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Classifying Crime Rates in Highly Urbanized Regions through Generic Mapping in a Modern Setting

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Abstract:

The use of Generic mapping is a wide range of processes used across earth studies on different investigations of different activities and actions that also include locations on planetary, ocean sciences, and beyond. A large community of research processes in Geo-mapping used generic mapping to process data and also to generate publication-based quantitative illustrations that automate workflows and design animations for research purposes. One of the major areas of study in which generic mapping is most important is the area of crime rates and its studies, especially in a largely urbanised area like the United States. The paper looks into the fundamentals in the study of crime rate and the process of depicting the class of crime through generic mapping with R language. The basics and importance of identifying crime rates and location are discussed and the result section shows some of the outputs derived from generic classification mapping.

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1 Introduction

The early twentieth-century crime cases might realistically be considered the criminology of urban places. In the late twentieth century, the attention of crime rate experts focused mostly on the extent and intensity of crimes in urban regions. By the end of the century, researchers focused on the extinction of crime rather than the notion that the urban region is a point for criminogenic occurrences. The research on urban crime has now focused on finding out why crime in urban places varies in crime rates why certain social and economic spatial characteristics are related to variations in urban criminology and how some crime features of these urban areas can affect individual criminality.

American criminologists Emile Durkheim, Max Weber, and Ferdinand [1, 2, 3] asserted that concerns about an urban region having a crime-causing effect on the individual is not authentic enough to base the claim and that other European sociologists also wrote that the changes that may occur as a result of the transition of societal activities from rural to urban and industrial based ones can have an effect on the rate of criminology cases in the region. They

proposed a point that during the increase and rapid growth in societal changes and rapid expansion of cities, the crime rates will increase and experience a lot of other problems. Assumption can be based on most of the eighteenth-century philosophers and scientists who believed that city life would be a high criminology point even without these rapid changes.

The scientist believed that in circumstances of less change or social stability, negative influences of the urban region would also lead to a high level of crime that can occur in non-urban populated places. This is not based on assumption, urban regions like London and certain European cities can be difficult to live in for an averagely inclined earner with a low-profile lifestyle and they can be subject to robbery when they go out at night [4, 5, 6, 7, 8]. The studies of these trends in the crime rate have also reached their advanced level where innovative GPS tools are used to map out and detect locations in urban places where there are high crime rates of different categories. This paper focuses on using the concept in geo and generic mapping to classify the rate of crime increase in urban areas like the US. This is a typical and basic example to use in identifying strategic locates for identifying the rate of crime occurrences and designing a means to counteract the highest level of crime and event crime minimisation based on Equation 1.

$$\min_c \|Y_{initial} - Y_{end}\|_m \quad (1)$$

$$Y_{initial} = D \int_{n=1}^m R \frac{dx}{dt} + C \quad (2)$$

$$Y_{end} = D \int_{i=1}^j R \frac{(2+X)dx}{dt} + C \quad (3)$$

$$(4)$$

Where $Y_{initial}$ and Y_{end} are the initial and end classified crime rates for a given region R , with c as the classified criminology rate in that region. The pattern of crime is classified based on individual changes and environment that lead to an increase in crime rates for that region. The proceeding section discusses briefly the different crimes and criminology reduction in different areas in the review process.

2 Literature Review

The American sociologist in criminology [9, 10, 11, 12] has shared a belief that the turn of the century has seen a pathway in urban life where social workers take their intellectual rationalization from the social Darwinists and this creates a juvenile court to try and control crime and certain delinquency among rebellious citizens that have a negative influence by life in the region. In the early twentieth and during World War II, some sociologies at the University of Chicago [13, 14, 15, 16, 17], relate the construct of explaining concerns why some cities may have higher crime rates than others. More interest was laid on documenting variations in crime rate levels in the cities. Crime in the city was caused by the influx of immigrants, especially the ones from crime-inclined ethnic groups. However, observation was made that some sections of the urban region consistently have higher crime rates than other regions regardless of the population of the area. Also, the demonstration was made on data that the crime rates can be strategies more accurately by paying attention to the ecology of the area rather than the ethnic composition of the populated and inhabiting areas.

The study [18, 19, 20] talked about immigrants who arrived in the United States and moved to poor and blighted areas because it is a place where they can afford to live, and crimes in these areas a very high and reflect poor living situations. The neighbourhood mostly experiences a great number and high level of poverty, including racial heterogeneity. As succeeding generations of immigrants improve their standard of living, they mostly move to better-neighbouring locations, and as a result, their initial ethnic group rate declines. This gives room for new immigrants from different ethnic groups to repopulate the place previously occupied by former immigrants. With the almost complete changes in population configuration, the crime rate remains the same and even grows higher as time proceeds. The conclusion was then made that criminogenic relations of the ethnic groups do not lead to elevated crime rates but the nature of the urban area and its economy and ecological values by which they live.

3 Variations in Urban Crime

There is a general assumption in the consensus among different criminologists [21, 22, 23] that urban areas have a higher rate of crime than rural areas and the reason why urban areas have the most occurrence of crime is the main point of research focus. Some research has also assumed that not all cities or neighbourhoods experience the same level of

crime occurrences and violence. The research question posed is, what is the source of these variations? And what is the cause of some cities experiencing a higher crime rate than others that have a relatively low level of crime? Researchers have tried to answer these questions by uncovering the correlations between urban crime rates to rural crime rates. The based in line with social disorganisation assumptions that are inclined to neighbourhood characteristics that are related to high crime levels in the area. The range of this correlation is studied extensively, and one of the common characteristics is related to the socioeconomic and demographic features of the intended area or area of interest. These demographic features include the poverty rate, residential mobility, racial composition, age structure, and also the divorce rate of the area. In studies of urban crime rates, these correlations appear often within short time intervals. There are three most focused correlates of these crime rates, this includes Poverty and equality, Racial composition, and Labour market conditions.

3.1 Poverty and Inequality

This is the literature on the association between social class and crime that exists as delinquency in a smaller but important group of studies that examines the effects of poverty on the crime committed [24, 25, 26]. This group of studies depicts the larger body of prose in which extensions are made on the controversy and disqualification in poverty as related to crime. At the University of Chicago, the significance of urban socioeconomic conditions for the incidences that lead to crime was recognised in ecology studies, and [Shaw and Mckay] made comparisons in the delinquency rates in different areas in twenty-one cities by making conclusions that three of the urban conditions supports high delinquency rates, racial, poverty, and mobility as the most prerequisite factors. The differences in a positive relationship between poverty and crime went uncontested. [Blau and Blau] registered the hypothesis that racial economic inequality and more poverty lead to the potentiality of violence. This can be countered by testing the content using data collected on one hundred twenty-five large standard metropolitan statistical areas (SMSAs). Findings show that if economic inequality is controlled, the positive correlation between poverty and criminology will disappear.

3.2 Racial Composition

The racial composition is the relationship between criminal violence and the racial structure of a given region. The strong positive correlation between criminal violence and an area with racial composition has shown to have a high true positive level across all levels of aggregation that includes states and cities of a given neighbourhood. More recently [27, 28], there have been attempts to introduce additional racial groups outside colored ethnic groups into measures of racial composition. These measure more accurately with racial heterogeneity and all levels of racial diversity within an urban region.

3.3 Labour Conditions

One of the possible areas that bridge the gap between economics and crime/race in a region is the research that looks into the labour market [29, 30, 31]. Criminologists try to categorise the relationship between crime and unemployment, but this has to come to an inconclusive end. Some later studies found that crime is positively correlated to the unemployment rate and studies that go beyond the simple consideration of employment have found that areas with unstable unemployment situations for a relatively huge amount of adults possess high crime rates. The labour market division seeks to give an exact definition of how job allocation perpetuates a system's stratification that regulates the poor and minor population to economic drawbacks. The focus of this research can help to understand underclass urban neighbourhoods comprising mainly African American and Latino residences with high crime rates. This is where the stratification of crime rate regions comes into play by utilising geo and generic mapping to classify the crime rates of different classes of crimes. A typical example used here is the US urban region, a suitable visual area to understand the increase in crime rates and how to counter affect the high positive rate to declination.

4 Method

The method used for crime rate stratification is the use of geo-generic mapping provided by R libraries for a typical example of crime rate classification. A minimisation function is used to compute the declination of the resultant classes of crimes detected in a given region. Figure 1 shows the selected urban region (US) to be used for stratification as the input image model for generic output mapping using the following Equation 5:

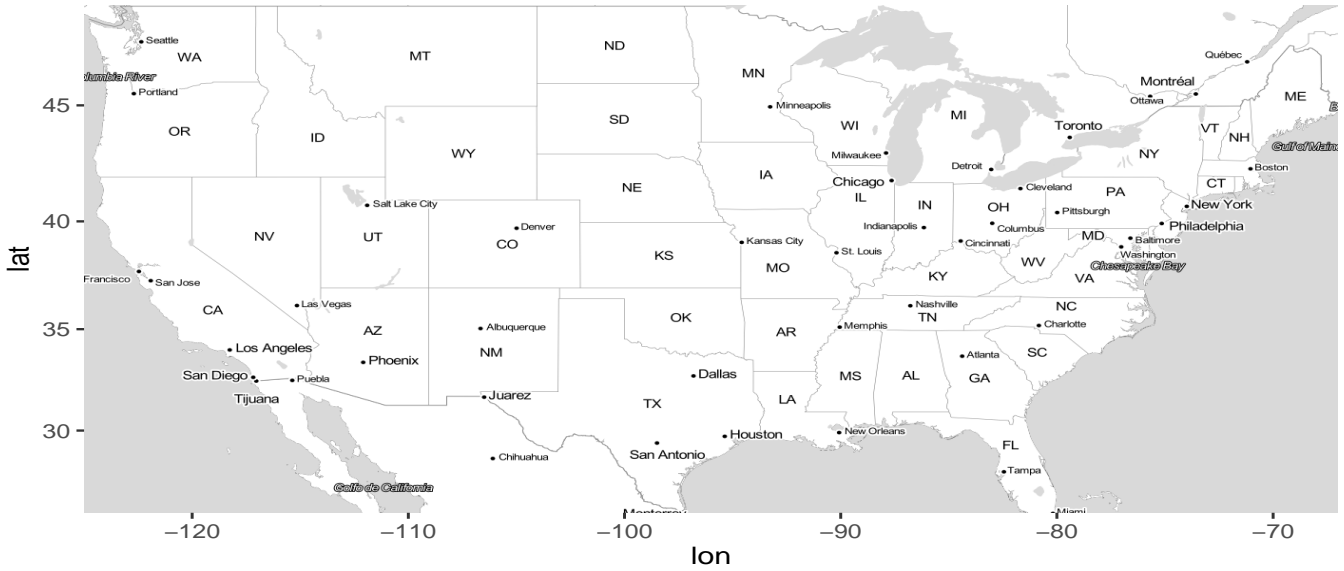


Figure 1: Inpiut image mage for the proposed model.

$$y = (2 + c) \int_{i=1}^{m+1} X(t+c)_r dx + \left[\sum_{i=1}^m X(t+c) \right]. \quad (5)$$

Where y is the predicted class of crime rates on input map image X , t and c are the constant factors present in the region, such as migration, racial classification and economic factors that could contribute to the increase in crime rates. The input image is pixelated and quantified by the generic function and the list or number of crime rates in the increase is saved in the archive is mapped out and a minimisation strategy is applied using Equation 6.

$$Y_{minimised} = \min_c X \|y_{initial} - y_{end}\|_m \quad (6)$$

The minimised resultant crime rate $Y_{(minimised)}$ is based on the reduction of the number of false cases detected and this can be obtained by looking at the constant environmental factors and the reduction of its occurrence annually or periodically. The initial and end resultant class of crime rates is obtained based on the original input image and the simulated form of the image matrix. The input image or image matrix X also depends on the number of instances m generated.

5 Result

Figure 2 shows the intensity of violent crimes in an urban region as the US, the intensity is mainly based on migration rather than racial complexity. The crime intensity shows that sometimes disadvantaged neighbourhoods could find it difficult to draw the attention of conventional institutes that help in controlling violent crimes. These institutes have settings that are conducive to prevalent crimes and combing their effect on the neighbourhood. Sometimes some violent crimes are produced by certain social variables that are considered to be alien to society, and yet independent and other dependent variables are measured based on contemporaneous values. It is also possible that crime can affect a neighbourhood in a way that reduces the number of presence that stabilises the public authorities (Figure 2. The crime intensity for violence can also gradually increase from the north to south part of the region based on migration and also on environmental factors like racial and social numbers.

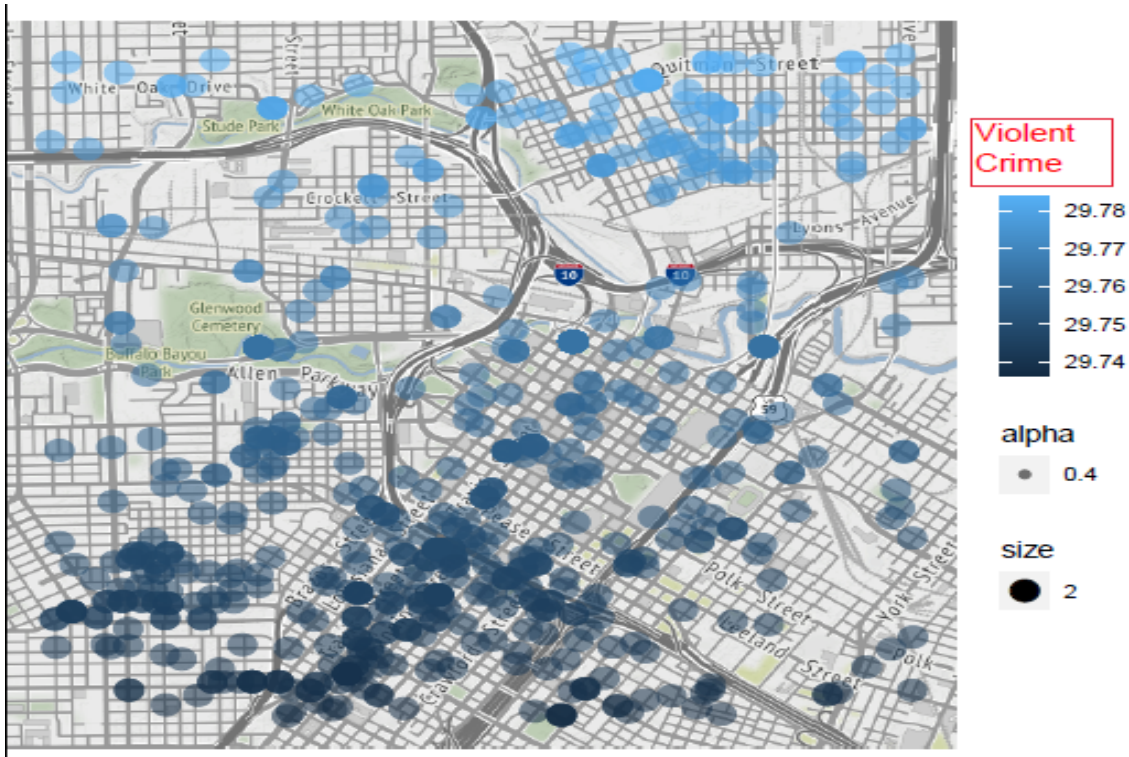


Figure 2: Violent crime intensity in Urban region (US).

Figure 3 shows that graphic contours of the violent crime that can be predicted are a certain pattern. The patterning and predictable class of crimes are depicted in a simple contour for the primary metropolitan statistical area with Fannin and Louisiana Street having the most crime occurring intensity for that district. The pattern of reduction can also be deduced from the areas with less crime violence like Quitman Street in the upper north region, this particular region might have less immigration and racial occurrence that results in less contouring lines around that particular region. This environmental constancy can also be emulated for crime-intensified areas, using Equation 6 with the intensified areas as the input metric and classified environmental factors for Quitman district as the group variable, to predict the reduction rate in the Louisiana district. Some work [32, 33], most times examines patterns in a certain metropolitan area as the statistical area examined for complementary perceptions such as the ecology of crime, the geography of crime, and also the political economy of crime. Using this analysis the extent to which the crime shifts are predictable for more than three years. The current model used in the paper can be used for a continuous period till the pattern changes. Figure 4 shows a more intensified pattern for robbery intensity that can be simulated in real-time for immediate analysis. This form of pattern can be tracked constantly by following the intensity of changes that occur in that particular region. A simple concurrent event can be tracked and traced in real-time from an analytical tool which can be accessed by the local authorities.

Figure 5 shows the four different classes of violent crimes and their intensity, with rape and murder, having the least occurrence from the neighborhood. Each of these different crimes also has its pattern as in Figure 3 when set as input for the crime dataset in Equation 2. Sometimes, crime is difficult to predict and is considered to be both random, and the possibility of occurrence at any time is 50 – 70% chances. This is a challenging issue for most neighbourhoods. A crime prediction model can analyse and compare different prediction classification algorithms to determine reliability and consistency in crime occurrence for a particular district. The model used here uses four different violent crimes by visualising the patterns and occurrences for each class of predicted crime in that region. Robbery and Aggravated assault have the most occurrence in intensity and can be reduced using the Reduction equation for each category. The model used here is simply based on simulation and future modifications will be made based on analytically inclined implementation.

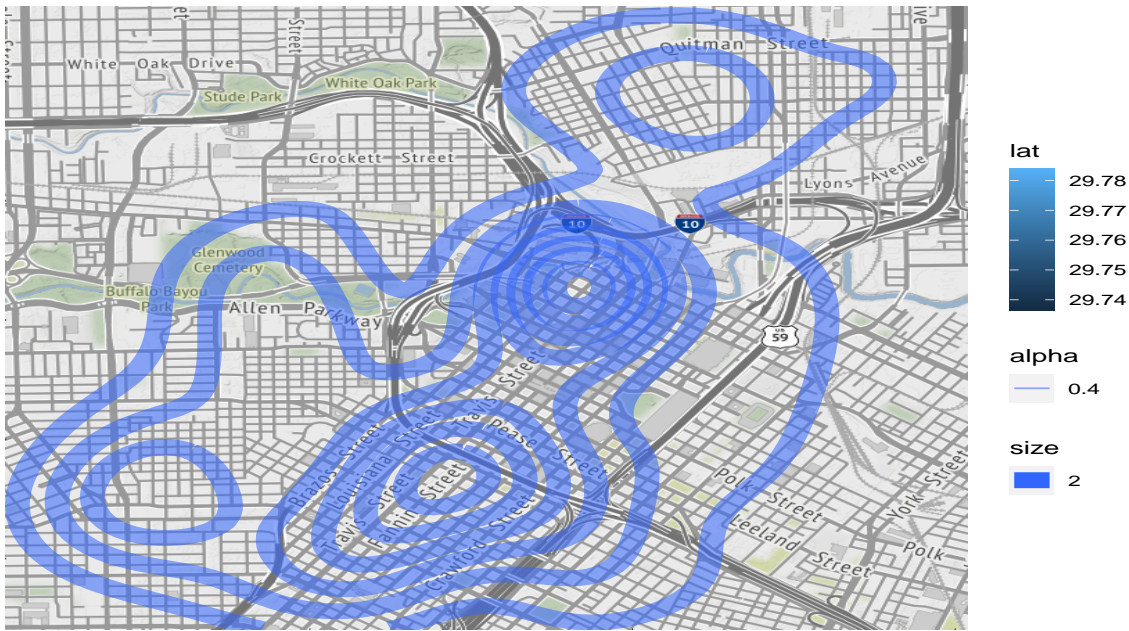


Figure 3: Patterns represented by line contours of Violet crimes in Urban region (US).

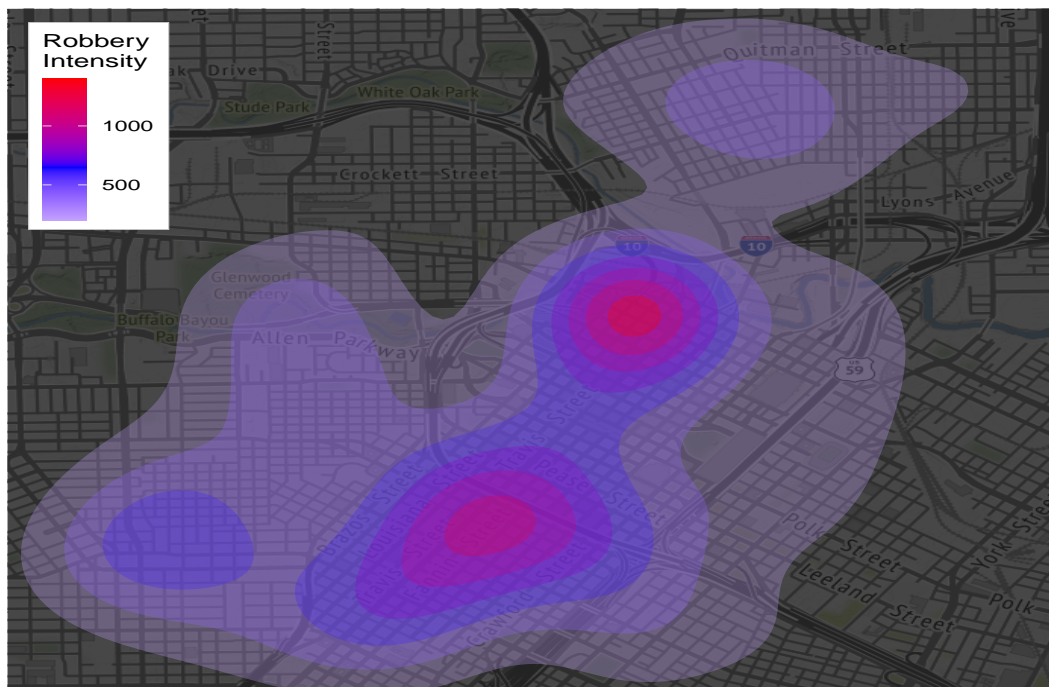


Figure 4: Patterns represented by the intensity in a robbery on Violet crimes in Urban region.

6 Conclusion

This paper set out to give a defined term in the principles of classifying crime rates in highly urbanized regions through generic mapping. Research questions such as, What do we know about urban crime? How do we minimise the rate of crime in an urban setting? It is a fact that cities are generally more in area of crime-prone than other hinterland. Also, crime rates can vary within cities. The reasons for these variations are not certain, and also why these variations rate more dramatically across different cities. The major theoretical perspectives on crime rates discussed in the paper

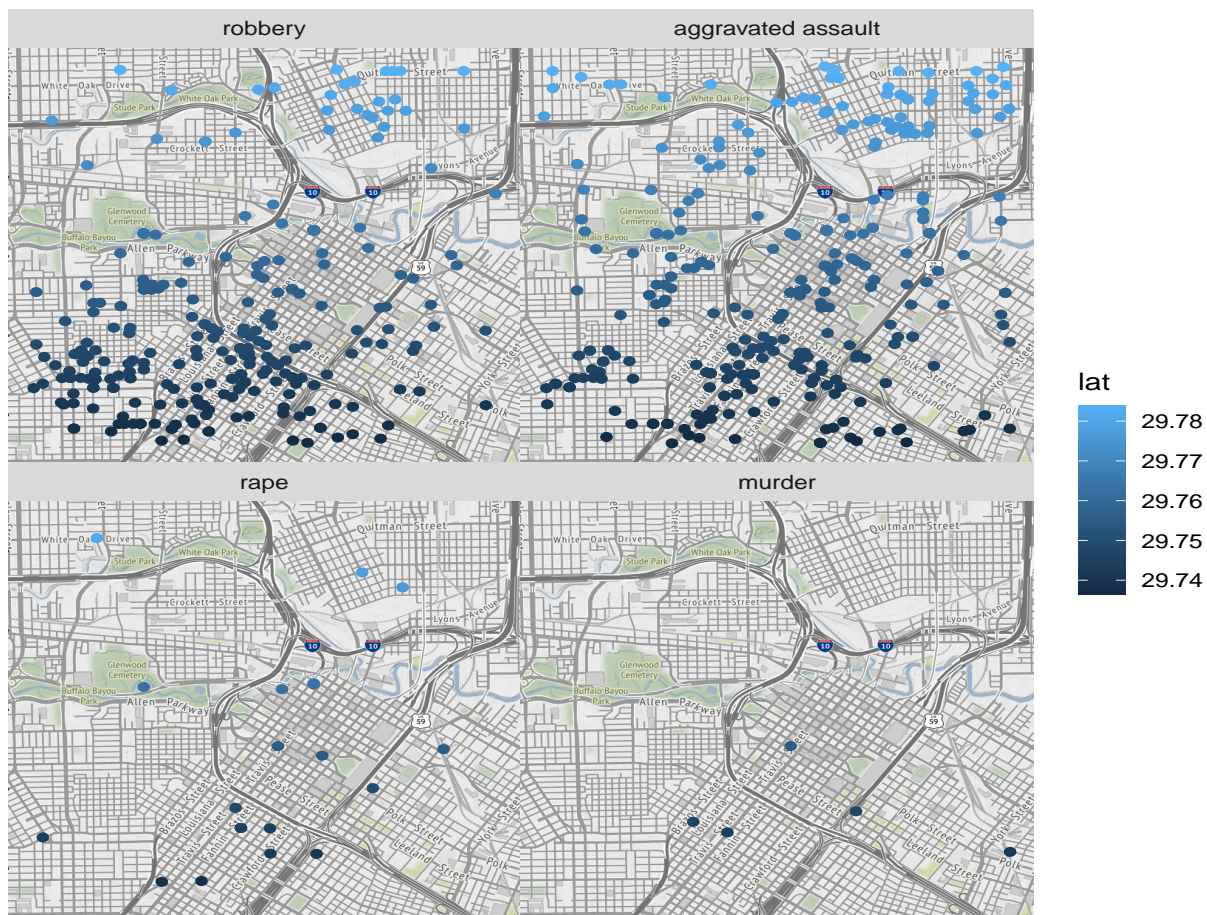


Figure 5: Classified Violent crimes in Urban region (US) based on crime intensity.

include social disorganisation, subculture theory, racial conflicts, and economic differences. The paper looks into the fundamentals in the study of crime rate and the process of depicting the class of crime through generic mapping with R language. The basics and importance of identifying crime rates and location are discussed and the result section shows some of the outputs derived from generic classification mapping. A minimisation function was also derived that can be used to reduce the increase in crime rates in this urban, from the initial and end resultant classified crime rates. The future perspective would be to design an analytical tool that can be served online which would evaluate a particular region and access the means for crime reduction online and also in real-time.

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