Application and Feasibility Analysis of Network Models and Data Analysis in Combating Organized Crime

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Abstract: This article discusses and analyzes in detail the development potential and application of big data mining and network visualization analysis in combating organized crime. Firstly, the article emphasizes the importance of combating criminal gangs and organized crime in modern society, comparing them to the foundation of stable national development and the cornerstone of national progress. Then it explores the security challenges faced by modern society and more issues related to organized crime, including the problem of crime caused by the wealth gap caused by urbanization and economic development, as well as the outdated technology for cracking down on existing security crimes. This article provides a detailed introduction to the potential of big data mining and network visualization, as well as the advantages of these technologies in practical applications. It covers the collection, processing, sharing, and application of data. At the same time, network visualization is used to visualize crime data, helping decision-makers better understand the current situation and problems of public security and organized crime. The article also discusses the application of artificial intelligence and mobile internet technology in combating organized crime. And the potential of big data in improving urban governance. Finally, this article looks ahead and emphasizes that big data mining and network visualization analysis will continue to play an important role in optimizing social security, indicating the broad prospects of these technologies in the future transportation field.

Keywords: network models, data analysis, gang and crime problem

1.   Introduction

Against the backdrop of the widening wealth gap, high unemployment among young people, rampant drugs and firearms, and the increasing problem of gangs and organized crime, organized crime, mafia, and gang activities have a significant negative impact on the overall ecology of society. This is well-known to all of us. Nowadays, there are many notorious criminal groups in the United States, such as 18TH street gang, Los Aztecas, the gang of lames, and the mafia. These gang members, who engage in drug trafficking, robbery, illegal coercion, and collecting protection fees, have caused many economic losses and worsened social security to people. This is an issue that we need to take seriously, as organized crime and gang crime can seriously affect society, such as posing a threat to public safety and tranquility. These criminal organizations often engage in illegal activities such as drug trafficking, gun smuggling, extortion, and robbery, causing direct harm and danger to the community. Organized

crime and gang crime have a negative impact on social stability. These criminal groups often incite violence and criminal activities in the community, disrupt social order, and weaken social confidence and cohesion. Organized crime and gang crime have both direct and indirect negative impacts on the economy. These criminal activities often involve illegal transactions such as drug trafficking, smuggling, and money laundering, which can disrupt legitimate economic activities, disrupt market order, and reduce confidence in business and investment. Combating organized crime and gang crime is the responsibility of legal institutions. These criminal activities violate the law and cause unacceptable harm to society. Cracking down on these crimes can maintain and restore legal justice, and convey a clear message to criminals that illegal activities will be subject to severe sanctions. In today's increasingly mature high-tech electronic devices and visual network analysis technology, Although big data and visual network analysis are frequently and efficiently used in various industries, This paper believe that these new technologies have not yet been fully applied to combat organized crime. Even today, the model of combating crime is still very traditional and inefficient. Big data mining and visual network analysis have great application potential in combating crime. By collecting and analyzing a large amount of data, the police and law enforcement agencies can grasp more criminal information and patterns, thereby better predicting and preventing criminal activities. By converting crime related data into graphical form, law enforcement agencies can have a clearer understanding of the patterns, relationships, and scale of criminal activities, provide more accurate and comprehensive intelligence support, and thus better carry out crackdown operations.

2.   Literature review

Organized crime networks have been a persistent presence through history, for example Sicilian Mafia, New York Mafia, Blood Gang and Crip Gang, with their development and expansion rooted in various factors. These criminal networks thrive on illicit activities and operate through an intricate web of connections and hierarchies. By understanding their modus operandi and the factors that contribute to their growth, it becomes possible to combat and mitigate the impact of organized crime. This article will review some literature on Big data mining and feasibility analysis of historical data of mafia and other gangs in order to have a more in-depth and comprehensive understanding of the subject.

In the 2020 article "Studying organized crime networks: Data sources, boundaries and the limits of structural measures" Paolo Campana, Federico Varese. Discuss the highlights the challenges in studying organized crime (OC) networks, specifically regarding the analysis of internal hierarchies and group positions within criminal markets. It discusses the use of phone wiretaps and police-recorded events as data sources, highlighting validity and reliability issues. The choice of whom to include in the analysis and the time span of police-recorded events impact the results. The paper also addresses the issue of network boundary specification and various criteria for assigning actors to OC groups. It suggests combining social network analysis (SNA) with qualitative methods and emphasizes the importance of interviews with key informants. The paper advocates for a mixed-method approach in studying OC networks, recognizing the limitations of structural analysis alone [1].

In the 2020 article "survive or perish: Organized crime in the port of Montreal and the port of New York/New Jersey" Anna Sergi, Luca Storti. Discuss the role of organized crime groups in shaping the social spaces within ports. The terrestrial part of ports is primarily controlled by organized crime groups, while trading activities take place in the maritime part. The comparative analysis of two ports, NY/NJ and Montreal, reveals similarities in illegal trades, networking, and organizational aspects, but differences in the involvement of organized crime groups in governance [2]. The traditional narrative of organized crime as a top-down hierarchical structure driven by ethnicity is challenged by the research. Instead, both structured and hierarchical groups and horizontally coordinated and fluid

groups coexist in ports, with the latter better suited for international trading. Ethnicity is not a defining factor for organized crime groups, but immigrant groups with common origins may be preferred recruitment pools. The control of labor unions within ports is influenced by factors such as labor market regulation, matching supply and demand, and union involvement in raising funds and supporting political machines. The relationship between organized crime and unions is complex and depends on various contextual factors. In the case of NY/NJ port, conflicts of interest, informality, immigrant workers, and high competition costs have created favorable conditions for organized crime groups to assume governance functions. Activities of organized crime groups in port environments are diverse and influenced by local circumstances. And New definitions of organized crime propose a common analytical approach that recognizes the mixing of agency and structure, as well as governing, producing, and trading aspects. Investigations show that organized crime groups in port environments are "entangled entities," where the understanding of one constituent relies on its relationship with others. Such groups engage in various interactions, with one constituent governing, another trafficking, and resources allocated to both. Traditional/modern or ethnic/non-ethnic distinctions do not adequately describe these groups, as they often specialize in multiple activities. Organized crime groups in ports experience different patterns of change over time due to the nature of the port space and global trade requirements. Understanding these groups requires an analysis that avoids both general law formulations and essential characteristic identification. The concept of traditional organized crime needs to be abandoned to comprehend how these groups adapt and survive in different socio-economic contexts. In the article determine the extent to which the criminal associations within the Italian-American Mafia reflect the hierarchical principles depicted in its organizational chart. The analysis was based on network data from profiles of members and known associates, gathered through federal investigations. The study investigated whether criminal collaborations were more likely to form between individuals of similar or different network centrality. The results indicated that collaborations occurred more frequently among individuals with similar centrality, supporting the entrepreneurial model of organized crime. The findings also suggested that formal rank had a weak relationship with the formation of criminal collaborations. The study highlights the importance of informal social status and criminal capital in shaping relationships within the Mafia. Analyze criminal associations within Italian-American Mafia families to determine if they reflected the hierarchical principles outlined in the organizational chart. By analyzing network data from federal investigations, the study found that criminal collaborations were more likely to form among mafiosi who had similar degrees of centrality within the organization. This preference for peers with similar criminal capital suggests that mafiosi valued relationships with individuals who could attract and maintain criminal partnerships. The findings challenge prior literature that emphasized the flexibility and looseness of informal networks within criminal organizations and highlight the efficiency of centralized hierarchical networks in accomplishing organizational goals [3].

In the 2012 article " Organized Crime Networks: an Application of Network Analysis Techniques to the American Mafia." Giovanni Mastrobuoni, Eleonora Patacchini. Discuss the presents a micro-level analysis of the US Mafia network, using a network-based approach. The study finds empirical support for sociological and historical views on how these criminal networks function. The analysis shows that family ties, violence, and mafia culture increase the number of connections within the network. Women are used to foster the network's centrality, but only within trusted families. The study also reveals that trust shapes the network, and connections are more stable where values are shared and the mafia culture is strong. The research suggests that understanding the characteristics of the network can guide crime prevention policies, such as targeting key players in specific areas or using detailed information on the hierarchy to break the chain of command [4]. Empirical studies on real-world social networks of criminals provide valuable guidance.

In the 2014 article " Type of organized crime in Italy. The multifaceted spectrum of Italian criminal associations and their different attitudes in the financial crisis and in the use of Internet thchnologies" Anita Lavorgna, Anna Sergi. Discuss Certain scholars in Italy still primarily focus on the Mafia when studying organized crime, while others view the Mafia as just one part of a larger category. In order to understand organized crime in transnational settings, it is necessary to consider other subsets of criminal groups in addition to the Mafia. The Italian organized crime scenario consists of four subsets, each with different goals and social opportunity structures. While traditional Mafia groups may engage in political activities and challenge the social order, other criminal networks focus on illegal trade. The power and danger of traditional crime groups are often measured by their military strength and territorial ties, which may not be applicable to other types of organized crime groups that rely on new technologies or influential networks. Organized crime groups adapt and react to various factors, such as alliances, competition, and political and economic conditions. The way different groups operate depends on their relations with broader society, which can vary from cooperation to antagonism. Therefore, measures to counter organized crime need to consider the different types of groups and their activities. Legal measures should address gaps in legislation and examine the seriousness of criminal activities and the organizational structures employed by different groups. A deeper understanding of the changing structures of criminal networks is necessary to effectively combat organized crime.

3.   Main Body

3.1.   The background and reasons for the breeding of organized crime and gang crime

Nowadays, the United States still faces serious problems of organized crime and gang crime. Organized crime usually refers to criminal activities carried out by organized groups, such as drug trafficking, smuggling, money laundering, robbery, etc. Gang crime refers to criminal gangs with clear goals and organizational structures, commonly found in impoverished urban areas. These groups typically involve gun trading, black market activities, violent crimes, etc. The US government has been working hard to combat organized crime and gang crime. Law enforcement agencies such as the Federal Bureau of Investigation (FBI), the Drug Enforcement Agency (DEA), and the Alcohol, Tobacco, Firearms, and Explosives Administration (ATF) play important roles in combating crime. In addition, the United States also uses legislation, court systems, and community projects to prevent and combat criminal activities.

The background and reasons for the breeding of gangs and organized crime in the United States are complex and diverse, involving multiple aspects such as society, economy, history, and culture. Taking the mafia as an example, the Italian mafia was a heinous terrorist organization, but that was not the case in Mafia back then. It was originally a secret gang organization formed by poor farmers in search of survival. Therefore, its members were all from rural areas and came from very poor backgrounds. Members often helped each other and were able to help each other in times of adversity. Therefore, it has similarities with the green forest heroes of China and Robin Hood of England back then. And maintain justice and fairness from time to time. Year after year, the role of the mafia in Sicily became increasingly prominent, becoming more authoritative than the government. At that time, in Sicilian life, the mafia became as important as three meals a day. Being able to become a mafia is naturally a noble thing. Don Vicini, the mafia leader who died in his hometown in 1954, although he was illiterate, his funeral was so grand that even the Italian king would envy him. The mafia has been a violent organization since its establishment. He has a side that stands out for the poor and upholds justice for the people. But without the correct theory as a guide, it is almost certain that it will go against its own side. With the passage of time, the nature of the mafia has also changed, transforming into a criminal gang that engages in all kinds of evil and is deeply hated. They used

violence to control livestock, slaughter, orchards, and ports on Sicily, and collected protection fees from private owners. Through violence, the Mafia established its authority in Sicily and extended this approach to the entire Italy and thus the world. The harmful effects of organized crime and mafia and gang activities on society and its entire social ecosystem are well-known. Several countries in today's world are plagued by organized crime. This phenomenon is particularly common in the United States, Latin America, the former Soviet bloc, and some countries in East Asia. Among European countries, Italy is a special case, as some regions in the south, such as Sicily, Calabria, Campania, and Apulia, have experienced the presence of strong religious foundations, which still pose a serious threat to their development. For example, in the case of Apulia, the cumulative GDP loss caused by criminal organizations in recent years has been 16%. There is a strong criminal organization in the region, which is a manifestation of weak institutions. In fact, organizations of the Black Hand type represent examples of "extralegal governance" providing specific services and protection, which would otherwise be provided by the state. Although literature on institutional quality and economic development mostly points to cross-border differences, Italy shows significant cross regional differences in institutional quality. The southern region, which still has strong criminal organizations, is the region with the lowest quality of systems. The following are some possible influencing factors:

- Economic conditions: Poverty and economic inequality are the soil that nourishes organized crime. In economically disadvantaged communities, young people may seek economic opportunities or social status, and joining gangs may become a choice.
- Problems in urban communities: Some urban communities face high unemployment rates, low education levels, housing problems, and other social issues. These issues may lead to marginalization and loss of hope in communities, allowing organized crime to flourish.
- Culture of violence and honor: In some communities, there is praise or beautification of violence and criminal behavior, as well as an emphasis on personal dignity and honor. These cultural values may prompt young people to seek to join gangs in order to gain social status and respect.
- Race and Minority Issues: Tensions and unfair treatment between races and minorities may lead to gang formation. Social exclusion and discrimination may lead some people to choose to strengthen their self-protection through gangs and seek common interests.
- Illegal drug trade: Drug trade is one of the main sources of many gangs. In the United States, the drug trade is a huge illegal economic system, in which gangs play an important role.

These factors are only one of the possible factors leading to organized crime and gang problems, and different regions and communities may have different situations and backgrounds. In order to address these issues, a comprehensive solution needs to consider multiple aspects such as socio-economic factors, education, employment opportunities, and legal enforcement.

3.2. Efforts made by US judicial and law enforcement agencies

The US judiciary and law enforcement agencies have been working hard to address organized crime and gang issues, and have taken a series of new efforts and measures. Here are some examples:

- Law enforcement cooperation and cross departmental cooperation: Strengthen cooperation between law enforcement agencies at different levels to jointly combat organized crime and gangs. For example, there has been an increase in information sharing, intelligence analysis, and collaborative action among federal, state, and local law enforcement agencies.
- Community participation and cooperation: Law enforcement agencies encourage the establishment of close cooperative relationships with community residents in order to better understand and respond to local organized crime and gang issues. This includes establishing connections between law enforcement agencies and community groups, educational institutions, religious institutions, etc., to create a safe and supportive environment.

- Prevention and rehabilitation: In addition to combating crime, some judicial authorities are also committed to preventing young people from joining gangs and providing opportunities for rehabilitation and re education. By providing services such as education, vocational training, social support, and rehabilitation plans, we help them stay away from crime.
- Targeted Strike Strategy: Law enforcement agencies use intelligence and analysis tools to adopt targeted strike strategies and concentrate resources on core members of organized crime and gang activities. This helps to weaken the strength of criminal organizations and disrupt criminal networks.
- Key areas and police resource allocation: For areas with serious organized crime and gang problems, judicial and police departments usually prioritize resource investment and strengthen patrol law enforcement to control criminal activities and restore community safety.
- New technology application: With the development of technology, law enforcement agencies use new technology tools such as data analysis, monitoring equipment, intelligent police systems, etc. to strengthen crackdown and prevention work, improve law enforcement efficiency and effectiveness [5].

These measures aim to strengthen cooperation between law enforcement agencies and communities, and comprehensively address organized crime and gang issues from prevention, crackdown, rehabilitation, and other aspects. However, the specific measures taken by each state and region may vary depending on regional differences and urgent needs. In combating organized crime and gang issues, big data analysis and visual network analysis have gradually been adopted by US law enforcement agencies. For example, in terms of big data analysis: law enforcement agencies use big data analysis to process and analyze a large amount of police data, including criminal records, reports, telephone communication records, etc. By analyzing these data, it is possible to reveal criminal patterns, identify potential criminal trends, and assist police officers in developing more effective law enforcement strategies. For example, in terms of visual network analysis: Visual network analysis helps law enforcement agencies analyze complex criminal networks and gang structures. By displaying the relationships among suspect, gang members, and affiliated institutions in the form of charts or graphs, law enforcement agencies can better understand the operation of criminal networks and reveal hidden associations and connections. This helps to capture criminal leaders, weaken criminal organizations, and support evidence collection and crackdown actions. These technological applications enable law enforcement agencies to better utilize information and data, conduct in-depth analysis of criminal activities, and provide targeted strike strategies. The application of big data analysis and visual network analysis helps to strengthen the intelligence and informatization level of law enforcement work, and improve the efficiency and effectiveness of crime crackdown.

3.3. New possibilities, new ideas

3.3.1. Social media analysis

Utilize big data analysis technology to analyze posts, comments, and user relationships on social media platforms to identify potential criminal organizations and networks. By monitoring specific keywords, criminal symbols, and behavior patterns, law enforcement agencies can be assisted in timely warning and combating criminal activities.

3.3.2. Fusion of sensor data

Combining sensor data from the physical world, video surveillance data, and big data from other sources for real-time crime monitoring and analysis. This may include technologies such as vehicle

recognition, facial recognition, pedestrian and vehicle trajectory analysis to provide automated crime detection and prediction capabilities.

3.3.3. Strengthen machine learning and prediction models

Train machine learning models and prediction algorithms through big data analysis to predict the time, location, and type of criminal events. These models can help law enforcement agencies optimize resource allocation and take early action to prevent the occurrence of criminal activities.

3.3.4. Real time update of visual network models

Utilize real-time data sources and automated algorithms to dynamically update visual network models to more accurately reflect the evolution and relationship changes of criminal organizations. This helps to track emerging gangs and criminal networks and take timely action to combat them.

3.3.5. Multimodal data analysis

Integrate multiple sources of data, such as social media data, communication data, financial data, behavioral data, etc., to conduct comprehensive multimodal data analysis to identify potential criminal activities and networks. This can provide more comprehensive criminal intelligence and deeper insights.

These new ideas highlight the potential advantages of big data analysis and visual network models in combating crime. However, implementing these ideas may require overcoming technical challenges, privacy, and security considerations. Therefore, further research and practice are still necessary.

This research think we can do more in visualizing network models. Data collection and integration: Establish a reliable data collection pipeline to obtain real-time data related to criminal activities and networks. This can include collecting data from law enforcement databases, social media platforms, communication data, and other open data sources. Ensure the quality and accuracy of data, and establish an appropriate data integration system. Real time data processing and analysis: Combining the process of data processing and analysis with the collection process to achieve real-time data updates. Utilize streaming processing technologies such as Apache Kafka, Apache Flink, etc. to process and analyze data in real-time to quickly capture criminal activities and changes in the network. Automated network generation: Develop automated algorithms that can construct and update network models in real-time from data. This may involve automatically discovering association relationships, identifying key nodes and edges, and updating the network based on the entry and changes of new data. These algorithms can be implemented based on social network analysis or graph analysis techniques [6]. Visualization and User Interface: Provides an interactive user interface for the visualization and analysis of network models. This allows users to explore and analyze the network based on their own needs and interests. Ensure an intuitive and user-friendly interface, providing summaries and detailed views of key information to support real-time network updates and analysis. Real time warning and decision support: Utilize real-time updated network models to achieve automated real-time warning and decision support. By monitoring the topology changes of the network, the behavior of key nodes, and the development trend of events, potential criminal activities can be identified in a timely manner and decision-making can be supported. This paper think these suggestions can help law enforcement agencies achieve real-time updates while using visual network models. However, it is important to balance real-time and accuracy in design and implementation, while also considering issues of data privacy and security. Although technological challenges and obstacles may exist, advanced data analysis and visualization tools offer enormous potential for achieving real-time updates of visual network models.

Regarding multimodal data analysis, the following are some more specific ideas and suggestions: data integration and cleaning: As multimodal data involves multiple sources and types of data, data integration and cleaning are first necessary. This includes unifying the data structure of various data sources, addressing missing values and incorrect data, and ensuring data consistency and accuracy. Feature extraction and fusion: For data with different modalities, appropriate feature extraction techniques are applied to transform them into actionable feature vector representations. This may involve feature extraction methods for images, text, speech, or other data types. Then, by fusing these feature vectors, the information of different modalities is comprehensively analyzed. Multimodal data integration analysis: Combining multiple data types for joint analysis, machine learning and data mining techniques can be used, such as clustering, classification, anomaly detection, etc. By combining the features of different modalities, the correlation and patterns between multimodal data can be revealed, and more comprehensive and accurate criminal intelligence can be obtained. Visual display and interaction: By utilizing visualization technology, multimodal data results are presented in an intuitive manner, providing multiple views and interaction methods to help users understand and analyze the data. For example, visualization methods such as charts, maps, and images can be used to present the analysis results of multimodal data to users. Deep learning and neural network models: Deep learning and neural network models also play important roles in multimodal data analysis. These models can simultaneously process different types of data and learn the complex relationships between them. Through deep learning methods, higher levels of feature expression and data analysis can be achieved.

4. Methodology

Having read a large amount of literature on mafia and gang issues, and understood the definition, characteristics, influencing factors, and related theories of organized crime, it will help researchers establish a holistic understanding of the field and provide a theoretical basis for subsequent research.

Historical analysis: By studying the historical development of organized crime, we aim to understand its origin, evolution, and impact. This method can reveal the social background and underlying motivations of organized crime.

Empirical research: Using quantitative data and statistical methods to analyze and explain the patterns, trends, and influencing factors of organized crime. This method can provide objective data support and help researchers discover relevant laws and associations.

Case study: an in-depth study of specific cases of organized crime, analysis of its organizational structure, operation mode, interest chain, etc. This method can provide detailed analysis and case inference, providing practical experience for theoretical and policy formulation.

Because organized crime and gang problems occur frequently throughout time and have seriously affected the work and life of local residents. And in recent years, the situation in some countries has been getting worse, such as Brazil and the United States. The issue of illegal drug immigration and gang firearms is often closely related. We hope to understand organized crime and the expansion and development of gangs and summarize some laws and principles. It is best to provide some ideas and new thoughts to law enforcement agencies to help them more effectively combat criminals.

My research is based on the data of the ScienceDirect literature database including the research paper on "social networks" "International Journal of the Law, Crime and Justice"

Studying Mafia connection networks: Data sources, boundaries and the restriction of basic measures" Talk over the feature and protest in studying gang crime networks, specifically regarding the analysis of internal hierarchies and group positions within criminal markets. It debates the use of phones or massage police-recorded as data sources, highlighting validity and reliability issues. The choice of whom to include in the analysis and the time span of police-recorded cases impact the results. The research also addresses the issue of network boundary specification and various criteria

for assigning actors to crime groups. It suggests combining social network analysis with qualitative methods and emphasizes the importance of interviews with main informants. The paper advocates for a mixed-method approach in studying gang connection networks, recognizing the limitations of structural analysis alone.

5.　Conclusion

The United States still faces serious problems of organized crime and gang crime. The public security department has been working hard to combat criminal activities and has taken a series of efforts and measures. This includes law enforcement cooperation and cross departmental cooperation, community participation and cooperation, prevention and rehabilitation, targeted strike strategies, key areas and police force configuration, and the application of new technologies. At the same time, new possibilities also bring new ideas and ideas. Some of these ideas include social media analysis, sensor data fusion, machine learning and prediction models, and real-time updates of visual network models. These new ideas hope to better utilize big data analysis and visual network models to solve organized crime and gang problems. However, implementing these ideas may face some challenges, such as data collection and integration, real-time data processing and analysis, automated network generation, visualization and user interface, real-time warning and decision support, etc. Despite potential technical challenges and obstacles, advanced data analysis and visualization tools offer enormous potential for realizing these ideas. Multimodal data analysis is also an important direction, including data integration and cleaning, feature extraction and fusion, multimodal data integration analysis, visual display and interaction, deep learning, and neural network models. Through these efforts, we can have a more comprehensive understanding and fight against organized crime and gang issues, and improve community safety and stability.

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