Ilkogretim Online - Elementary Education Online, Year; Vol 20 (Issue 4): pp. 715-724
http://ilkogretim-online.org
doi: 10.17051/ilkonline.2021.04.75

Determination of Crime Density Patterns in High Schools in Kota Kinabalu City Using GIS Applications

Lizalin Kalang, Faculty of Humanities Art and Heritage, Universiti Malaysia Sabah, lizalinkalang94@gmail.com
Oliver Valentine Eboy, Faculty of Humanities Art and Heritage, Universiti Malaysia Sabah, Universiti Malaysia Sabah

ABSTRACT- Crime is a negative phenomenon found in society. In this regard, crime is said to be a lot in town and is more likely to concentrate around the city centre. The most common crimes in the city are property and violent crime. The rise in crime issues due to urban development lead urban schools to be threatened with criminal activity. Criminal behaviour outside the school can affect student safety. Therefore, this study highlights the study of property and violent crime in schools' focus areas. In this regard, the lack of research on criminal issues from many disciplines, especially in Geography is one of the major cause of ineffectiveness in crime prevention. Hence, due to this problem, this study focuses on the application of Gegraphic Information System (GIS) as a tool used in Geography for crime mapping. This study used property and violent crime statistics data of Kota Kinabalu for the year 2018 which was obtained from the Kota Kinabalu District Police Headquarters (IPD). The data were entered into GIS software and then analyzed using pattern analysis which is Kernel Density. The result of this study is a crime density pattern map. Based on the crime density pattern map, a high-density pattern of property crime is found in the Kota Kinabalu zone while violent crime is found in two zones namely Kota Kinabalu and Signal Hill. It was found that no school was in the high-density pattern of the property and violent crimes.This study contributes to crime mapping using GIS analysis. In addition, the findings of this study can help the schools, police and city planner to overcome the property and violent crime in the city and the schools that are affected by it.

Keywords: Crime Mapping, GIS, Density Patterns, Kernel Density, Crime, Property Crime, Violent Crime, School

I. INTRODUCTION

Crime is said to be a feature of urban life nowadays and often increased due to urbanization and industrialization which has brought changes in terms of population structure and lifestyle. In short, crime hasa negative effect that increases due to urban development (Nor Ina and Norizan, 2007). This statement is supported by Sidhu (2005) as he said that public fear of crime is a major concern for policymakers especially when it involves property and violent crime. The rise in crime issues due to urban development lead the urban schools to tend to be the focus areas of crime (Franket al., 2010). Consequently, the environment of urban schools is also threatened with criminal activity. Therefore, school safety should be a major consideration for urban schools especially secondary schools, (Shamsiah, 2005). The rise of crime issues outside the school area may have a high tendency to affect student's safety and hence, it will create an unproductive learning environment, (Burdick, 2013). Property and violent crime in urban areas will affect the school area, especially high schools. This is because the students in secondary schools are mostly teenagers. They are easily affected by criminal influence and easily victimized by criminal behaviour (Roman, 2004). Therefore, based on these statements it can be concluded that the study of urban crime should not be carried out only in-focus areas such as shopping malls and other premises but should also be conducted in the school area to identify which school is located in a high-density area of crime in the city.

Regarding this problem, there is the latest technology that can be used to do urban crime study more efficient namely Geographic Information System (GIS). The studies of crime in school focus areas using GIS has been conducted before. However, in Malaysia this study is still less applied. The analysis used by previous researchers has not yet been maximized. Therefore, the researcher would like to introduce the latest analysis method namely Kernel Density which can produce a clear results. According to Ahmad Tarmizi et al (2017), the lack of study in crime issue for most disciplines, especially in the Geography field is one of a contributor to the ineffectiveness of crime prevention. Therefore, this study was conducted to identify the density patterns of crime in high school area in Kota Kinabalu city with GIS application. The

use of technology, especially GIS, provides new opportunities to produce crime mapping and improve crime prevention (Mohd Norashad and Tarmiji, 2016; Zaini and Nor Shah, 2009).

This study used the property and violent crime statistics data of Kota Kinabalu for the year 2018 which was obtained from Kota Kinabalu District Police Headquarters. The property crimes involved in this study are theft, car theft, motorcycle theft, van / truck / heavy machinery theft and burglary. Meanwhile the violent crimes involved are murder, injuring people with objects or without objects, rape, individual robbery without weapons and group robbery without weapons.The data were entered into GIS software then analyzed using Kernel Density analysis. Kernel Density analysis will produce high, medium and low density crime patterns. Subsequently, the interview was also conducted with two police officersto verify the data. However, qualitative analysis was not used in this study. The purpose of the interview was only to make a justification for the results of the study.

As a conclusion, this study is important to see how GIS applications can be used to identified crime density patterns in urban and in school focus areas as well. Besides, this study can be used as a reference to other researcher to applied GIS in the future studies of crime mapping. As a results, this study has successfully proven that GIS can be used to determined the density pattern of crime in high school focus areas in Kota Kinabalu. To summarize, the results of the crime maps in this study can be used as a guide for the police, schools and other security agencies to take the appropriate action to prevent the crime in high school focus area in Kota Kinabalu city .

DEFINITION OF CRIME AND GIS

Criminal activity can be characterized in many ways (Ivin, 1911). However, it is generally related to the law (Mohd Dahlan and Ida Shafinaz, 2010). Meanwhile, the basic idea of what crime is that it can cause problems or distress to others (Giddens, 1993). Thus, the individual who commits a criminal offence will be punished (Gan, 2007). Crime often occurs in an urban area. This fact is undeniable due to the population increased and the high cost of living. The crimes that often characterized in urban areas were property and violent crime, (Nor-Ina and Norizan, 2007). Property crime means a crime involving the loss of property does not involve physical harm. Property crime does not involve physical injury because it involves the loss of goods or money and breaking into the premises (McGuire, 2000). Meanwhile, violent crime is a threatening act and causes an injury to a person. Violent crimes include killing, attempting murder, armed bandits by group, unarmed bandits by group, armed robbery, unarmed robbery, rape and injuring people, (Saravanan, 2010).

Concerning that, there is one application that can be integrated into criminal studies nowadays called Geographic Information System (GIS). GIS was introduced by the Canada Geographic Information System in 1960 (David, 1997). GIS is a computer-based system to capture, store, analyzing and presenting spatial data (Rosmadi, 2015). The earth's objects are represented in the form of symbols using computers (Ang, 2015). The use of technology, especially GIS, opens new opportunities for crime mapping to support crime prevention, (Mohd Faris, 2006). In addition to that, GIS is not just about creating maps, but it also develops databases. Each item in the GIS database is represented by various shapes such as points, lines and polygons that represent an area or zone (Debats and Gregory, 2011).

THE EFFECT OF CRIME IN THE SCHOOL AREA

School safety is important and should be given serious attention especially for the schools in urban areas (Shamsiah et al, 2005; Franket al, 2010). Also, school safety should be a major consideration for schools with significant accidents and crime incidents (Norlia and Sufean, 2006).

According to Burdick (2013), education levels are very different in the United States. The schools in urban area have higher crime rates than suburban schools. As a result, most students in urban schools have poor performance compared to suburban schools. This proves the negative impact of crime on student achievement.

Haas's study in the year 1988 also found that property and violent crime were higher in urban schools. The main reason for the high crime rate around the school is due to no control over criminal activity outside the school and no law enforcement by the school.

Initially, research on crime around the school area was concentrated in high school. There are several reasons in which high schools potentially a high-risk area of crime. Some of the reasons are high school consist of matured students and easily affected with criminal activity, (Roman, 2004).

Furthermore, the youths in schools located in the urban areas easily affected by the criminal activity that happened around the school due to limited parental care as the youth are considered to be self-sufficient. Therefore, secondary schools that consist of large groups of individuals from that age group are characterized by higher incidence rates as crime focused areas, (Timothy and Terance, 2011).

Based on previous studies that have been reviewed, it is found that schools located in urban areas are more likely to be hotspots for crime.
Therefore, we should note that studies on urban crime should not be focused on the city center alone. In other words, the studies on crime in other areas in the city such as in schools should be further enhanced.

GIS APPLICATIONS IN CRIME MAPPING

Nowadays, many different types of mapping can be produced using GIS and these include crime mapping. The use of GIS in crime mapping can help authorities to reduce crime efficiently and effectively (Canter, 1997; Aziz, 2011).
From the studies of Zaini and Nor Shah (2009), they said GIS is truly can be used to overcome the crime. Initially, in their studies, the crime mapping using GIS was to indicate the location of the crime collected from the Police Report System (PRS) to the GIS application to identify crime areas. The geocoding analysis was used in their studies. The result of geocoding analysis was a digital map of the crime to shows the distribution of crime within the administration area.
Besides, according to the studies of Syerrina and Nuzlinda (2015), criminal cases in Peninsular Malaysia were analyzed using autocorrelation analysis. Based on the analysis, crime hotspot in that area was identified and mapped.
Also, a study of crime mapping using hotspot analysis in India was conducted by Jaishankar in the year of 2009. From the results of the analysis, it was found that the crime hotspot not only in focus location but also in the surrounding area.
Olajuyigbe et al (2016) also used GIS to create crime mapping using geostatistic analysis. Inverse Distance Weight (IDW) analysis was used in this study for interpolation of data obtained through the Global Positioning System (GPS). Studies have revealed that crime is increasing along major transport routes through the Akure metropolis and also to certain areas such as post offices, Oke-Aro, Odo-Ikoyi and Isolo. At the same time, this study revealed that the transport route through Akure is exposed to criminal activity.
Lastly, Canter (1997) used the Nearest Neighbor Hierarchical (NNH) analysis in crime mapping studies. The finding shows that robbery cases in Baltimore increased by 45% between 1990 and 1997. By 1997, 73% of all robberies reported in Baltimore had occurred in commercial areas.

Based on previous studies on the application of GIS in crime mapping outside and within the country, it can be concluded that the analyzes used in GIS applications are relevant to conduct criminal studies nowadays.

GIS APPLICATION IN CRIME MAPPING IN SCHOOL FOCUS AREAS

There are several studies on the application of GIS in crime mapping in school focus areas that have been done as in the study Filiberto (2016) which he has used hotspot analysis to identify the density pattern of property crime and violent crimes that occur in school areas.

Next, the study of crime mapping in schools using GIS was also conducted by Elizabeth (2014). She has conducted quantitative analysis by studying crime as a factor affecting schools using GIS through buffer analysis.
Last but not least, a study of crime mapping in school focus areas using GIS applications has also been conducted by Hashim et al (2018) in Malaysia. This study has identified the pattern of crime index distribution in school focus areas in Petaling and Klang by using buffer analysis and Crime Location Quotients(LQC) as the main method to identify the pattern of crime space distribution in school focus areas.

RESEARCH AREA

Kota Kinabalu, Sabah has been selected as the study area. Whereas the focus areas of this study were on the selected zones namely Kota Kinabalu, Damai, Luyang, Sembulan, Dah Yeh, Fung Yee Ting, Kolam, Bukit Padang, Signal Hill, Likas, Teluk Likas and Kolombong. The selection of these zones due to the distance of these zones that close to each other and this make easier to identify the crime patterns in that area. Besides, these zones were also the area with many high schools. Figure 1 below shows a map of the research area.

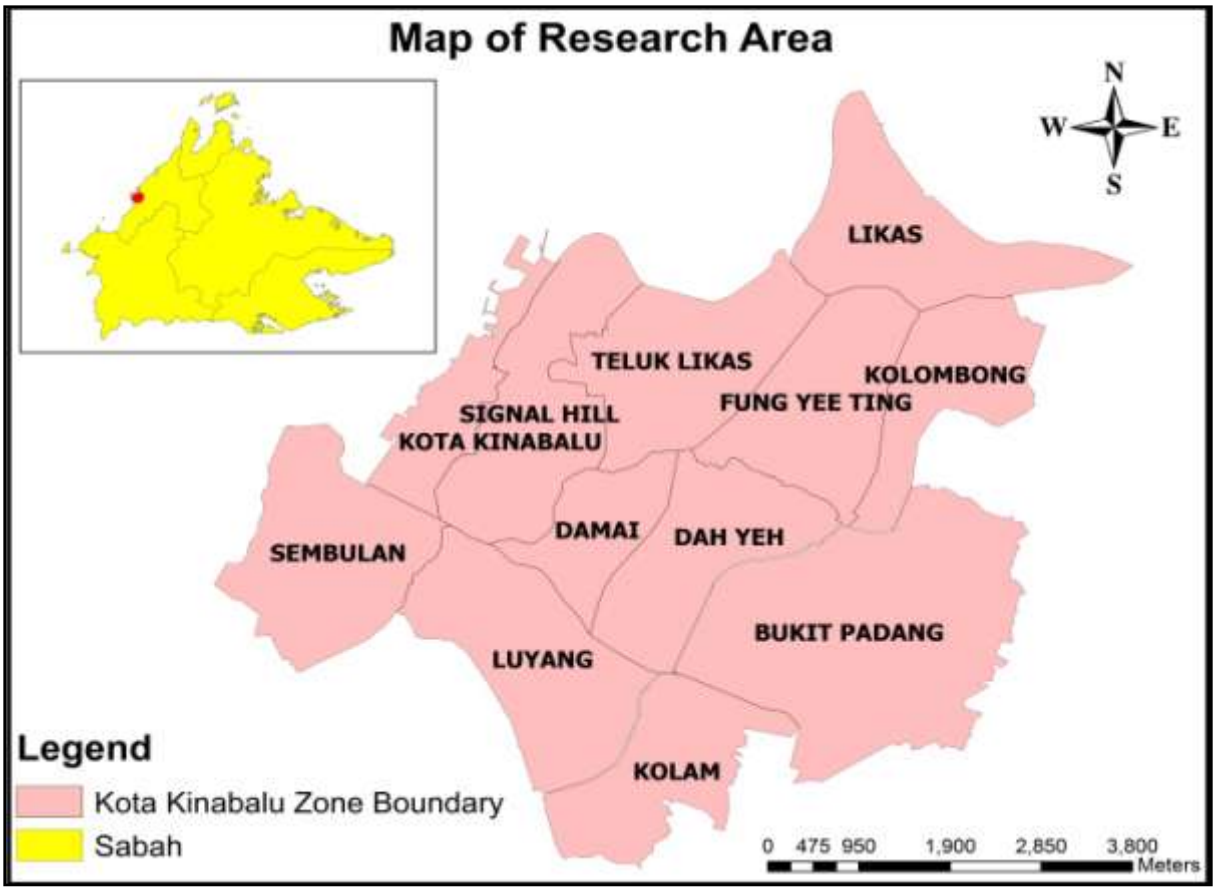

Figure 1. Map of the research area.

II. METHODS

In this study, the researcher used quantitative methods. All the statistical data of property and violent crime analyzed using GIS software. In the early stages of this study, the database will be developed first as it is the first step in a GIS study. The spatial data in this study consists of the zones area and high schools location. The spatial data obtained from a digitized map of Kota Kinabalu. There were 12 zones selected in this study as shown in table 1 while the 14 high schools involved shown in table 2. Besides the spatial data, attribute data also important to describe geographical phenomena. In this study, the attribute data consists of statistical data of property and violent crime of the year 2018 in Kota Kinabalu obtained from the Kota Kinabalu Police District Headquarters. The method used in this study was density pattern analysis called Kernel Density. Kernel Density analysis is used to determine the density pattern of property and violent crime in the study area. It will produced high, medium and low density of crime patterns. Details related to Kernel Density analysis will be explained further in the next section.

As mentioned earlier, this study was also conducted an interview with two police officers to verify the data and to make a justification for the results of the study. However, the qualitative analysis was not used in this study.

Table 1. The list of selected zones

NUMBER	ZONES NAME
1	Kota Kinabalu
2	Damai
3	Luyang
4	Sembulan
5	Dah Yeh
6	Fung Yee Ting

7	Kolam
8	Bukit Padang
9	Signal Hill
10	Likas
11	Teluk Likas
12	Kolombong

Source: Digitized map of Kota Kinabalu district, scale 1: 12 500 obtained from JUPEM (2018)

Table 2. The list of high schools involved

Number	High Schools Name
1	SMK All Saints (M)
2	SM Kian Kok
3	SMK Agama Kota Kinabalu
4	SM Tshung Tsin
5	SMK Perempuan Likas
6	SMK Likas
7	SMK Sanzac
8	SMK Konven ST Francis
9	SM Sains Sabah
10	SM Teknik Likas
11	SMK Tun Fuad
12	SMK Shan Tao
13	SMK Lok Yuk Likas
14	SMK Kolombong

Source: Digitized map of Kota Kinabalu district, scale 1: 12 500 obtained from JUPEM (2018)

KERNEL DENSITY ANALYSIS PROCESS

Kernel Density is an analysis used to detect density patterns in GIS. It is widely accepted as the most appropriate analysis technique that capable to identify the density patterns and at the same time produced clear maps that are not limited by shape or boundaries (Chaineyet al, 2008). This analysis was used in this study to identify the density patterns of crime in the selected research area. The process of Kernel Density analysis in this study is shown in figure 2 below. This process begins by performing Kernel density analysis to both property and violent crime. Next, reclassification was performed to categorize the data into high, medium and low density. After reclassification, raster data was converted to polygons. The results obtained will show the high, medium and low-density patterns of crime in the research area.

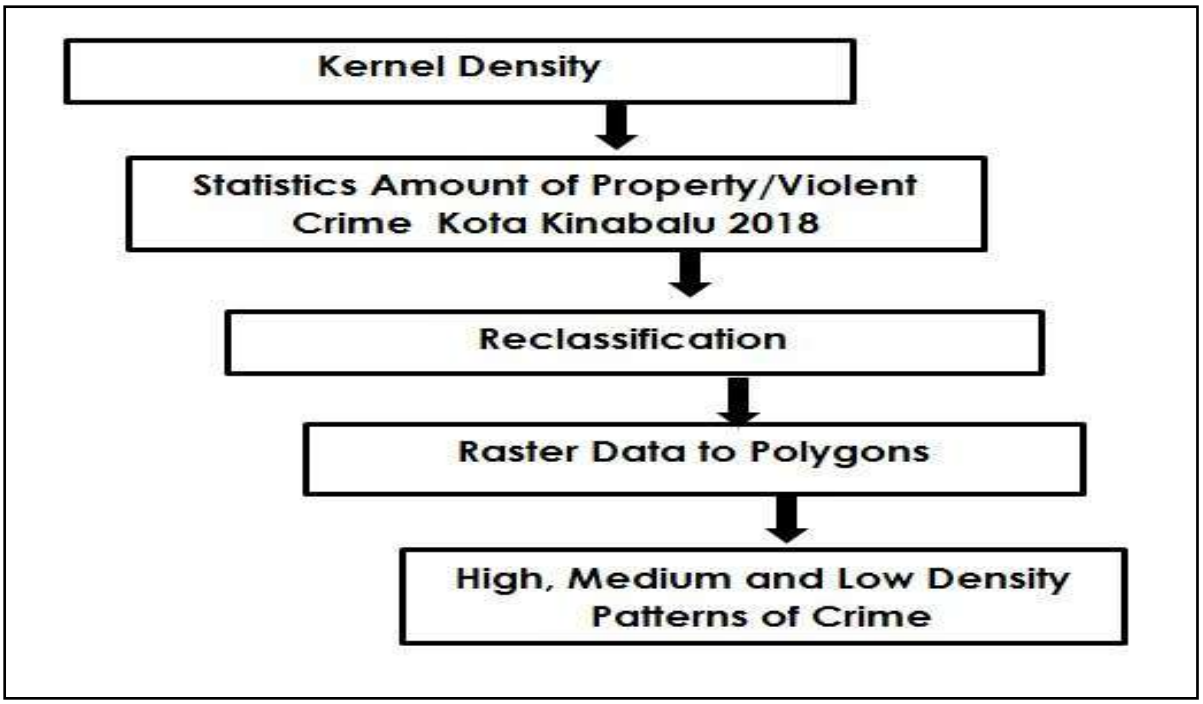

Figure 2. Process of performing Kernel Density analysis.

III. RESULTS

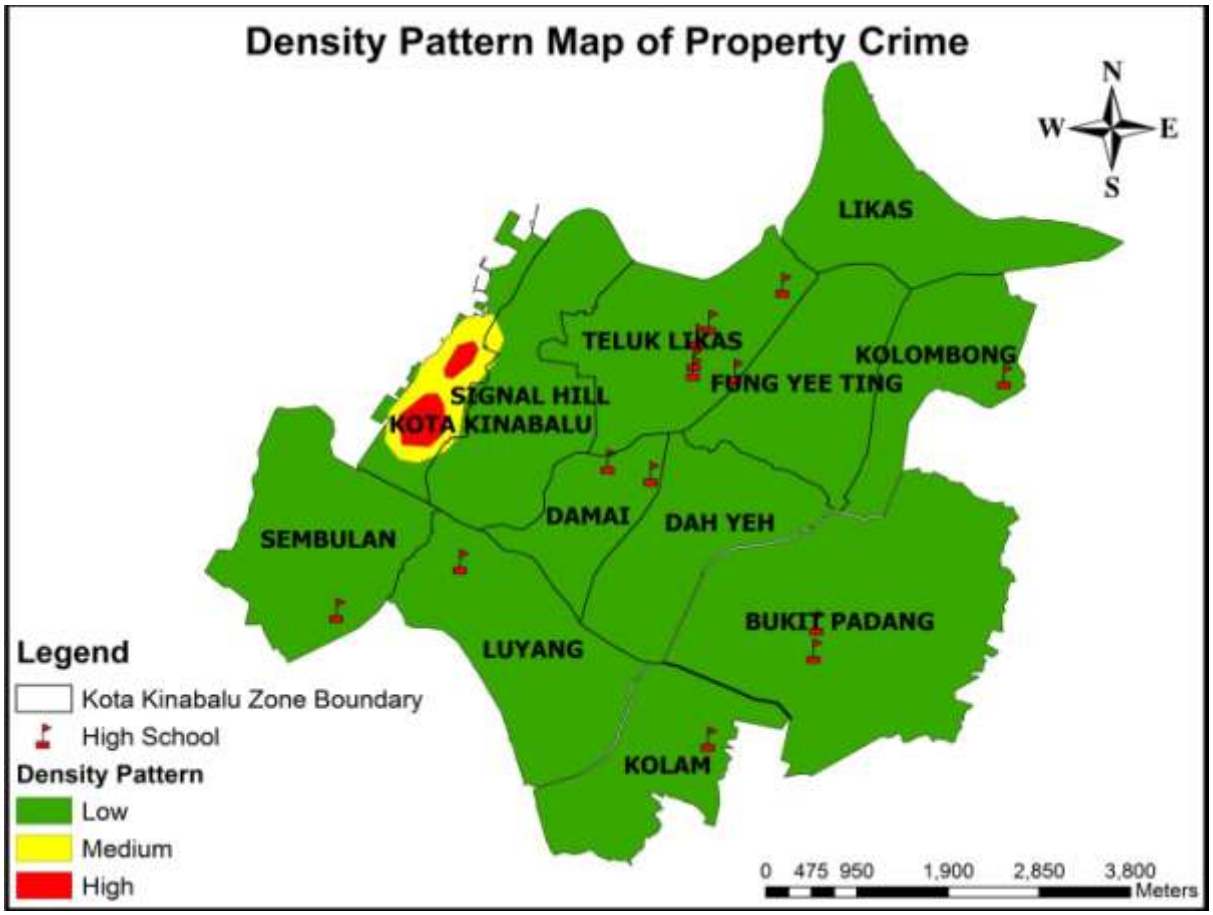

Figure 3. Density pattern map of property crime using Kernel Density analysis.

Figure 3 above shows the density pattern map of property crime. Based on the map, it can be seen that the high-density pattern of property crime was located in the Kota Kinabalu zone. Based on an interview with two police officers namely Arif and Muhammad Huzaimi (2019), the high-density pattern of property crimes mostly concentrated in the Kota Kinabalu zone. According to them, Kota Kinabalu zone is a hotspot for property crime because it is a city center. Since Kota Kinabalu zone is the city center, people always concentrate in that area and it became a crowded place. Therefore, the chances for criminals to commit property crimes are higher, they added. Apart from that, Kota Kinabalu is also a zone with a high population. They said the population in that zone has become higher due to the presence of outsiders. This makes Kota Kinabalu zone more congested and has caused property crime became more prevalent. However, it was found that no high school was located in that zone. All high schools involved located in a low-density pattern of property crime. Details related to this will be explained further in the discussion section.

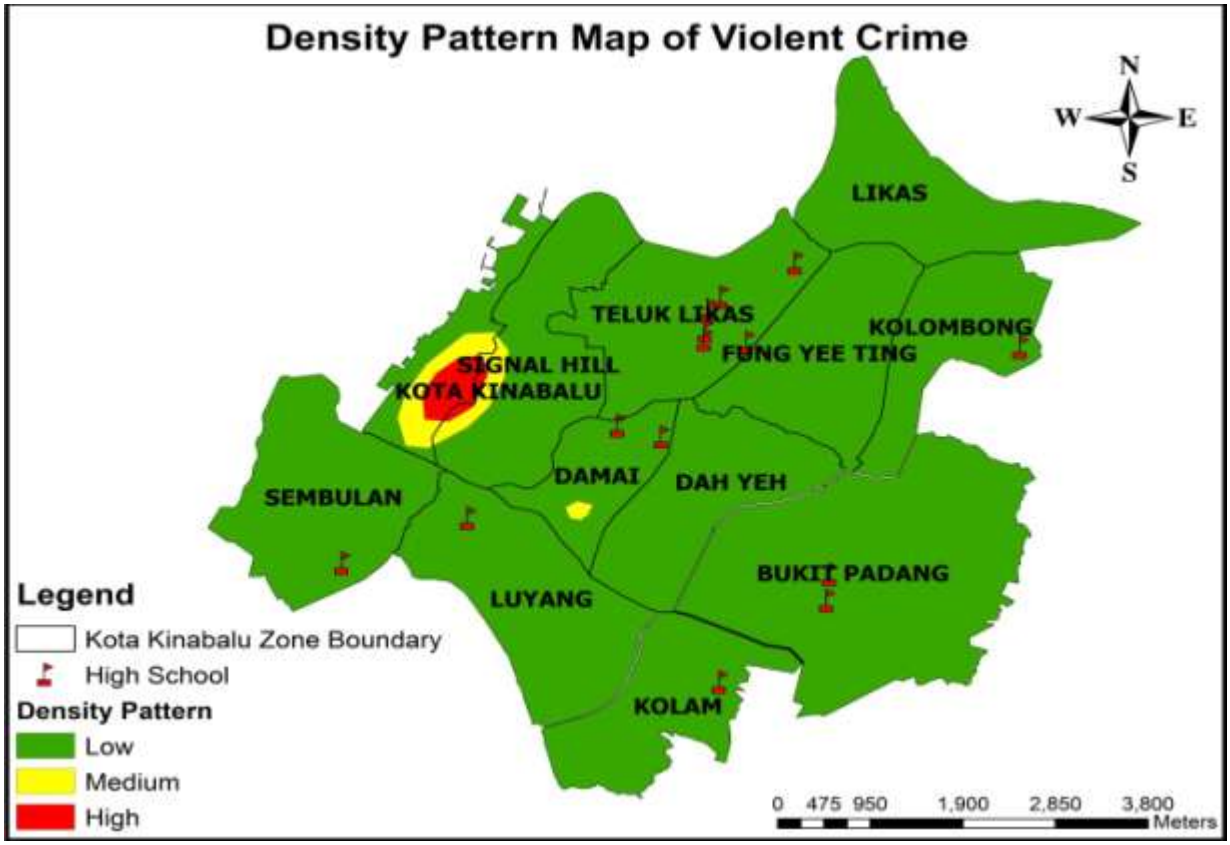

Figure 4. Density patterns map of violent crime using Kernel Density analysis.

Meanwhile, figure 4 above shows a density pattern map of violent crime. Based on the map, it can be seen that high-density patterns of violent crime was concentrated in two zones namely Kota Kinabalu and Signal Hill. According to Arif (2019) and Muhammad Huzaimi (2019), overall high-density pattern of violent crime normally concentrated in Kota Kinabalu and Signal Hill zones. They said violent crime has often been concentrated in the Kota Kinabalu zone as the zone has many entertainment centers as found in the Kota Kinabalu Waterfront. Besides, they said the causes of violent crime such as injuring people with objects or without objects and murder often occurs when the individual is under the influence of alcohol, marijuana, syabu and others. Meanwhile, rape is often reported occur in boarding houses and budget hotels around the Kota Kinabalu zone. Rape occurs when the victim has met the individual through social media then the individual invites the victim to meet (Arif, 2019; Muhammad Huzaimi, 2019). For individual robbery cases and group robbery cases without weapons in Kota Kinabalu are more likely to occur on sidewalks and shopping malls (Arif, 2019).

As for the Signal Hill zone, violent crime is concentrated in this area because the zone is a relatively quiet and isolated place (Arif, 2019; Muhammad Huzaimi, 2019). However, according to them, the zone became a crowded area for residents and tourists at peak times. Usually, residents and tourists went to Signall Hill Tower to enjoy the scenery in the evening. Other than quiet and isolated, the geographical factor which is hilly making it more difficult for the police to conduct regular patrols in that area. Therefore, Signall Hill

zone has the potential to be a high-crime area (Arif, 2019; Muhammad Huzaimi, 2019). As we can see from the density pattern map of violent crime, it also found that no school was located in those zones. The schools involved are within the low-density pattern of violent crime area. Details related to this will be explained further in the discussion section.

IV. DISCUSSION

As a result, it can be said that GIS applications can be used to process and analyze criminal related data faster and easier to understand. Based on this study, GIS application was able to produced crime density pattern maps in high school focus areas using Kernel Density analysis. As we can see in the density pattern map of property crime in figure 3, it shows that the high-density pattern of property crime is located in the Kota Kinabalu zone. According to Arif and Muhammad Huzaimi (2019), Kota Kinabalu zone is a hotspot for property crime as it is a city centre. Furthermore, Kota Kinabalu zone has a high population. Therefore, the chances for criminals to commit property crimes are high. Based on the results, it was found that no high schools were within the area of the high-density pattern of property crime in that zone. All the high schools involved were located in the areas with low-density pattern of property crime.

Next, based on the density pattern map of the violent crime in figure 4, the high density patterns for this crime was located in Kota Kinabalu and Signal Hill zones. According to Arif and Muhammad Huzaimi (2019), high-density pattern of violent crime normally concentrated in Kota Kinabalu and Signal Hill zones. They said Kota Kinabalu zone has many entertainment centers such as bar and club as those in the Kota Kinabalu Waterfront. Consequently, the violent crimes occured when the individual under the influence of alcohol, marijuana, and drug. Whereas, Signal Hill zone also became a hotspot for violent crime because the place are quiet, dark and isolated but many people especially tourists came to Signal Hill during peak hours. Therefore, Signall Hill zone has the potential to have a high density pattern of violent crime. The result shows that there also no high schools within the area of high density pattern of violent crime in those zones.

Based on the findings shown through the map in this study, there were no schools located within the areas with high-density pattern of property and violent crime. It can be concluded that high schools in Kota Kinabalu city were still in the area with a low-density pattern of property and violent crime. According to Arif and Muhammad Huzaimi (2019), although high schools in Kota Kinabalu city are in the areas with low-density patterns for both urban crime but the safety of students still strictly guarded. According to them, the police and the school have worked together by implementing various ways to maintain the safety of students. One of them is by appointing a School Liaison Officer (SLO). SLO is a police officer who has been appointed and will responsible for maintaining the safety of the schools. Each school has an appointed police officer. The SLO will thoroughly monitor the school and always in touch with the school from time to time. Other than that, SLO will visit the school twice a month and attend meetings with the parents and teachers association to give talks on crime prevention.

According to Arif and Muhammad Huzaimi (2019), criminal acts outside the school area will create anxiety among students and may affect student safety. In addition, it can also influence the high school students. Therefore, although the high schools involved were not in the areas with high density pattern of property and violent crime, the police, school, and other authorities should always be aware of criminal acts happening outside the school.

V. CONCLUSION AND CONTRIBUTION OF STUDIES

To conclude, the findings in this study has proven that GIS can be used effectively in the field of crime mapping. From the previous studies as well, we also can see that GIS analysis widely used in crime mapping as in the study by Philip (1997), Aziz (2011), Zaini and Nor Shah (2009), Syerrina and Nuzlinda (2015), Jaishankar (2009) and Olajuyigbe et al (2016).In addition to that, this study introduced other analysis called Kernel Density. This study shows that Kernel Density can be used to identify the density patterns of crime in urban school area. As the results, the maps show the areas with high-density pattern of property and violent crime were Kota Kinabalu and Signal Hills. However, there were no schools located in the area with a high-density pattern of property and violent crime.

There are some limitations in this study. This study has used statistical data of property and violent crimein Kota Kinabalu for year 2018 only. This makes this study unable to make comparisons of the crime

pattern for the current and previous years.Besides, this study only involved secondary schools. This means that primary schools and other types of schools located in area with high-density of property and violent crime in Kota Kinabalu city cannot be identified.Moreover, this study only focuses on 12 zones in Kota Kinabalu city. The study area that has been selected does not involve the entire zone in Kota Kinabalu city.

Since researchers has used statistical data of property and violent crime in Kota Kinabalu for year 2018 only, therefore future researchers should use crime statistics data for several years to see a comparison of property and violence crime patterns that occurs in the schools focus areain Kota Kinabalu city.In addition, it is better if future researchers involving all types of schools in Kota Kinabalucity. The purpose is to identify schools that are included in zones that have high-density patterns of property and violencecrime. Last but not least, in the future, researchers suggest a study should be made for all zones in the city of Kota Kinabalu so that criminal patterns in Kota Kinabalu city can be identified using GIS.

This study is important as the density pattern maps of both crime can be a guide for the police and school in Kota Kinabalu to take appropriate action to reduce crime in schools areas.Therefore, studies on the crime using GIS in school focus areas should be done extensively in the future

VI. ACKNOWLEDGEMENT

The authors wants to say thank you to Universiti Malaysia Sabah for providing financial support through the Post Graduate Scholarship Scheme. It helps to completed the research and produce this paper.

REFERENCES

1. Ahmad Tarmizi Abd Rahman, Nor-Ina Kanyo, Norizan Mohd. Nor, Norhuda Salleh, Norita Jubit, Siti An-Nur Arsyi Lajimin & Norcikeyonn Samuni. (2017). Property crime in a hotspot area in Sabah: A discovery. *Borneo Communication Journal, 5, 19th Convocation Special Edition* UMS, 104-119.
2. Ang Kean Hua. (2015). Geographic Information System (GIS). Introduction to computer perspective. *Malaysian Journal of Society and Space,* 11(1), 24 - 31.
3. Aziz Shafie. (2011). Evaluation of the spatial risk factors for high incidence ofdengue fever and dengue hemorrhagic fever using GIS application. *Sains Malaysiana 40*(8), 937–943.
4. Burdick-Will, J. (2013). School violent crime and academic achievement in Chicago. *Sociology of Education,* 86(4), 343-361.
5. Canter, Philip R. (1997). Geographic Information Systems and crime analysis in Baltimore County, Maryland. *Crime Mapping and Crime Prevention Journal*, 8, 158–190.
6. Chainey, S., Tompson, L., & Uhlig, S. (2008). The utility of hotspot mapping for predicting spatial patterns of crime. *Security Journal*, 21, 4-28.
7. David, Jb. (1997). *The GIS primer: An introduction to Geographic Information Systems. Innovative GIS Solutions.* Colorado: Inc. Fort Collins.
8. Debats, D.A. & Gregory, I.N. (2011). Introduction to historical GIS and the study of urban history. *Social Science History* 35(4), 455-463
9. Department of Mapping Survey Malaysia (JUPEM). (2018). Kota Kinabalu District Map.
10. Elizabeth F. P. 2014. Learning In Harm's Way: The Effects Of Neighborhood Violence On School Performance. (Bachelor Thesis). College of William and Mary. (Unpublished).
11. Filiberto Viteri Chavez. 2016. Spatial Mapping For Improved Intra-Urban Education Planning. Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000245627 on January 27, 2019.
12. Frank, R., Andrew J. Park., Patricia L. Brantingham., Joseph Clare., Kathryn Wuschke &Mona Vajihollahi(2010). Identifying high risk crime areas using topology. (2010) IEEE International Conference on Intelligence and Security Informatics (ISI 2010), Vancouver, BC, Canada 23-26 May.
13. Gan Kong Meng. (2007). *Study of rape cases in Kedah and Perak state prisons*. Bachelor Thesis, Universiti Sains Malaysia.
14. Giddens, Anthony. (1993). *Sociology (Second Edition).* United Kingdom, Cambridge: Polity Press.
15. Haas, M. (1988). Violent schools-unsafe schools the case ofHawaii. *Journal of Conflict Resolution*, 32 (4), 727-758
16. Interview with Arif bin Razak on 02 July 2019 at the District Police Headquarters (IPD) Kota Kinabalu, Sabah.
17. Interview with Muhammad Huzaimi on 02 July 2019 at the District Police Headquarters (IPD) Kota Kinabalu, Sabah.

18. Ivin, William. M. (1911). What is crime? Proceedings of The Academy of Political Science in the City of New York, July.
19. Jaishankar, K. (2009). Use of Crimestat in crime mapping in India: An application for Chennai City Policing. *CrimeStat IV*, 65-66.
20. Kaplan, D.H. (2004). *Urban Geography*. United States: Kent University.
21. Kota Kinabalu District Headquarters. (2019). Statistics of property and violent crime in Kota Kinabalu Year 2018. (Unpublished data)
22. Mcguire, J. (2000). *Behaviour, Crime and Legal Process.* Chichester: Wiley
23. Mohd Dahlan A. Malek and Ida Shafinaz Mohamed Kamil. (2010). Crime and Social Problems Among Teenagers: The Challenges and Reality of Cyberspace. University of Malaysia Sabah.
24. Mohd Faris Dziauddin (2006). *GIS in teaching Geography subject in malaysian schools.* Geographic Education Issues in Malaysia. Tanjung Malim: UPSI.
25. Mohd Norashad Nordin & Tarmiji Masron. (2016). Analysis of drug abuse hotspot in Malaysia: A case study of the North East district, Penang. *Geografia:Malaysian Journal of Society and Space*, 12 (5), 74-82.
26. Nor-Ina Kanyo & Norizan Hj Md Nor. (2007). Crime from a Geographic perspective: A case study in the Northeast district of Penang. Geography Conference 2007 Universiti Malaya, Kuala Lumpur, 21-22 Ogos.
27. Norlia Arshad & Sufean Hussin. (2006). Safe School Policy: A survey of Kuala Lumpur city zone. *Journal of Education*, 26, 27-36.
28. Olajuyigbe, A., Omole, K., Bayode, T &Adenigba, A (2016). Crime mapping and analysis in the core area of Akure, Nigeria. *Journal of Remote Sensing & GIS* 5: 178
29. Roman, Gouvis. (2004). *Schools, Neighborhoods, and Violence: Crime Within the Daily Routines of Youth.* Lanham, Md.: Lexington Books.
30. Rosmadi Fauzi. (2015). Issues, challenges and prospects of the application and implementation of Geographic Information Systems in Malaysia. *Geografia:Malaysian Journal of Society and Space* 11(2), 118 – 127.
31. Ruslan Rainis & Noresah Mohd Shariff. (1998). *Geographic Information System (GIS).* KL:Dewan Bahasa dan Pustaka.
32. Saravanan Anna Malai. (2010). The level of effectiveness of crime prevention measures through the Safe City program. Case study in Kajang city center. Accessed from https://www.researchgate.net/publication/278329407 on 27 January 2019.
33. Shamsiah Mohd Amin, Shahrulbanun A.Ghani, & Azaiah Ab. Latib. (2005Safe School Concept and Implementation. Education Seminar 2005, Faculty of Education UTM, 15 October.
34. Sidhu, A. S. (2005). The rise of crime in Malaysia. *Journal of the Kuala Lumpur Royal Malaysia Police College*, 4, 1-28.
35. Syerrina Zakaria & Nuzlinda Abd. Rahman. (2015). Analyzing the violent crime patterns in Peninsular Malaysia, Exploratory Spatial Data Analysis (ESDA) Approach. *Journal of Business and Social Development* 2(1), 104-113
36. Timothy C. Hart & Terance D. Miethe (2011) Violence Against College Students and Its Situational Contexts: Prevalence, Patterns, and Policy Implications, Victims & Offenders, 6:2, 157-180
37. Zaini Nordin & Nor Shah Mohd Saad. (2009). Towards a safe city, urban crime prevention through sharing GIS mapping of crime hotspots. Public Sector Geospatial Bulletin Edition 2/2010. 12-22.