in 70 locations across 5 boroughs.

Longitudinal Employer-Household Dynamics (LEHD) data are the product from both the Census Bureau and United States?. It was created to provide information on local job market and to improve the Census Bureau's demographic data programs. LEHD data is conducted on different administrative sources, primarily Unemployment Insurance (UI) earnings data, the Quarterly Census of Employment and Wages (QCEW), censuses and surveys. In LEHD data, employment information is combined to generate job level quarterly earnings history data, which include information on where workers live and work, and firm characteristics such as firm industry.

This data was geocoded in zip codes and merged with land use and geographic data at the tax lot level in a ESRI shapefile and database table format from the Primary Land Use Tax Lot Output Map (MAPPLUTO), together with Land Use Data. Operated by the Department of City Planning, MAPPLUTO contains data from PLUTO and tax lot features from the Department of Finance's Digital Tax Map (DTM). In order for us to find ideal shelter locations, we took land use status into consideration. The vacant building dataset ____ (did we use PLUTO instead of 311 like he suggested?!?).

3.2 Descriptive Statistics

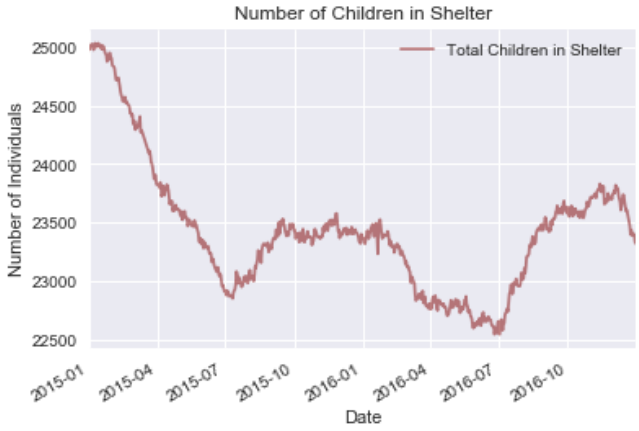

Fig. 1: Number of children residing in homeless shelters from Jan. 2015 - Dec. 2016

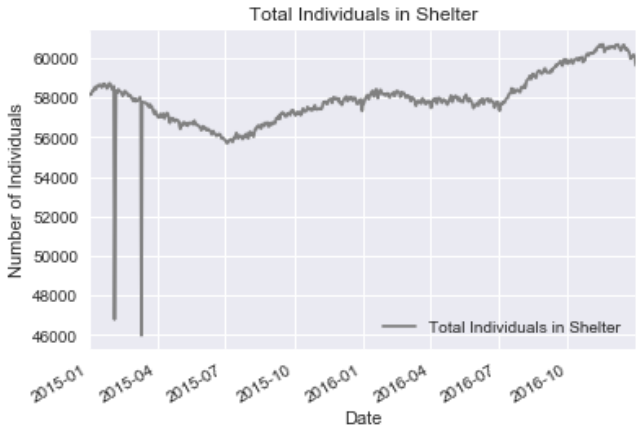

Fig. 2: Total number of individuals residing in homeless shelters from Jan. 2015 - Dec. 2016

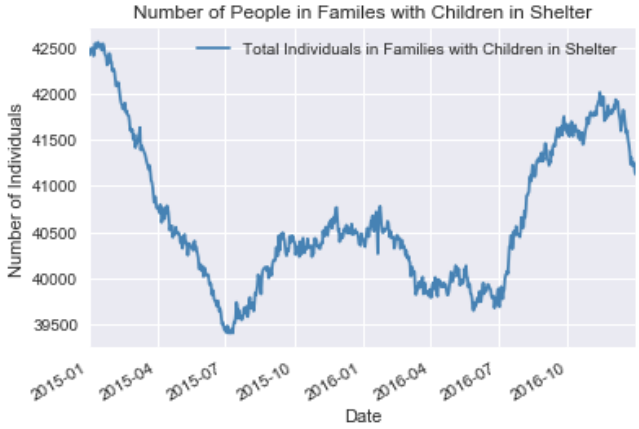

Fig. 3: Number of individuals in families with children residing in homeless shelters from Jan. 2015 - Dec. 2016

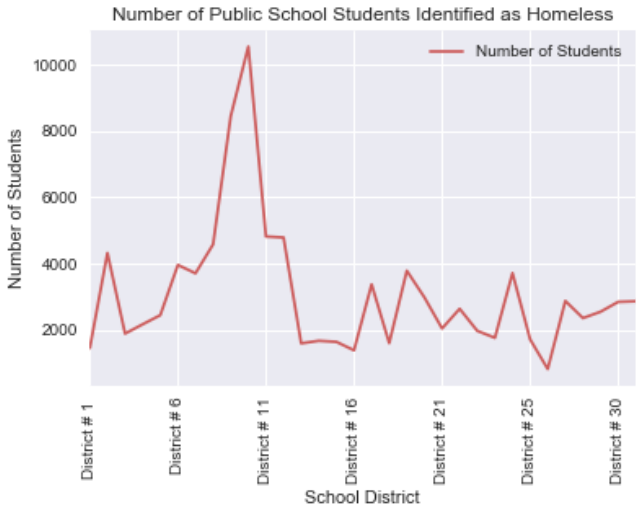

Fig. 4: Number of public school children in each school district

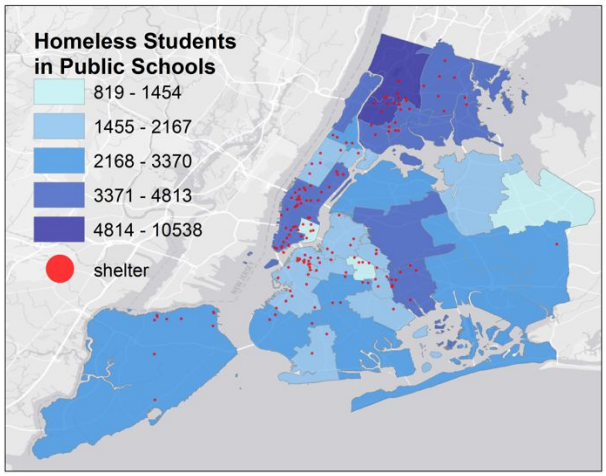

Fig. 5: Map showing the number of homeless public school students per school district and homeless shelter locations.

Tens of thousands of people are homeless and living in shelters in New York City each night. Figures 1,2, and 3 show how many people are sleeping in shelters during 2015-106. The average number of children living in shelters is 23,435. This is about half of the average total number of people living in shelters each night, which is 57,982. The average number of people who are in families that have children is 40,662. Children account for approximately 40% of the number of people living in homeless shelters. Families with children account for approximately 70% of the total number of people living in homeless shelters. Figure 4 shows a distribution of the number of homeless children that attend public school. School district 10 has the highest amount of homeless children than any other school district with 10, 538. School district 26 has the least amount of homeless children. Looking at Boroughs, Bronx has the most amount of homeless public school children with 36,852. Staten Island only has 2,860

children. **ADD FIGURE WITH A MAP OF SCHOOL DISTRICT PUBLIC SCHOOL CHILDREN.**

The data that we received from OpenData New York's website has a list of 76 hospitals and healthcare centers, of which only 60 have georeference. Due to this we only considered 60 facilities across the city. Figure 5 shows the categorization of the facilities (**Possibly use GIS to plot these locations?**).

3.3 Methodology

Based on the merged Enigma and NYSTEACHS, MTA, HHC, and rent data (model variables), we generated a scoring system to compare each neighborhood's (by zip code) performance and a predictive model to test the likelihood of shelter allocation in each zip code. By computing each variable's average, we use clustering to determine different numbers of quantile for each variable based on its mean, and a regression model to generate predicted scores. A scale of 1-20 (1 being minimum, 20 maximum) is assigned to each zip code as the total score to represent their performance.

3.3 Limitation on Current Methodology

Limitation for our study can be caused by bias from both dataset incompleteness and model unfairness.

The following datasets may fail to reflect unbiased and timely information for our dataset:

1. HHC healthcare data does not cover all of the hospitals and care facilities in New York City. It excludes some of the major hospitals like Mt. Sinai and New York Presbyterian Hospital, NYU Langone, etc.
2. The 472 subway stations includes some transfer stations that are categorized as two or more stations. These stations are not evenly distributed across the five boroughs. The difference in the number of station between boroughs may affect our model on neighborhoods preferences while location shelters
3. The vacant building dataset was acquired from 311 open data. This may perform the inability in timely reporting and updating on land use status

Model unfairness

1. Our model specification is given by:
    a. For each variables scoring quantile distribution, we are using clustering instead of mean ± standard deviations for now, the fairness of which is not secured yet.

IV. Results

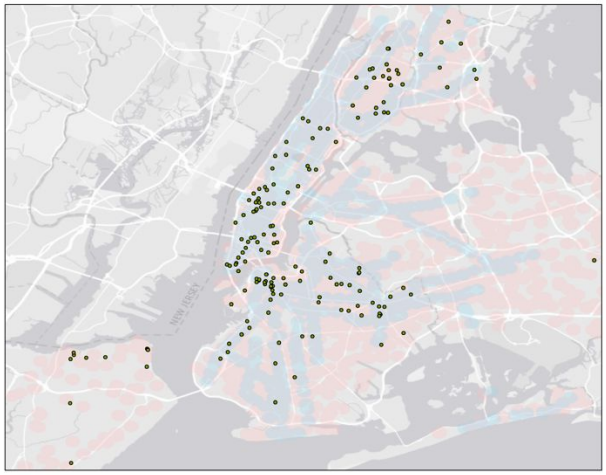

Fig. 6: Histogram of Site EUI for all properties

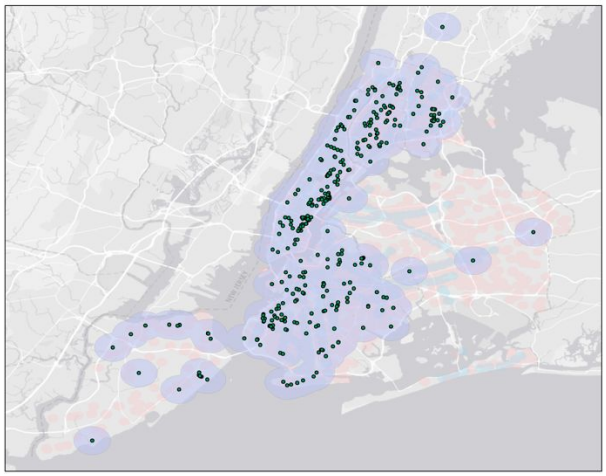

Fig. 7: Histogram of Site EUI for all properties

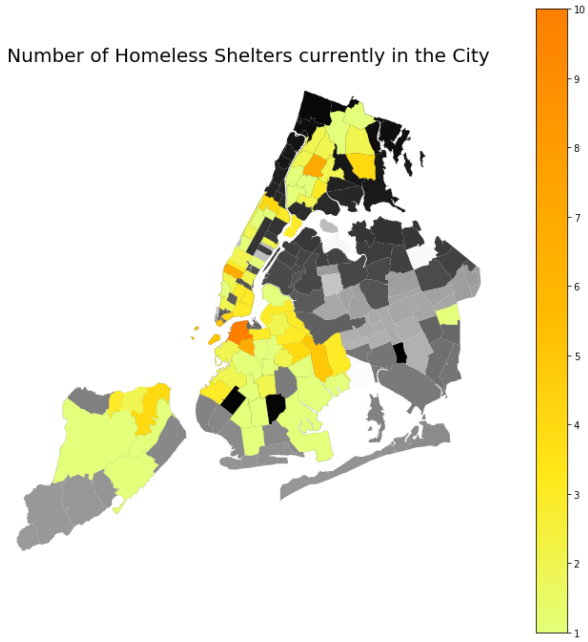

Fig. 8: Histogram of Site EUI for all properties

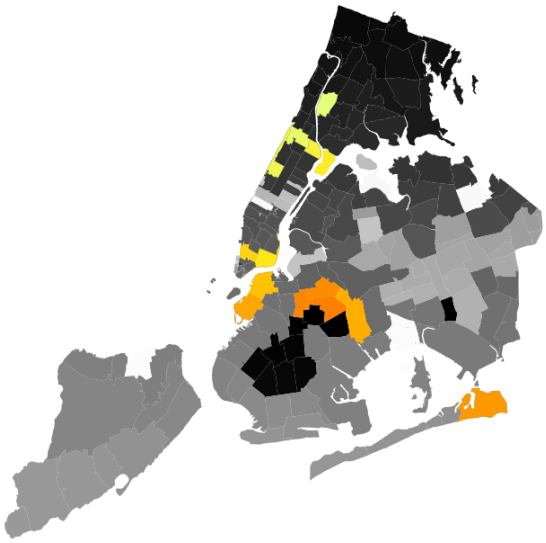

Fig. 9: Histogram of Site EUI for all properties

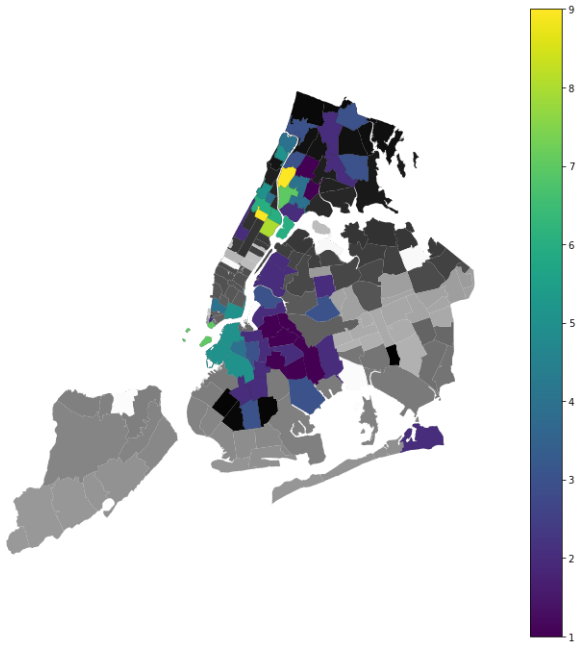

Fig. 10: Histogram of Site EUI for all properties
Fig. 1: Histogram of Site EUI for all properties
Fig. 1: Histogram of Site EUI for all properties

Based on the merged Enigma and NYSTEACHS, MTA, HHC, and rent data (model variables), we generated a scoring system to compare each neighborhood's (by zip code) performance and a predictive model to test the likelihood of shelter allocation in each

V. Discussion

VI. Conclusion

References

The template will number citations consecutively within brackets [1]. The sentence punctuation follows the bracket [2]. Refer simply to the reference number, as in [3]—do not use "Ref. [3]" or "reference [3]" except at the beginning of a sentence: "Reference [3] was the first ..."

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[1] G. Eason, B. Noble, and I. N. Sneddon, “On certain integrals of Lipschitz-Hankel type involving products of Bessel functions,” Phil. Trans. Roy. Soc. London, vol. A247, pp. 529–551, April 1955. *(references)*

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