Analysis of Correlation Heatmap: Income, Streetlights, and Crime in Tucson

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1 Analysis of the Correlation Heatmap

The heatmap provided is a correlation matrix that illustrates the relationships between various variables: median household income (MEDHINC_CY), average household income (AVGHINC_CY), streetlight count (Streetlight_Count), crime count (Crime_Count), arrest count (Arrest_Count), and the proportion of nighttime crimes (Night_Crime_Prop). The color intensity and values (ranging from -1.0 to 1.0) indicate the strength and direction of the correlation, with positive values showing a direct relationship and negative values indicating an inverse relationship.

1.1 Key Insights from the Heatmap

1.1.1 Income vs. Crime and Arrests

- MEDHINC_CY and AVGHINC_CY exhibit a strong positive correlation with each other (0.95), indicating that median and average incomes in neighborhoods are highly consistent.
- Both MEDHINC_CY and AVGHINC_CY have moderate negative correlations with Crime_Count (-0.32 and -0.19, respectively) and Arrest_Count (-0.26 and -0.13, respectively). This suggests that higher income levels are associated with lower crime and arrest rates, though the relationship is not extremely strong.

1.1.2 Streetlights vs. Crime

- Streetlight_Count has a moderate positive correlation with Crime_Count (0.56) and Arrest_Count (0.68), indicating that areas with more streetlights tend to have higher crime and arrest numbers.

- There is a weak positive correlation between Streetlight_Count and Night_Crime_Prop (0.20), suggesting a slight tendency for more streetlights to be associated with a higher proportion of nighttime crimes.
- The correlation between Streetlight_Count and income variables (0.11 with MEDHINC_CY, 0.22 with AVGHINC_CY) is weak, implying that streetlight presence is not strongly tied to income levels.

1.1.3 Crime and Arrests

- Crime_Count and Arrest_Count are strongly positively correlated (0.97), indicating that areas with more reported crimes also tend to have more arrests.
- Night_Crime_Prop has a weak positive correlation with Crime_Count (0.044) and Arrest_Count (0.12), suggesting that the proportion of nighttime crimes does not strongly drive overall crime or arrest rates.

2 Connection to Hypotheses

2.1 Hypothesis 1: Thefts/Violent Crime vs. Area

Do thefts and violent crimes occur more often in richer or poorer neighborhoods?

The heatmap supports the idea that thefts and violent crimes (represented by Crime_Count) are more likely to occur in poorer neighborhoods. The negative correlations between MEDHINC_CY (-0.32) and AVGHINC_CY (-0.19) with Crime_Count suggest that as income decreases, crime rates tend to increase. This aligns with the hypothesis that poorer areas may experience higher crime rates, possibly due to socioeconomic factors like limited resources or opportunities. However, the correlation is moderate, indicating other factors might also influence crime distribution across areas.

2.2 Hypothesis 2: Crime Rate vs. Streetlight Presence

Does the existence/presence of city streetlights influence crime rates?

The heatmap does not support the hypothesis that more streetlights reduce crime rates. Instead, the positive correlations between Streetlight_Count and both Crime_Count (0.56) and Arrest_Count (0.68) suggest that areas with more streetlights have higher crime and arrest rates. This could imply that streetlights

are more prevalent in areas with higher crime (e.g., urban or high-traffic zones) rather than causing a reduction in crime. The weak positive correlation with Night_Crime_Prop (0.20) further suggests that streetlights do not significantly deter nighttime crimes, contrary to what might be expected if lighting were a deterrent. This could indicate a need for further investigation into whether streetlight placement or density plays a role beyond mere presence.

3 Conclusion

The heatmap provides evidence that crime rates are inversely related to income, supporting the first hypothesis that poorer neighborhoods may experience more thefts and violent crimes. However, it challenges the second hypothesis, as the presence of streetlights appears to correlate with higher, rather than lower, crime rates, possibly due to confounding factors like urban density or crime reporting patterns.