I - Introduction

New transformations in technology and innovation lead to the advancement of modern cities as hubs for diversity and booming populations. Cities like Los Angeles, New York, and San Francisco now serve as symbols of American innovation, where technology shapes the cities' dynamics and trajectory. While these new technology cities populate the news with stories of growth and flourishing, economic and technological development still comes at a cost for those who cannot keep up. Much of the sociological literature surrounding urban poverty focuses on legacy cities such as St. Louis, Baltimore, or Detroit; cities in the Rust Belt burdened by the loss of manufacturing jobs and deindustrialization during the late twentieth century. The focus on twenty-first century technology cities, however, reveals a new path for urban poverty research to understand how current advancements in technology and innovation affect the residents living in these cities.

The use of GIS tools, such as ArcGIS, allows us to zoom out and examine the city of Los Angeles from a census-tract level view, comparing and contrasting urban poverty characteristics taking place in each census tract. Most statistical analyses operate under the assumption that space does not matter, considering the fact that the data used is not spatial. However, this analysis assumes that place does in fact matter, and the use of spatial data, in this case, allows us to study the forces driving variations in opportunity and mobility in relation to their geographic location in Los Angeles.

Census tract-level data comes from Social Explorer and is laid out over the top of an existing shapefile consisting of the boundary of Los Angeles city. Once the spatial data is mapped into the Los Angeles boundary, univariate and bivariate spatial statistical models are applied to the data to map trends in certain indicator variables using median home values as the dependent variable. Accounting for drivers of opportunity such as race, education, income, and geographic location transform this analysis into a multi-level spatial statistical model which takes place into account.

Thus, this paper attempts to answer a few questions; How do home values in Los Angeles differ by racial makeup? Is it more difficult for certain racial groups to obtain reasonably affordable housing? How does education affect one's ability to access higher home values?

II - Data & Methods

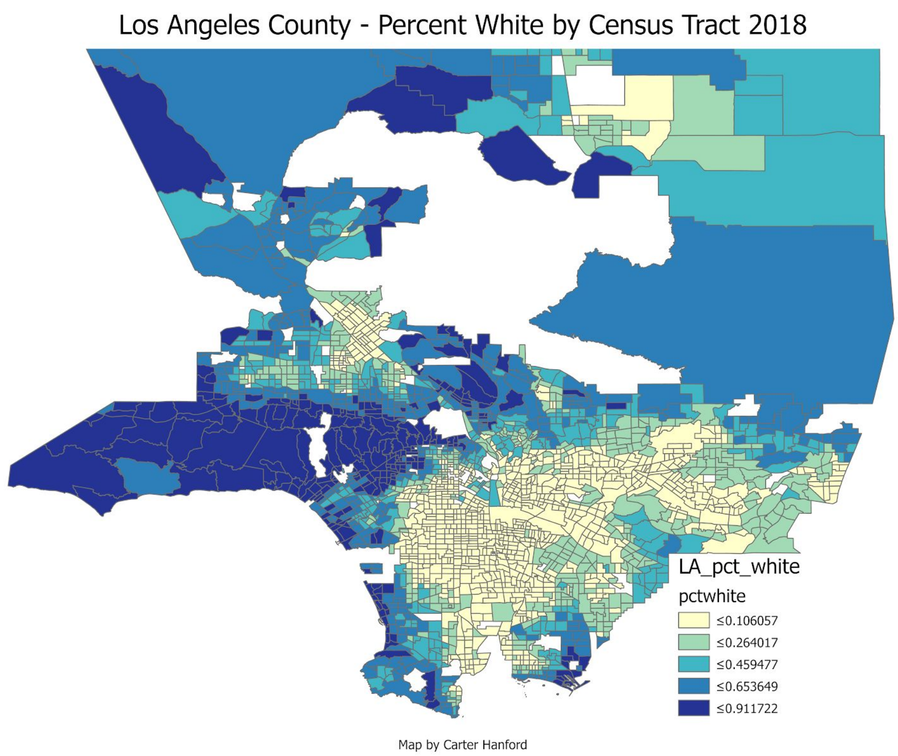
For this study I use the American Community 5 year survey for years 2014-2018, obtained from Social Explorer. In this case, the unit of analysis is each census tract in the City of Los Angeles, thus producing a study which observes and examines aggregate patterns from a spatial framework. I compute basic descriptive spatial statistics such as standard distance, mean center, and directional distribution for a few key variables, and then compute basic Moran's I statistics for each variable in the analysis. Finally, I compute two sets of bivariate spatial statistics, including bivariate Moran's I for the dependent variable (median home value) and two independent variables, and bivariate local indicator of spatial association (BiLISA) models.

I used a few key pieces of software to complete this analysis. Cleaning the original raw data from Social Explorer was accomplished in R. In the R project, I cleaned the data and removed all unnecessary variables as well as calculated variables that I needed for the analysis including; poverty rate, education level, and normalized demographic variables. Next, I exported the data set and transferred it to ArcPro which was used to create most of the maps shown below.

Finally, GeoDa was used to make maps from the bivariate Moran's I and BiLISA models. All the content included in this paper is public on my github page.

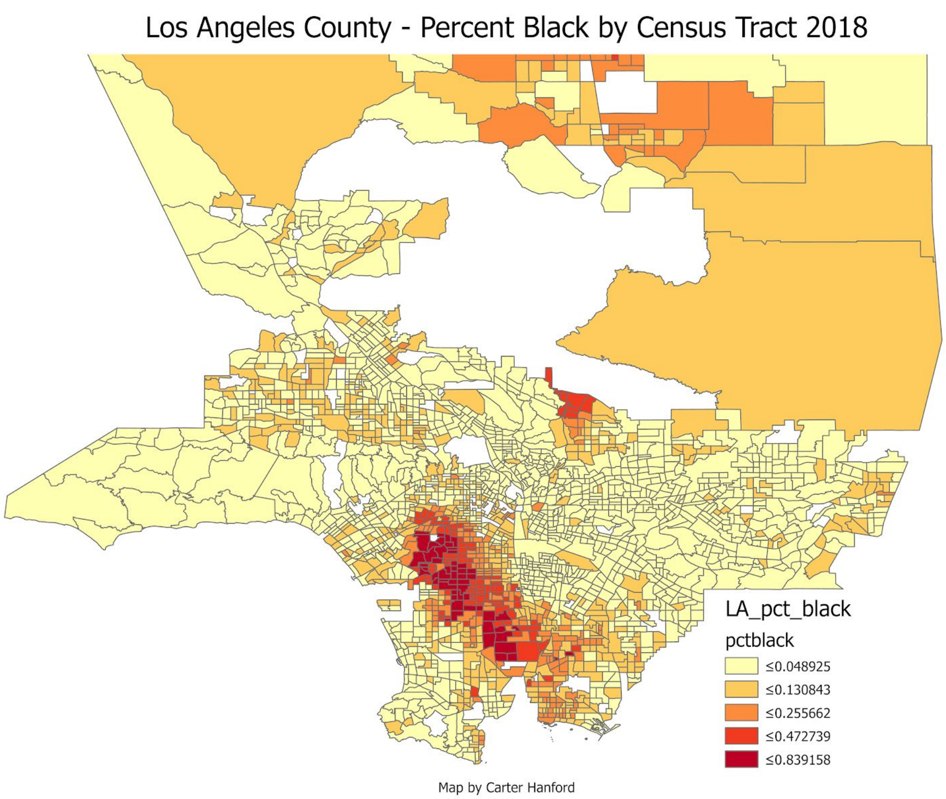
III - The Demographics of Los Angeles County, California

The analysis begins by taking a look at the demographic makeup of Los Angeles County, California. Figure 1 represents a normalized percentage of white residents living within each census tract.



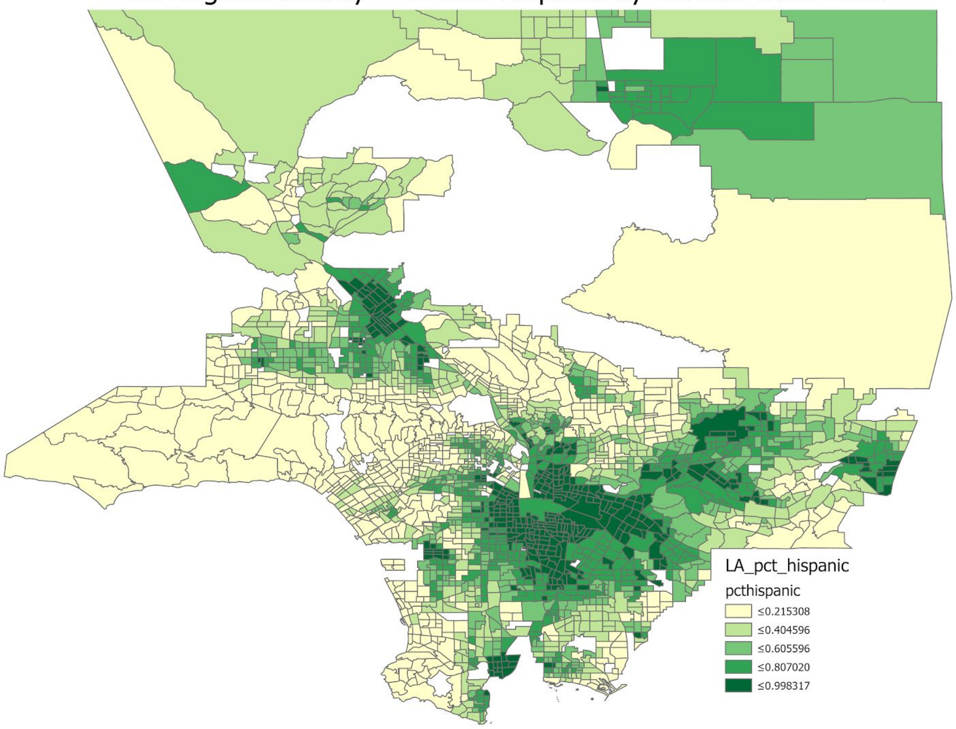
In general, white individuals in Los Angeles County tend to form clusters around the coast of the Pacific Ocean, as well as in Northeastern and Northwestern areas of the County. Areas like West Hollywood, Bel-Air, and Calabasas are all very wealthy areas of Los Angeles, and also considerably dominated by white populations with proportions in certain census tracts reaching 91% or higher.

Figure 2 represents a normalized percentage of black individuals living in Los Angeles County. The map indicates that the black population of LA seems to be clustered in the city. Whereas the white population seemed to spread out across the region, the black population map indicates the opposite, showing that blacks in Los Angeles County tend to be clustered together in areas of the city.



Finally, figure 3 represents the proportion of Hispanics living in each census tract in Los Angeles County. From the map, it's clear that the hispanic population is more spread out than the black population, but is not as sparse as the white population. While the white population has high proportions in broader areas of the region, the hispanic population still seems to be clustered in an area east of downtown Los Angeles.

Los Angeles County - Percent Hispanic by Census Tract 2018



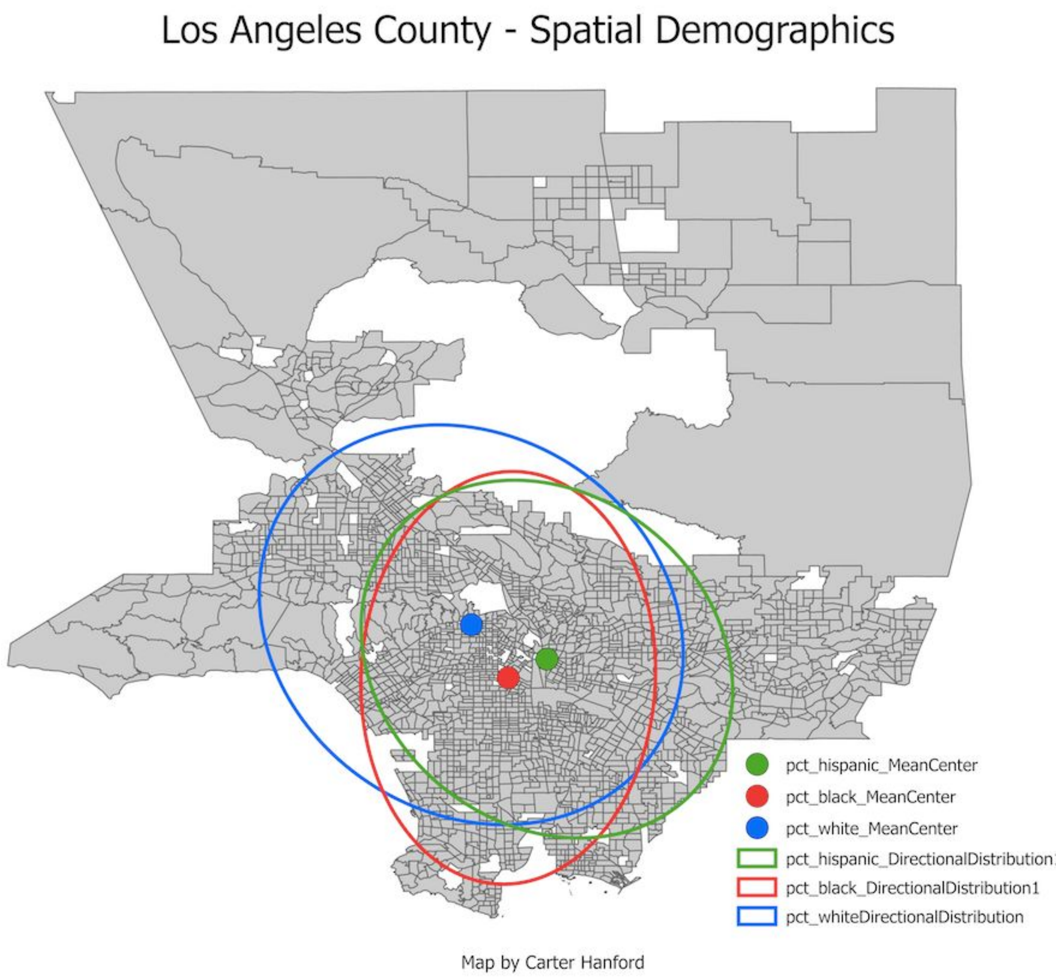
Map by Carter Hanford

While these maps help us understand the spatial demographics of Los Angeles visually, statistical tools such as standard distance, mean center, and directional distribution add a secondary layer to this spatial demographic analysis. Figure 4 and Table 1 represent these three spatial statistical tools and their numbers for comparison.

Table 1 - Descriptive Spatial Statistics for Los Angeles County 2018

Variable	Name	Median Home Value	Percent Black	Median Income
Mean Center	Mean Center - X Coordinate	6476589.176	6479726.346	6481153.663
	Mean Center - Y Coordinate	1842895.936	1832906.158	1847573.045
Directional Distribution	Angle Rotation	128.247	1.756	139.104
	Y Axis length (m)	88460.363	60128.837	99511.789
	X Axis Length (m)	72598.786	101212.631	80223.941
	Area of Ellipse (m2)	20174645180.13	19118127233.775	25078777093.230
Standard Distance	Standard Distance (m)	80919.156	25373.139	90383.839
	Area (m2)	20569821133.71	2022442731.77	25663116742.160

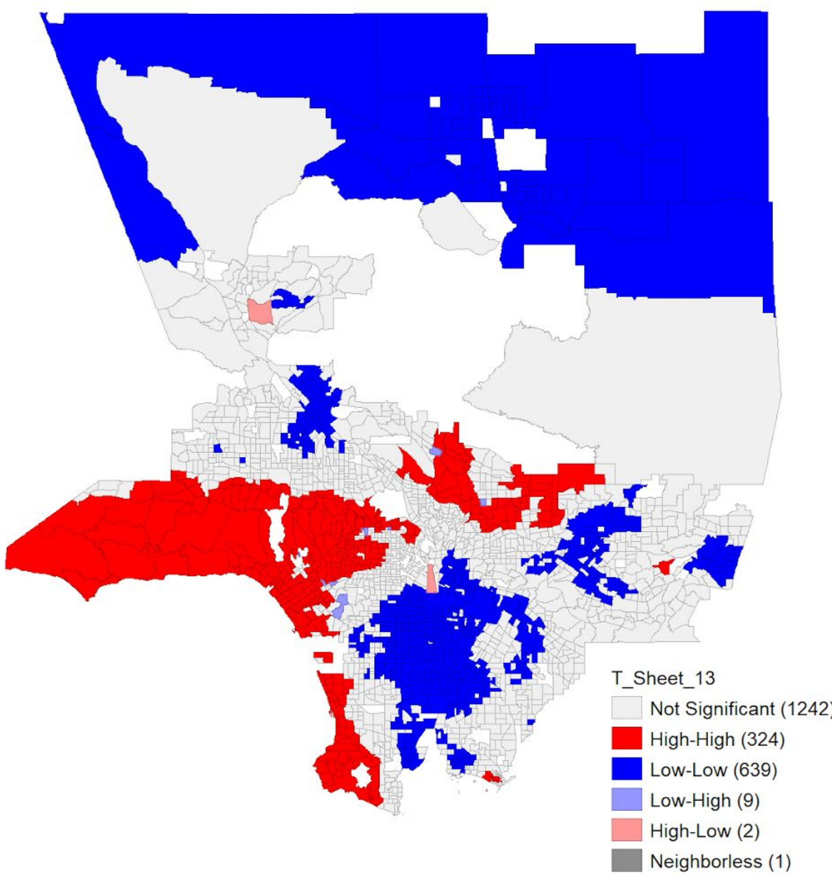
Source: Table created by author. Data obtained from U.S. Census Bureau, ACS Survey 2018-2012



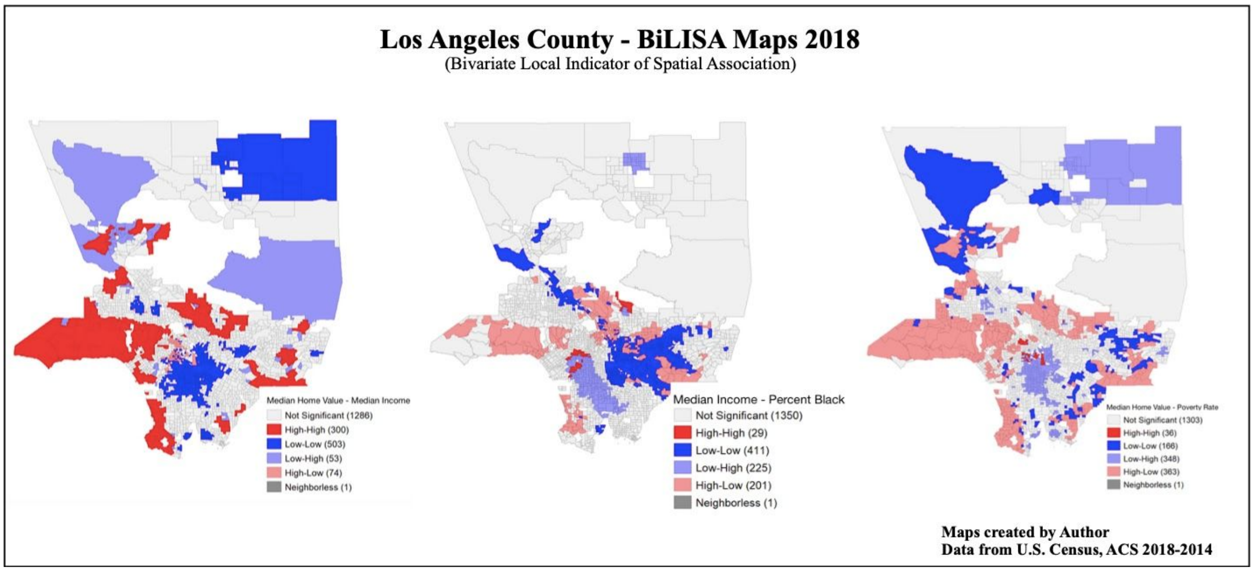
As noticed from Figure 4, the black population of Los Angeles has the smallest directional distribution, indicating that this population is clustered into smaller regions in the city of Los Angeles. Interestingly, the directional distribution of the white population seems to be anchored by the large proportions in the census tracts of West and Northwest Los Angeles County. However, while this is a county-wide analysis, moving one analysis level down to the city level would allow for one to research trends within the city of Los Angeles itself. While there are differences in directional distributions present, I hypothesize they would be exacerbated further if not being pulled and influenced by larger tracts in the upper Northeastern parts of the county.

IV - Spatial Statistics

Spatial autocorrelation is one of the most important foundational concepts to spatial statistics. Spatial autocorrelation analyses attempt to identify strong degrees of relative similarity with one variable, or many, and itself in place. Figure 5 examines spatial autocorrelation with one variable, median home value, identifying how the variable is related to itself in space.



As indicated from Figure 5, the overwhelming majority of spatial autocorrelation present among home values is positive spatial autocorrelation. Thus, there is a strong element of place that needs to be accounted for in statistical models. We can take this analysis one step further and look at bivariate spatial autocorrelation among multiple variables. Figure 5 analyzes three separate BiLISA maps with the dependent variable of the study, median home value.



In the first map, representing a BiLISA analysis of median home values and median income in Los Angeles, there is positive spatial autocorrelation present which indicates that tracts with high home values tend to have higher median incomes as well. Interestingly, when examining income and percent black in map 2, there are many counts of positive spatial autocorrelation with “low-low,” which indicates low median income in tracts with lower proportions of black individuals. Finally, in map 3, there is a switch to negative spatial autocorrelation. In tracts with high median home values there are low levels of poverty, and in tracts with lower home values there are higher levels of poverty. The power of the BiLISA analyses is that it is able to capture these trends in space across regions such as Los Angeles County.

IV - Conclusion

Overall, the spatial statistical analyses performed in this paper indicate a negative relationship between race and opportunity. Across Los Angeles County, blacks and hispanics tend to not be spatially associated with census tracts with high median home values and high median incomes. Instead, the opposite is true, especially with blacks, according to the BiLISA analysis. In Los Angeles County, blacks live in census tracts with much lower median home values and median incomes than whites, indicating a lack of opportunity exacerbated by geographic location.

While it is not possible to include all the maps created for this assignment, I encourage you to navigate my Github repository dedicated to this homework assignment. In the maps folder, I have included all the maps from this analysis, including some from the actual assignment that did not make it into this paper.