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Clustering of Spatial Inequality in the US Neighborhoods

What factors cause and continue to drive Spatial Inequality

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Introduction

Spatial inequality, as defined by Economic Innovation Group, is the geographic unevenness in economic stability. In recent decades, spatial inequalities have become a defining feature in some American cities and have risen exponentially in the past few years. How socioeconomic inequalities continued to cause such division amongst American life, became an even larger problem for those of underprivileged backgrounds. A United Nations report, they determined that inequality wasn't only driven by income, but rather also by other factors including employment, age, ethnicity, and class. Tackling these issues is imperative to a functioning society for all and understanding and closing the divide of inequality should be at the forefront of any future policy decisions. This project will try to see what the biggest factors are regarding inequality and hopefully find ways to ensure a balance among social, economic, and environmental dimensions of sustainable development.

Background on similar research and explanation of area of interest

Our team decided to focus on Los Angeles City, and the surrounding regions in California for the basis of our analysis. Since Los Angeles is one of the most populated cities in the U.S., we assumed that it would be a credible sample to find potential factors of inequality. Los Angeles is also known as one of the most diversified cities in the US having communities of minorities holding around 73 percent of the residents today (An Equity Profile, 2022). This factor also contributes to our interest because studies have shown that minority communities are more likely to have less income and economic opportunity to the majority (Wilson, 2022). A past study has also found that communities and cities in South LA such as Compton and Willowbrook have had unemployment rates being above 15 percent and poverty rates being near

29 percent (An Equity Profile, 2022). This is interesting because the wealthier cities in LA county such as Beverly Hills have an unemployment rate of just 4.7% (Beverly Hills, n.d). Based on these factors, our group wanted to find the potential factors that are contributing to these income disparities.

Problem Statement & Research Questions

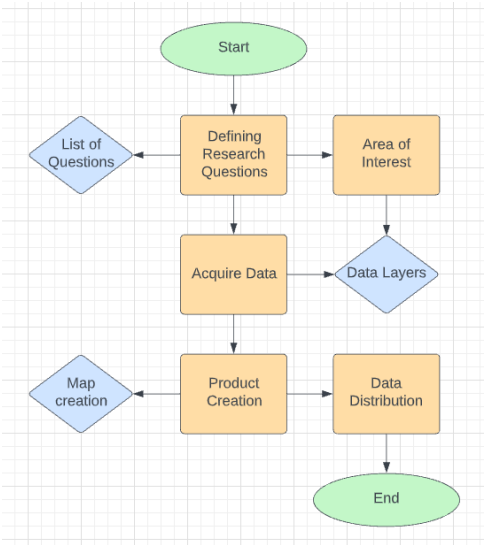
The main purpose of this project will be to discover what factors drove spatial socioeconomic inequality in the greater Los Angeles area. The discovery will be made by observing how race, income levels, education and gender affect Inequality and observing how areas of inequality compare to those without and see how those metrics affect inequality levels.

Spatial data source and preparation details

In order to gain a deeper insight into the clustering of spatial inequality in U.S. neighborhoods, we decided to scope in on the city of Los Angeles since it is a city where there are both sides of the spectrum when it comes to the wealth gap. The first task the team performed was sourcing reliable data to use in the map model. In order to make sure our data was coming from a reliable source, the team used the “authoritative” search filter. This made it so that any data set we were looking at was from Esri. The team then moved on to the next step where we selected the most relevant data sets from the first batch that we picked. Once this sorting process was finished, we had around seven different map layers to help us understand the different clusters of spatial inequality in LA based. The six variables we chose to use in our model were crime, education levels, race, unemployment rates, population density, poverty status as the base layer.

Methodology Flowchart

The project started with determining and defining the research questions for determining spatial inequality in United States Neighborhoods. The agreed upon area of interest in this project was understanding what factors drove the socioeconomic inequality within the greater Los Angeles area. We then focused on areas of interest such as how race, income levels, and education affected inequality. After procuring online data layers, the group proceeded to create products and to make sure that the created maps are able to communicate the information accurately and effectively. Distribution of the data was done by publishing the data onto the ArcGIS website.



Spatial Analysis Method

The main method of spatial analysis used in our project was clustering. This method is used to find natural patterns and hot spots of correlating data between the chosen factors and map layers. Clusters are represented by symbols that are proportionately sized to the number of point characteristics in each cluster. Cluster symbols with fewer points have fewer points than cluster symbols with more points. The size range applied to the cluster symbols can be changed to better emphasize insights or visualizations. Using clustering we are able to find instant visual correlations between different spatial inequality factors. By changing one map to key map features such as dots layered on top of a base map and another map layer, we were able to note correlation between hot spots, cold spots, outliers, and other patterns. Overall, supporting our analysis and insights that we find. We also use Python implementation to visualize each layer being added on which gives us a visual to see how each variable performed.

Discussion of Results

Unemployment Rates vs. Poverty

The image (Figure 1A) depicts the unemployment rates and percent of population whose income is below the poverty level. Green being the lowest rate 0.0-3.5%, yellow 3.5-10.1%, orange 10.1-16.7, dark orange 16.7-100%. The blue dots visualize the percent of the population whose income in the last 12 months is below the poverty level. The bigger the dot/circle, the higher percent of the population is below the poverty level, the biggest being more than 70%, the smallest being less than 0. A correlation of clusters and outliers can be noted, mainly in the area in between Inglewood and Huntington Park, as well as along the coastal regions of LA. The hot spot or clusters of blue dots are likely areas of spatial inequality. Unemployment is a contributing factor to poverty, areas with a higher unemployment rate equals a loss of income, therefore a higher rate of poverty. However, poverty also contributes back to unemployment. For example, it becomes more difficult to travel to interviews, pay for child care, or care for one's health, making a job hunt all the harder. In all, as the unemployment rate rises, poverty rises as well, spatial inequality can be seen in the drastic differences of clustering between coastal LA areas and the inner city areas, to reduce spatial inequality, it would be recommended to focus on addressing the hot spot areas.

Population Density vs Poverty Status

Here we have a direct side by side comparison of Population Density (Fig. 2A) vs. Poverty Status (Fig. 2B) in Los Angeles. The dark red in the left image indicates areas with higher levels of population density while the lighter yellow-orange areas display areas that are less dense. For the right image, the dark purple color indicates areas where 25% or more of the

income in those areas is below poverty levels. When looking at these two images, we can deduce that both population density and poverty status are highly correlated. The data shows us that poverty levels are concentrated in the same areas where high population density can be found such as South Los Angeles and Downtown adjacent areas. The same can be said for Hollywood, Boyle Heights, and Northeast Los Angeles where this same clustering of correlating data can be found. In contrast, all the coastal areas that are known to be affluent unsurprisingly display a very small amount of population density along with drastically lower poverty rates.

Education vs. Poverty Status

This evaluation is a comparison between Educational achievement (Figure 3A) vs. Poverty Status (Figure 3B) in the Greater Los Angeles region. Figure 3A shows educational achievement is described as a color spectrum in which yellow would describe the lowest educational level achieved (Less than 9th Grade) followed by light green, green, cyan, blue, violet, maroon and red being Graduate/Professional Degree. Figure 3B shows the dark purple color as areas where 25% or more of the income in those areas are below the poverty level. Looking at both images side-to-side we come to understand a generalized conclusion in which higher poverty levels and lower achieved education are interrelated. The data depicts areas where those who achieved an education level that was less than the 9th grade generally lived in areas with a high concentration of residents that live below the poverty level. An example of this would be Huntington Park where most of the residents lived with an education hovering around less than 9th grade and a high school diploma. There are areas however that go against this notion but not to the same degree. Irvine is an example of this in which there are people with bachelor's degrees and graduate/professional degrees living in areas of high poverty with surrounding areas contrasted with areas of relatively little poverty with similar degree levels such

as Lake Forest and Chino Hills. A general consensus could be reached in which bigger cities tend to have a heavier amount of people who live below the poverty level and those who received lower levels of education.

Crime and Poverty

This analysis compares the relationship between poverty and crime rates in the Greater Los Angeles area. The left (Fig 4A) map shows the constant poverty statistics map we have been using throughout this project, while the map on the right (Fig 4B) shows the crime rates. In regard to the crime rates map, the symbols are represented by index ranges. The larger the circles and the darker the red, indicates a higher density of crime activity. The poverty map again shares the same symbology as before, with darker shades indicating higher poverty rates. After evaluating both maps, we can conclude that again the majority of the target variables we are finding are generalized in the inner city and generally away from the coast and the suburbs in the east. One outlier in the crime rates is that we can see a larger crime index in the west coast city just west of Inglewood. In comparison to the poverty statistics we have, the coastline doesn't appear to have much poverty. Here is where we can make inferences based on real-world knowledge. Crime doesn't always necessarily have to be committed in lower poverty neighborhoods. In the perspective of criminals, they would want to commit crimes like robbery where there are incentives like a higher cash-out, so to speak. This can't be found in lower income neighborhoods. A better analysis can be done if there is data that tracks where the criminals are coming from. We can suspect that they come from the lower income neighborhoods.

Ethnicity and Poverty

This section will cover insight on the possible correlation between ethnicities and poverty rates throughout LA County. The clustering spatial analysis performed was specifically on the southern and middle part of the LA County, Central and San Fernando Valley. The reason why we chose these regions is due to the large differences in poverty rates. The poverty layer used in this example is the same as the previous sections. The layer with the colored dots represent the different races per area of land, specified by square meters . The two races of interest in this section will be “White” (pink dots) and “Hispanic or Latino Population” (teal dots). These can be seen in Figure 5. After analyzing the southern section of LA County, we found that the primary race in the largest poverty cluster (with poverty being >25%) was Hispanics/Latinos. This includes cities such as Downtown LA, Westlake, and all the way down to Westmont. As we got away from the inner city, we found that poverty rates began to slowly decrease. However, we found that the highest poverty rated area in the middle of LA County, which generally had a lower poverty rate, still had Hispanics/Latinos as the majority race. Areas around that poverty cluster in middle LA County had lower poverty rates. With that we discovered that the “White” race had the majority of those areas. This is also true towards the west most side of LA County, towards the coast line. To generalize these findings, we concluded that “Hispanics/Latinos” have the strongest relationship with higher poverty rates. Additionally, we found that the “White” race held the majority of the lowest poverty rates, specifically in the middle and west side of the county.

Conclusion

Spatial Inequality is a societal threat that has affected all corners of the world, so much that the United Nations expressed its urgency. To combat the inequality that exists we can understand what factors lead to such inequality and what are driving it. Some prominent factors

that were observed to factor in inequality were low education status, high crime, population density and unemployment rate. When observing these variables as clusters in relationship with poverty statistics, it was found that where there were high rates of the variables, there was a correlation to poverty areas. After this analysis, the results can now be shared and used by legislatures to tailor future policy decisions that can help close inequality gaps.

Appendix

Figure 1A

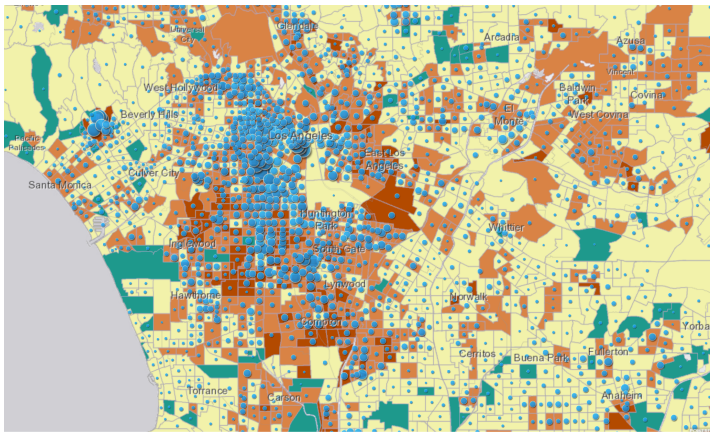


Figure 2A

Figure 2B

Figure 3A

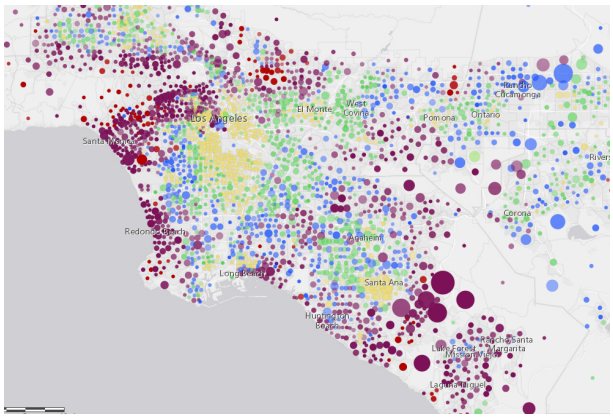


Figure 3B

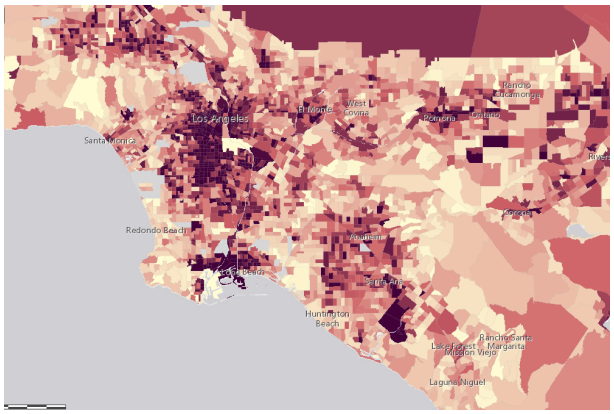


Figure 4A

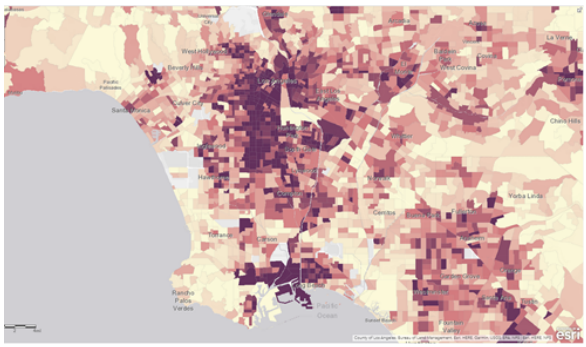


Figure 4B

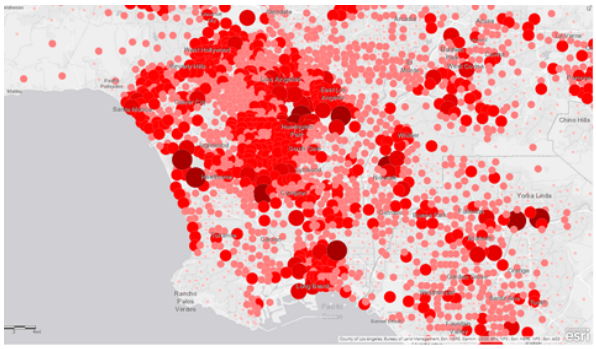


Figure 5

Central LA Region

San Fernando Valley

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ArcGIS WebMap

Python Notebook