Literature review on crime and big data

Introduction

Crime is a complex, dynamic and multifaceted social phenomenon with far-reaching implications and consequences for people, communities and society. Criminal activity is prevalent around the world. Homicides and robberies have become an inevitable concern due to the rapid industrialization and increase in urbanisation, which have caused instability in society and causalities (Wang et al., 2020).

The United Kingdom, an industrial nation, has witnessed the continued evolution of crime, from old-fashioned crimes such as robbery or arson to new-age, highly sophisticated digital ones, including cybercrime and phishing scams.

The exploration of crime goes beyond statistical analysis and dives deeper into understanding the psychology of perpetrators, the effectiveness of law enforcement and the justice system along with socio-economic factors, cultural diversity and political landscape (Boushehrian, M., 2002). Furthermore, the study of crime in a society is significant due to its implication on social policies, the well-being of the community, and the overall growth of the nation.

This literature survey sets out to explore the vast amount of research related to crime in the United Kingdom. It intends to contribute to a comprehensive knowledge of the web of factors driving crime, the numerous types of crimes that occur, the efficacy of solutions and their administration, and the ongoing issues faced by the United Kingdom in creating and preserving a secure and just society by primarily incorporating various research findings into their public policies, judiciary and law enforcement systems.

Crime and its causes

Since the 1980s, violent crime has increased steadily worldwide, severely affecting people's quality of life, which leads to a decrease in the productivity of society and a rise in inequality. The authors showcase that any rise in inequality lowers the morality of an individual, which is inversely proportional to the probability of crime. Organized crime gangs, including drug traders, arms traffickers, and mafia, are also some of the major driving factors for increased crime (Fajnzylber et al., 2002).

Outside of organized crime, any violent crime, such as knife attacks, hit and runs, which are instigated by the public, is attributed in most cases to alcohol (Ons.gov.uk, 2015) as it is a significant activity being performed during the night (Hadfield et al., 2016). This intoxication of alcohol during the night leads to a feeling of heightened aggression, which increases the risk of violence.

The above incidents are examples of traditional crimes. Now, in the 21st century, with the rise of the digital age and computers, criminals are looking towards new avenues to extract money from unsuspecting internet users, such as older adults who are not well versed in digital security.

Cybercrimes are classified as crimes performed by expert hackers who use tools such as social engineering and viruses to gain illegal access to the accounts of unsuspecting people. Taking the Covid lockdown of 2020 as a great chance to scam people, cybercrime activity sharply rose during the lockdown (Lallie et al., 2021) as criminals started targeting people, most of whom were working remotely. Other instances of cybercrimes include leaking pictures, cyberstalking and identity theft.
Increased crime rates occur when the following factors come together: a target, a perpetrator, and the lack of any safety systems such as law enforcement (Cohen et al., 1979). This paper justifies the analysis

of the repetition of offences by perpetrators, which is an essential measure of the total crime and the rate at which it changes.

Methodology and Analytical Strategy

Crime analytics is defined as the gathering and analysis of crime data to predict, prevent and monitor criminal activity using predictive analytics, social profiling and artificial intelligence tools. (Oatley, 2021). The prediction and controlling of crime have become critical issues for governments. Scientists and researchers conduct numerous studies to analyse crime and how it correlates with urban factors influencing crime (Wang et al., 2020).

Criminal acts are categorised as Violence against a person, which is an act of physical aggression resulting in harm, injury, or death. Including Brutality resulting in biological damage and roughness without bodily harm. Next, these crimes are based on the location variety of each offence record and utilised categorization of public spaces to extract instances of violence that occurred in spaces such as streets and car parking and private spaces accessible to the everyone (such as pubs and clubs), and on mass transit which ensures that the at-risk population could be actively involved in addressing the crime (Muhammad Salman Haleem et al., 2020).

A case study conducted in two cities, namely Glasgow and Birmingham, in the United Kingdom, shows that these cities are comparable in terms of deprivation, crime rates, and population. Glasgow, being the most deprived city in Scotland, has 30% of its neighbourhoods ranking in the country's top 10% of the most deprived areas. Similarly, Birmingham ranks as England's sixth most deprived local authority, with 40% of its neighbourhoods ranking among the country's 10% most deprived areas (Button et al., 2021).

Since its establishment in 1999, the Scottish Parliament has pursued separate welfare and housing policies from England. After the 2007/8 financial crisis, the UK government implemented public spending austerity measures, including reducing the provision of social welfare programs (Lymperopoulou and Bannister, 2022).

It is important to note that there have been changes in how crime rate data has been recorded since April 1, 1998. Previously, crime rates were measured using the year from 1 January to 31 December. However, since 1998, the financial year system has been used instead. In addition to this change, the criteria for several crime categories have been broadened, increasing reported crime rates since 1998.

Notably, the most challenging categories are violence against people and fraud and deception, which have seen the most significant increases. Therefore, it is vital to consider the impact of these changes when interpreting crime data for research purposes. (Han et al., 2013)

We look at how the percentage of foreign-born people affects the pendant variables and approximate the coefficients from 1970 to those from later years. The paper utilised selected effects instances in this research because they require more irregular speculations concerning the liberty of time-varying independent variables than random effects models (Adelman, Reid et al. 2017).

The usage of big data analytics has been gaining traction to help investigators analyse and predict crime. Some of the sources of big data that are used for the purpose include social media, CCTV tapes, finance data and server logs. The amplitude of this data is vast and contains information about national Security, fraud, money laundering and identity or financial theft (Oatley, 2021).
There are variations in the analytical methods used, for example, Artificial Neural Networks (ANNs) are modelled to function like a brain which can be used to predict emerging trends and potential criminal

activities. They are used a shortcut to find associations in criminal activities. Other methodology includes fuzzy systems, machine learning, link analysis. These are used on platforms such as Hadoop and MapReduce in order to crunch terabytes of data and extract trends (Manojit Pramanik et al., 2017).

New innovative methods are being designed to predict and stop criminal activity before it occurs, such as using anomaly detection through block processing and k nearest neighbour to detect criminal activity in CCTV. The algorithm is based on pixel coordinate trajectory in which it calculates the angle and speed of a person in the video to determine if he/she is a potential perpetrator (Xu et al., 2020).

Except for robbery, unemployment does not have a major effect on violent offences and is not statistically significant. Like what they discovered for different property offences, the outcome of actual returns on all fierce offence subcategories is positive and statistically significant. Real profits may positively impact crime, as they have highlighted property offences. Sexual offences and acts of violence against individuals are not significantly affected by the percentage of young people. Once more, the influence of the Gini coefficient varies depending on the violent crime subcategories (Han et al., 2013).

One potential issue with utilising the Gini coefficient as an imbalance indicator is that it is only available nationwide rather than at the PFA level of disaggregation. As a result, the Gini coefficient only reflects increases in inequality for the UK and ignores variations among PFAs. As an alternate measure of income inequality, we have also included the interquartile wage, which is determined by dividing wage rates, to address this point. At the PFA level, this wage inequality indicator is accessible (Han et al., 2013).

Various urban factors also are taken into consideration which predict crime. Some factors include geography, housing, education, economy (Wang et al., 2020). These factors can be automatically extracted by data mining of social media. These methods have been in use since the 1980s in some capacity. However, with criminal activity become more digitized every, automation of the application of these techniques to examine criminal attributes becomes practical enough to be implemented (Manojit Pramanik et al., 2017).

Future Directions

Significant data technology implementation by UK police forces is not expected to be feasible for some years. The police's basic data infrastructure now has serious flaws, making it challenging to do simple data input tasks. Many police officers considered that technology was "out of reach" for them because it was employed in other fields and would enable them to do their jobs in a better way. It is anticipated that the main shortcomings of core data infrastructure will be fixed in the upcoming years, enabling forces to effectively leverage big data technology. Future uses of big data in law enforcement include Visual Surveillance, Predictive Risk Assessment of Individuals, Beyond Predictive Mapping, Predictive Hotspot Mapping, and Open-Source Analytics. These applications are predicated on the needs identified during staff and officer interviews (Rusi.org, 2017).

The following are some possibilities for future research in significant data-enhanced criminal investigations:

- Analyzing the traits of various data sources and the methods for choosing the best data sources to meet specific research objectives. The vast amount of data being collected means that traditional methods need to be quicker to handle it all. As a result, choosing suitable data sources is essential for handling security intelligence.

- Choosing suitable analytical models, i.e., there are several data analytical techniques for big data analytics, and some of them are better suited for particular datasets and research goals than others. According to the HACE theorem (Wu et al., 2014), big data also brings with it new difficulties that are beyond the capabilities of current analytical techniques, such as uneven data circulation and distributed processing with many components. The project team, therefore, must compare the features of several analytical models and align them with the most suitable approaches.

- Correlation between methodology and data mining techniques. Once the analytical methodologies have been chosen, project teams need to decide on an appropriate methodology to direct the entire scope of the study. The clustering technique, for instance, works better with the CRISP-DM methodology than it does with the AMPA methodology (Fatih Özgül et al., 2017). For investigative operations to be successful and efficient, tactics and strategies must be appropriately matched.

- Seeking appropriate data integration techniques to address laborious investigative concerns. A single data source is used in the majority of current studies on Security and criminal investigation. However, combining information from several sources is necessary to solve increasingly tricky investigative tasks.

- Dealing with the range of data formats from various data sources. In order to adapt to the changing nature of investigations and new types of criminal data that may be coming from untouched data sources, project teams need to improve their frameworks, analytical methods, and tools constantly.

Conclusion

In summary, studying crime data in the United Kingdom provides a significant understanding of the trends and patterns in criminal activity. Although overall crime rates are subject to volatility, successful policymaking and law enforcement methods require a deeper understanding of individual crime categories, geographic differences, and socio-economic determinants. The result of this research emphasizes how important it is to keep up the fight against crime by addressing its underlying causes and putting targeted interventions in place to make communities safer. Collaboration among different stakeholders, such as government agencies, law enforcement, and community organizations, can help us create a society that is devoted to enhancing public safety and resilience to crime.

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