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Geoint as a Driver of National Security

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ABSTRACT

Geospatial Intelligence (GEOINT) is a pivotal driver of national security, integrating advanced analytical techniques to strengthen law enforcement, analyze movement patterns, and enhance geospatial data accuracy. This study highlights the role of GEOINT in addressing critical security challenges such as terrorism, threat analysis, and decision-making through intelligence surveillance. As an essential component of GEOINT, movement pattern analysis underpins its implementation and contributions across various countries, showcasing its adaptability to diverse security frameworks. Furthermore, techniques such as Geographic Information Systems (GIS), Artificial Intelligence (AI), and the analysis of relative motion augment the effectiveness of geospatial analysis by increasing the probability of accurate surveillance and data interpretation. The study underscores GEOINT's pivotal role in validating criminal data and optimizing workflow for law enforcement agencies, emphasizing its importance as a multidisciplinary tool in modern security operations. These findings demonstrate GEOINT's transformative impact on ensuring global safety and fortifying national security strategies

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INTRODUCTION

Geospatial Intelligence is an elevation field of science that combines the formulation and processing of data to the dissemination of spatial-based information or maps to obtain more meaningful information related to activities on Earth. This geospatial-based data can take the form of imagery, aerial photography (Goel et al., 2021) sensor data and many other forms of geospatial data. Geospatial Intelligence aims to know and map activity patterns on earth, from human activities to other moving object activities, and support decision-making to maintain national security. Geospatial intelligence is an important implementer in preventing complex problems arising from state security due to threats and providing solutions to decision-making (Preye Winston Biu et al., 2024) more objectively and flexibly to the enormity of evolving threats.

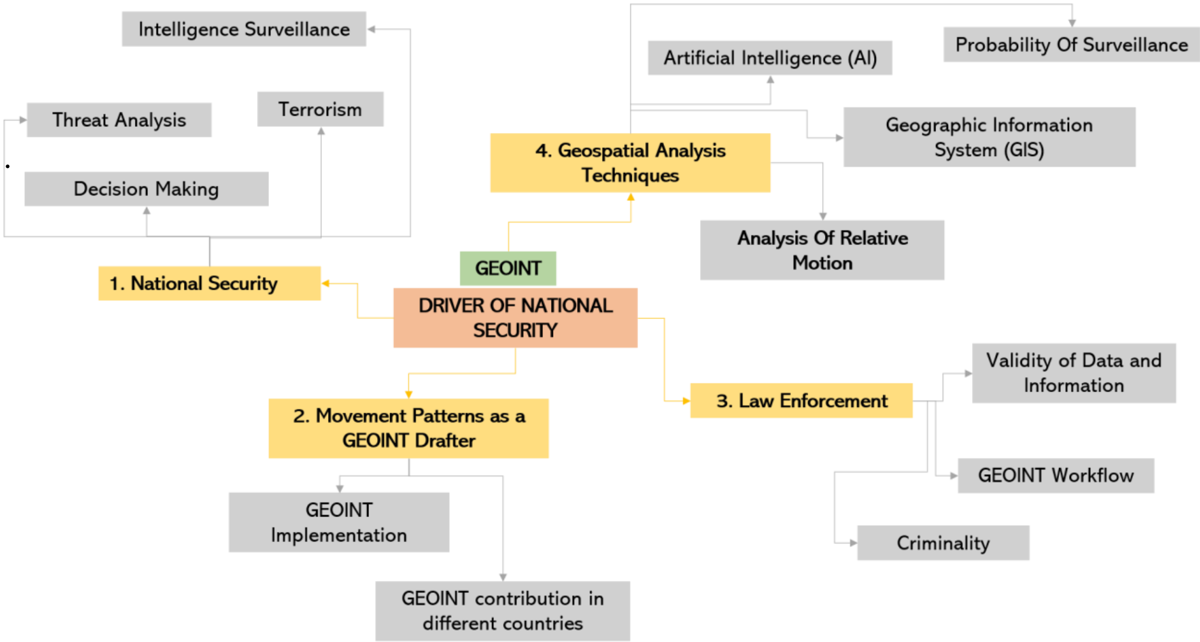
Geospatial intelligence can also provide movement pattern analysis involving the use of geospatial data, such as Geographic Information Systems (GIS)(Spiegel et al., 2012), optical range, radar(J. Li et al., 2022) and GPS data, to analyse and understand movement patterns of moving objects. It can be key in national security, law enforcement, or monitoring illegal activities. Geospatial data processing techniques in detail will be discussed in this essay. Geospatial Intelligence can be applied in various sectors of life, such as for national security, and analysis of movement patterns with multi-disciplines on earth such as disaster management, resource management and urban planning changes, business can also be explored with geospatial data. More detail will be discussed in several sections in this essay related to the application of geospatial data in life. This geospatial data becomes our "eyes" as humans to see what is in the other part of the world that cannot be observed with human eyes.

LITERATURE REVIEW

This research employs a literature review approach to examine the theme of Geospatial Intelligence (GEOINT). A literature review is done by collecting, analyzing, and synthesizing various scientific literature, research reports, and policy documents relevant to the specific theme, it is for development and application of GEOINT through this research. The sources used include academic journals, books, publications from government agencies and international organizations, as well as technical studies related to the integration of geospatial analysis in national security. Through this method, this research aims to identify the main trends, challenges, and potential utilization of GEOINT in various strategic scenarios, including in supporting spatial data-based decision making.

METHODOLOGY

This research uses a literature review with the author collecting scientific articles as supporting themes, analyzing and synthesizing some conclusions from scientific articles that are closely related to Geospatial intelligence as a supporter of national security and drawing a common thread from all selected articles. The literature review stage begins with determining the theme, finding previous research articles and supporting documents as a source of data analysis, then the previous research is grouped based on the subthemes compiled by the author. Subthemes in research on GEOINT as a supporter of national security are national security, movement patterns as a GEOINT drafter, law enforcement and geospatial analysis techniques. This subtheme is arranged as a brainstorm to proceed to the analysis stage. Here is a brainstorming scheme for the research in question.



Source: Processed by the Researcher
Figure1. Brainstorming Scheme of this Research

RESULTS AND DISCUSSION

National Security

The word intelligence is often associated with the field of surveillance and monitoring which connotes securities and law and then becomes more meaningful when connected with geospatial data where security and legal factors apply both individually, within the community, nationally and even globally. The security and legal system in a country will be greatly helped by utilising the international geospatial system in its application such as reflecting on the global crimes that occur between Palestine and Israel. For example in the context of national security, intelligence agencies may use geospatial data to monitor and analyse the movements of military commands (Jimenez Velez, 2023) or armed groups in sensitive areas. They can track travel routes, meeting points, and activity patterns to detect potential threats or suspicious activity (Sufi et al., 2023).

There are many examples that we can discuss in the geospatial linkage of intelligence to national security. Some of these examples are spelt out below. When the TNI has to handle the Papua KKB case, the TNI applies Geospatial Intelligence (GEOINT) to obtain data and information in observation and reconnaissance efforts with various methods and technologies, to facilitate high-ranking officials to make strategic decisions in their operations. Several news sources say that geospatial databases traded by data brokers increase every year, especially those intended for intelligence and investigation efforts [7], this trend and interpretation of geospatial data can be used as an opportunity for law enforcement activists and decision-makers to prevent the emergence of security threats, both ordinary crimes and acts of terrorism (Nwachukwu et al., 2022).

One form of military threat that disrupts national security is acts of terrorism. Today's acts of terrorism have used the novelty of fairly sophisticated technology to launch attacks. Therefore, defence institutions should be more vigilant about the use of advanced technology in various knowledge and knowledge bases. There needs to be a concrete form of surveillance and intelligence security measures, as well as increasing national security capacity based on geospatial technology and cyber security to assist countries in developing development (Udochukwu et al., 2014), border security surveillance and communication in the context of terrorism cases (Prof Dr. Aftab Ahmad Malik, 2023).

In the past, national security cases in Nigeria have been an international security challenge. Methods in the identification of remote surveillance, wiretapping and spatial-based intelligence (Shehu et al., 2023) are carried out to achieve intelligence data digitally as input or supporting data in security management operations.

Movement Patterns as GEOINT Drafter

In addition, in the context of transportation and logistics, companies can use movement pattern analysis to optimize delivery routes (Changmai et al., 2023) and monitor the performance of their fleets. By understanding vehicle movement patterns, they can identify areas with heavy traffic or inefficient travel time and make necessary adjustments. Overall, geospatial intelligence for movement pattern analysis provides valuable insights into understanding movement dynamics across a range of contexts, from national security to logistics management.

For example, logistics management in the case of urban growth in Egypt resulted in the rate of urbanization, problems arising from unorganized expansion, rapid population increase and land use and cover change (Hegazy & Kaloop, 2015). The growth of cities (Alastal & Shaqfa, 2022) that causes environmental problems and impacts (Sandino et al., 2018) is also experienced by the country of Colombia, where there is tropical deforestation which includes natural forests and plantation forests and mineral extraction of about 3.4%, illegal mining and illegal logging and land grabbing traced with high-resolution geospatial data sets on land cover change (González-González et al., 2021). The issue of urban growth continues to be the thorny problem of urban expansion as happened in Can Tho City, Vietnam where the city is still developing, experiencing accessibility problems due to urbanisation to unfavourable locations, ranging from limited connecting access to the city centre, to waste of land resources (Hong Diep et al., 2022). The expansion of cities is also predicted as a trigger for flooding disasters globally, due to the shrinkage of green space (Luo et al., 2019). This can be overcome with geospatial-based intelligence to explore urbanization actions for the better even if only with satellite image data.

Another example is spatial-temporal analysis applied by the National Geospatial-Intelligence Agency to determine potential areas of disaster, population movement, and land use change.

In the scope of daily scale community life, geospatial implementation can be applied such as detecting patterns of movement and human activities against land use specifications (Cowen et al., 2019), certain activities such as sports that are associated with the level of crime that occurs such as persecution and theft in the surrounding environment (Micheli et al., 2022).

Natural disasters are an international and multi-sectoral issue because they involve many factors and actors in their identification and prevention. Geospatial data have had a role in helping analyze the vulnerability and vulnerability of an area to disasters (L. Li et al., 2005) such as vulnerability to floods and landslides (R M & Dolui, 2021) for a long time. A simple example that can be taken from the analysis of movement patterns with geospatial intelligence is the post-disaster population movement and the determination of the location of emergency rescue facilities (Zhao & Liu, 2018), if the population movement information and location determination are not known accurately, it will interfere with the distribution of aid to affect and affected populations (Bengtsson et al., 2011) or geospatial analysis to identify risks from an area's exposure to toxic gases by first determining the geological source of the toxic gas.[25].

Geospatial data can also be used as a response in disaster prevention, one of which is to detect forest and land fire activity, in Indonesia and several countries in the world such as Canada. However, geospatial data alone is not enough for a process of intelligence and surveillance of forest and land fires due to inaccurate information on forest fires caused by weather factors and human activity factors, which ultimately makes it difficult for law enforcement. So a renewable method is carried out by cooperating with artificial intelligence (Pinto-Hidalgo & Silva-Centeno, 2022) called Geospatial Artificial Intelligence (GEOAI) where this method records and can validate the burned area in each cluster into a pattern through Sentinel-2 satellite images (Purbahapsari & Batoarung, 2022).

Law Enforcement

In law enforcement, geospatial data can be utilized by analyzing movement patterns such as vehicle movements related to criminal activities [28], such as drug trafficking or smuggling of other illegal goods. By mapping travel routes and distribution points, law enforcement agencies can identify anomalies in illegal trade routes and take appropriate precautions.

The major challenge faced by law enforcement and intelligence agencies is in terms of determining where geospatial data are sourced from, how accurate methods of collecting and processing data and intelligence information (Butkovic et al., 2013) because there is a need for good validity and accuracy in predictively analyzing the form, number and motive of crime (*12-Duncan.Pdf*, n.d.), this increasingly appears the urgency of accurate and valid data on the number of crimes that are increasing every year in various countries both those that include ordinary crimes, to crimes that can threaten multisector and national security.

A spatial-temporal analysis is one method of analysis that, although fundamentally capable of analyzing crime geographically and the results of crime incidents, can be geographically coded and support law enforcement agencies in identifying impacts and developing appropriate surveillance Operandi (Hart & Zandbergen, 2013). The substance of law enforcement in several regions of the world has utilized geospatial analysis and integrated it with the database of crime reports owned as one of the intelligence workflows in the country (Döllner, 2020), this is intended to detect the profile of the perpetrator of the crime, the motive of the crime and even find the perpetrators of crime directly. This method of working on geospatial analysis has the concept of repetitive and expanded spatially and temporally, this repetition analysis can effectively map patterns or motives of crime, to track down perpetrators (Spaulding & Morris, 2022). The search for missing persons can also be overcome by quantitative geospatial data analysis by law enforcement in conducting investigations (Quinto-Sanchez & Huerta-Pacheco, 2023), indeed there are still weaknesses of this analysis due to distance limitations where it can only detect at relatively close distances (<5 miles) but can be done even in forested areas or near waters (Bunch et al., 2017). Piracy, which is determined by the movement or activity of ships, results in the conclusion that pirates find it easier to attack ships (Tsioufis et al., 2024) and tankers (Alexopoulos, 2023) close to the coastline so that territorial waters become potential areas for piracy. Faced with the increasing amount of traffic at sea, it is necessary to have an automatic and near real-time detection system monitoring and visualization of movement at sea (Ray et al., 2019).

Geospatial Analysis Techniques

Geospatial data is data that is quite accurate, near real-time, can be accessed easily and is relevant when used for various scales and applications. Geospatial agencies in various countries have developed risk analysis and security systems from the use of documented geospatial data to suit national and sub-national needs (Borges et al., 2023). This is important considering its accessibility which is quite easy and loose in processing because of its nature as observational data. Many processing methods are developed and used for various needs. One interesting data analysis method is the analysis of the relative motion of an object where this method becomes an innovation in geospatial science that produces conclusions of geographic data and information of an area, spatial indexing and other geographically based general services such as city governance, logistics management and other needs that can be accommodated because they are based on moving objects. Such analysis is dynamic in the current era, all of which use data mining, big data and cloud-based computing storage systems (Feng et al., 2019).

The Indonesian National Police Traffic Corps as an apparatus that has the main task in the field of security, order and smooth traffic, uses spatial monitoring data that is managed in an integrated manner through several geospatial information system platforms and database systems to visualize the movement of existing vehicle traffic (Rachmi Azanisa Putri et al., 2023). Then the US Commando Joint Force (USJFCOM) utilizes GEOINT to support the development of their Multinational experiment concept, as well as a training or simulation medium to deploy geographically commanded forces based on ongoing conditions with various modeling applications and methods (Shears, 2013).

Geospatial in the future increasingly presents its power in analyzing geospatial perceptibility and can present the implications of a combination of the physical and digital worlds where geospatial perception and the real world are indistinguishable (Dold & Groopman, 2017). Even by combining a variety of new technologies that are currently developing such as artificial intelligence (AI) and extended reality (XR) (this software is a new generation of emotion-based intelligent systems) with geographic information systems, it can be utilized for the detection of types of threats in urban areas based on the results of analysis of emotions, models, privacy and environmental issues (Rokhsaritalemi et al., 2023). It is undeniable that artificial intelligence-based predictive analytics has now become the main option that is widely applied (Shapiro, 2019) in various countries as a form of critical effort from law enforcement or police and a country's judicial system in decision-making, so that its use is not only in the judiciary but also judicially of a country.

Many remote sensing platforms provide more and more commercial geospatial data, and various algorithms are implanted so that multiple needs can also be accommodated but geospatial-based artificial intelligence has its challenges and complexity where visual patterns and the number of images produced at any time have increased drastically and significantly, especially in terms of data size, so manual checking by humans has become a thing that impossible and subjectively annotated, and certainly impractical (Barb & Shyu, 2010). An example is commercial geospatial data used to detect maritime traffic volume, knowing that an increase or decrease in traffic volume indicates an anomaly that needs to be investigated by law enforcement. Like the act of piracy, which is determined from the movement or activity of ships, it is concluded that pirates are easier to attack ships close to the coastline so the territorial waters area becomes a potential area for piracy. Facing the increasing amount of traffic at sea, it is necessary to have an automatic and near real-time detection system for monitoring and visualizing movement at sea. The algorithm combines visual spectrum satellite imagery with the Automatic Identification System (AIS) into an artificial intelligence process capable of clarifying the behaviour of captured vessels (Jones, Koehler, et al., 2023).

Reconnaissance analysis and monitoring using appropriate spatial resolution levels can provide forecasts of future activity levels, for example by using the Loess-based seasonal trend decomposition method (STL). With this method can also be known the estimation of the density of the new kernel, is against criminal, incident, and cyber network security traffic (Veerasamy et al., 2022) and civil (Malik et al., 2014). Data and information in the form of terrorism incidents and locations can be mapped and then used to measure the distance between terrorism locations and the distance between terrorism incidents with critical infrastructure locations such as public services and settlements. This can be made in the form of probabilities for the development of geospatial models towards intelligence management.

Digital geospatial data processing can be used multidisciplinary, can be used for monitoring climate conditions (Jones, Kuehnert, et al., 2023) and weather which in recent times has increased in terms of demand for spatial climate data. A method of geospatial climatology concept was found where this approach uses expert knowledge about climate patterns and geographical aspects of the region and topography (Daly et al., 2002).

CONCLUSIONS AND RECOMMENDATIONS

With the ease and density of commercial geospatial data that can be obtained and advances in technology and renewable methods, this geospatial data can support various needs. Based on intelligence, geospatial data becomes a technique for driving action and maintaining national security by identifying movement patterns and looking for anomalous sides of an activity that escapes eye monitoring. In the field of defence and security, intelligence-based geospatial is used in formulating procedures for preventing and mitigating disasters caused by nature and humans, for example, due to climate change and due to urban growth to expansion which results in changes in land cover and crimes both ordinary crimes to global crimes, piracy and illegal logging. Spatial data if only used as monitoring data will be less useful but with the spice of intelligence on spatial data, it will help law enforcement to maintain and defend national security from all forms of threats, both military, non-military and hybrid threats. Geospatial intelligence is also not only limited to the scope of a country but globally, unobstructed by territorial and time boundaries, near real-time as an early warning. Platforms and methods have been widely developed to go hand in hand with artificial intelligence, and digitalization-based forms of geospatial data are very useful for multidisciplinary aspects because fundamentally the spatial-temporal analysis used encourages many countries to compete to use it and obtain the easiest data access. Although geospatial intelligence has global potential that is not limited by region and can be near real-time, there are important challenges in its implementation, especially related to the aspect of task security. Ease of data access with a strong security system can produce accurate information. Conversely, weaknesses in this aspect can be a major threat to the geospatial data users themselves.

However, this study still has some limitations that need attention. Among them, there are limitations in the depth of discussion related to the integration of geospatial data with certain artificial intelligence platforms, as well as empirical evaluation of the effectiveness of implementation in various real scenarios. Therefore, further studies are needed to address these limitations, including exploring more adaptive and secure frameworks for the application of geospatial intelligence.

With its vast complexity and potential, we encourage researchers and practitioners to continue this research to strengthen the theoretical and practical aspects of geospatial intelligence. Multidisciplinary collaboration is urgently needed to explore new solutions, improve implementation efficiency, and ensure that these technologies can provide optimal benefits in supporting defence and security, both at the national and global levels.

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REFERENCES

12-Duncan.pdf. (n.d.).

Alastal, A. I., & Shaqfa, A. H. (2022). GeoAI Technologies and Their Application Areas in Urban Planning and Development: Concepts, Opportunities and Challenges in Smart City (Kuwait, Study Case). Journal of Data Analysis and Information Processing, 10(02), 110–126. https://doi.org/10.4236/jdaip.2022.102007

Alexopoulos, T. A. (2023). On global maritime oil piracy: an association rules analysis. Energy Systems, 0123456789. https://doi.org/10.1007/s12667-023-00639-3

Barb, A. S., & Shyu, C. R. (2010). Visual-semantic modeling in content-based geospatial information retrieval using associative mining techniques. IEEE Geoscience and Remote Sensing Letters, 7(1), 38–42. https://doi.org/10.1109/LGRS.2009.2017214

Benà, E., Ciotoli, G., Petermann, E., Bossew, P., Ruggiero, L., Verdi, L., Huber, P., Mori, F., Mazzoli, C., & Sassi, R. (2024). A new perspective in radon risk assessment: Mapping the geological hazard as a first step to define the collective radon risk exposure. Science of the Total Environment, 912(September 2023). https://doi.org/10.1016/j.scitotenv.2023.169569

Bengtsson, L., Lu, X., Thorson, A., Garfield, R., & von Schreeb, J. (2011). Improved response to disasters and outbreaks by tracking population movements with mobile phone network data: A post-earthquake geospatial study in haiti. PLoS Medicine, 8(8), 1–9. https://doi.org/10.1371/journal.pmed.1001083

Borges, D. E., Ramage, S., Green, D., Justice, C., Nakalembe, C., Whitcraft, A., Barker, B., Becker-Reshef, I., Balagizi, C., Salvi, S., Ambrosia, V., San-Miguel-Ayanz, J., Boschetti, L., Field, R., Giglio, L., Kuhle, L., Low, F., Kettner, A., Schumann, G., … Reichenbach, K. (2023). Earth observations into action: the systemic integration of earth observation applications into national risk reduction decision structures. Disaster Prevention and Management: An International Journal, 32(1), 163–185. https://doi.org/10.1108/DPM-09-2022-0186

Brennan, S., Coulthart, S., & Nussbaum, B. (2023). The Brave New World of Third Party Location Data. Journal of Strategic Security, 16(2), 81–95. https://doi.org/10.5038/1944-0472.16.2.2070

Bunch, A. W., Kim, M., & Brunelli, R. (2017). Under Our Nose: The Use of GIS Technology and Case Notes to Focus Search Efforts. Journal of Forensic Sciences, 62(1), 92–98. https://doi.org/10.1111/1556-4029.13218

Butkovic, A., Orucevic, F., & Tanovic, A. (2013). Using Whois Based Geolocation and Google Maps API for support cybercrime investigations. Recent Advances in Telecommunications and Circuits Using, June 2013, 194–200.

Changmai, S., Saran, S., & Gupta, P. K. (2023). Geospatial Application for Dairy Supply Chain Management. Journal of Geomatics, 17(2), 174–183. https://doi.org/10.58825/jog.2023.17.2.63

Cowen, C., Louderback, E. R., & Roy, S. Sen. (2019). The role of land use and walkability in predicting crime patterns: A spatiotemporal analysis of Miami-Dade County neighborhoods, 2007–2015. Security Journal, 32(3), 264–286. https://doi.org/10.1057/s41284-018-00161-7

Daly, C., Gibson, W. P., Taylor, G. H., Johnson, G. L., & Pasteris, P. (2002). A knowledge-based approach to the statistical mapping of climate. Climate Research, 22(2), 99–113. https://doi.org/10.3354/cr022099

Dold, J., & Groopman, J. (2017). The future of geospatial intelligence. Geo-Spatial Information Science, 20(2), 151–162. https://doi.org/10.1080/10095020.2017.1337318

Döllner, J. (2020). Geospatial Artificial Intelligence: Potentials of Machine Learning for 3D Point Clouds and Geospatial Digital Twins. PFG - Journal of Photogrammetry, Remote Sensing and Geoinformation Science, 88(1), 15–24. https://doi.org/10.1007/s41064-020-00102-3

Feng, M., Shaw, S. L., Fang, Z., & Cheng, H. (2019). Relative space-based GIS data model to analyze the group dynamics of moving objects. ISPRS Journal of Photogrammetry and Remote Sensing, 153(November 2018), 74–95. https://doi.org/10.1016/j.isprsjprs.2019.05.002

Goel, R. K., Yadav, C. S., Vishnoi, S., & Rastogi, R. (2021). Smart agriculture – Urgent need of the day in developing countries. Sustainable Computing: Informatics and Systems, 30(December 2019), 100512. https://doi.org/10.1016/j.suscom.2021.100512

González-González, A., Clerici, N., & Quesada, B. (2021). Growing mining contribution to Colombian deforestation. Environmental Research Letters, 16(6). https://doi.org/10.1088/1748-9326/abfcf8

Hart, T. C., & Zandbergen, P. A. (2013). Reference data and geocoding quality: Examining completeness and positional accuracy of street geocoded crime incidents. In Policing (Vol. 36, Issue 2). https://doi.org/10.1108/13639511311329705

Hegazy, I. R., & Kaloop, M. R. (2015). Monitoring urban growth and land use change detection with GIS and remote sensing techniques in Daqahlia governorate Egypt. International Journal of Sustainable Built Environment, 4(1), 117–124. https://doi.org/10.1016/j.ijsbe.2015.02.005

Hong Diep, N. T., Nguyen, C. T., Diem, P. K., Hoang, N. X., & Kafy, A. Al. (2022). Assessment on controlling factors of urbanization possibility in a newly developing city of the Vietnamese Mekong delta using logistic regression analysis. Physics and Chemistry of the Earth, 126(March 2021), 103065. https://doi.org/10.1016/j.pce.2021.103065

Jimenez Velez, A. F. (2023). Geospatial Collective Intelligence Approach in the appreciation phase of military planning. Ciencia y Poder Aéreo, 18(2), 67–74. https://doi.org/10.18667/cienciaypoderaereo.772

Jones, A., Koehler, S., Jerge, M., Graves, M., King, B., Dalrymple, R., Freese, C., & Von Albade, J. (2023). BATMAN: A Brain-like Approach for Tracking Maritime Activity and Nuance. Sensors, 23(5). https://doi.org/10.3390/s23052424

Jones, A., Kuehnert, J., Fraccaro, P., Meuriot, O., Ishikawa, T., Edwards, B., Stoyanov, N., Remy, S. L., Weldemariam, K., & Assefa, S. (2023). AI for climate impacts: applications in flood risk. Npj Climate and Atmospheric Science, 6(1). https://doi.org/10.1038/s41612-023-00388-1

Li, J., Hong, D., Gao, L., Yao, J., Zheng, K., Zhang, B., & Chanussot, J. (2022). Deep learning in multimodal remote sensing data fusion: A comprehensive review. International Journal of Applied Earth Observation and Geoinformation, 112(April), 102926. https://doi.org/10.1016/j.jag.2022.102926

Li, L., Wang, J., & Wang, C. (2005). Typhoon insurance pricing with spatial decision support tools. International Journal of Geographical Information Science, 19(3), 363–384. https://doi.org/10.1080/13658810412331317742

Luo, Y., Shen, M., Li, E., Xiao, Y., Wen, H., Ren, Y., & Xie, J. (2019). ur na l P of. Carbohydrate Polymers, 115713. https://doi.org/10.1016/j.carbpol.2019.115713

Malik, A., Maciejewski, R., Towers, S., McCullough, S., & Ebert, D. S. (2014). Proactive spatiotemporal resource allocation and predictive visual analytics for community policing and law enforcement. IEEE Transactions on Visualization and Computer Graphics, 20(12), 1863–1872. https://doi.org/10.1109/TVCG.2014.2346926

Micheli, M., Gevaert, C. M., Carman, M., Craglia, M., Daemen, E., Ibrahim, R. E., Kotsev, A., Mohamed-Ghouse, Z., Schade, S., Schneider, I., Shanley, L. A., Tartaro, A., & Vespe, M. (2022). AI ethics and data governance in the geospatial domain of Digital Earth. Big Data and Society, 9(2). https://doi.org/10.1177/20539517221138767

Nwachukwu, M. A., Nwachukwu, J., Babatunde, A., Anyanwu, J., Ekweogu, C., & Nwachukwu, A. N. (2022). Geospatial Intelligence Training Concept for Terrorism Surveillance, Nigeria to Infusive Sub-Saharan African Countries. American Journal of Geospatial Technology, 1(1), 44–51. https://doi.org/10.54536/ajgt.v1i1.537

Pinto-Hidalgo, J. J., & Silva-Centeno, J. A. (2022). AmazonCRIME: a Geospatial Artificial Intelligence dataset and benchmark for the classification of potential areas linked to Transnational Environmental Crimes in the Amazon Rainforest. Revista de Teledeteccion, 2022(59), 1–21. https://doi.org/10.4995/raet.2022.15710

Preye Winston Biu, Johnson Sunday Oliha, & Ogagua Chimezie Obi. (2024). the Evolving Role of Geospatial Intelligence in Enhancing Urban Security: a Review of Applications and Outcomes. Engineering Science & Technology Journal, 5(2), 483–495. https://doi.org/10.51594/estj.v5i2.826

Prof Dr. Aftab Ahmad Malik. (2023). The Modern Electronic and other Technologies to Combat New Wave of Terrorism and Criminal Activities. International Journal for Electronic Crime Investigation, 7(3), 8. https://doi.org/10.54692/ijeci.2023.0703156

Purbahapsari, A. F., & Batoarung, I. B. (2022). Geospatial Artificial Intelligence for Early Detection of Forest and Land Fires. KnE Social Sciences, 2022, 312–327. https://doi.org/10.18502/kss.v7i9.10947

Quinto-Sanchez, M., & Huerta-Pacheco, N. S. (2023). Missing persons patterns from Mexico: evidence of a forensic emergency crisis. Forensic Sciences Research, 8(4), 288–294. https://doi.org/10.1093/fsr/owad026

R M, Y., & Dolui, B. (2021). Statistical and machine intelligence based model for landslide susceptibility mapping of Nilgiri district in India. Environmental Challenges, 5(May), 100211. https://doi.org/10.1016/j.envc.2021.100211

Rachmi Azanisa Putri, Panca Hadi Putra, & Ryan Randy Suryono. (2023). The Integrated Information System Implementation Strategy in Korlantas Polri Based on the Zachman Framework Approach. Jurnal RESTI (Rekayasa Sistem Dan Teknologi Informasi), 7(2), 381–388. https://doi.org/10.29207/resti.v7i2.4842

Ray, C., Dréo, R., Camossi, E., Jousselme, A. L., & Iphar, C. (2019). Heterogeneous integrated dataset for Maritime Intelligence, surveillance, and reconnaissance. Data in Brief, 25. https://doi.org/10.1016/j.dib.2019.104141

Rokhsaritalemi, S., Sadeghi-Niaraki, A., & Choi, S. M. (2023). Exploring Emotion Analysis Using Artificial Intelligence, Geospatial Information Systems, and Extended Reality for Urban Services. IEEE Access, 11, 92478–92495. https://doi.org/10.1109/ACCESS.2023.3307639

Rossmo, D. K., & Harries, K. (2011). The Geospatial Structure of Terrorist Cells. Justice Quarterly, 28(2), 221–248. https://doi.org/10.1080/07418820903426197

Sandino, J., Pegg, G., Gonzalez, F., & Smith, G. (2018). Aerial mapping of forests affected by pathogens using UAVs, hyperspectral sensors, and artificial intelligence. Sensors (Switzerland), 18(4), 1–17. https://doi.org/10.3390/s18040944

Shapiro, A. (2019). Predictive policing for reform? Indeterminacy and intervention in big data policing. Surveillance and Society, 17(3–4), 456–472. https://doi.org/10.24908/ss.v17i3/4.10410

Shears, J. (2013). The new intelligence. GEO: Connexion, 12(10), 20–21. https://doi.org/10.1201/9781420013863.ch1

Shehu, A., Aliyu Kangiwa, H., & Sani, A. (2023). Remote Surveillance: a Means of Intelligence Gathering for Minimizing Security Challenges in Nigeria. Journal of Engineering Science, 29(4), 59–71. https://doi.org/10.52326/jes.utm.2022.29(4).15

Spaulding, J. S., & Morris, K. B. (2022). An optimised approach to near repeat analysis for intelligence driven crime linkage. Journal of Policing, Intelligence and Counter Terrorism, 17(1), 24–47. https://doi.org/10.1080/18335330.2021.1945663

Spiegel, S. J., Ribeiro, C. A. A. S., Sousa, R., & Veiga, M. M. (2012). Mapping spaces of environmental dispute: Gis, mining, and surveillance in the Amazon. Annals of the Association of American Geographers, 102(2), 320–349. https://doi.org/10.1080/00045608.2011.641861

Sufi, F. K., Alsulami, M., & Gutub, A. (2023). Automating Global Threat-Maps Generation via Advancements of News Sensors and AI. Arabian Journal for Science and Engineering, 48(2), 2455–2472. https://doi.org/10.1007/s13369-022-07250-1

Tsioufis, M., Fytopoulos, A., Kalaitzi, D., & Alexopoulos, T. A. (2024). Discovering maritime-piracy hotspots: a study based on AHP and spatio-temporal analysis. Annals of Operations Research, 335(2), 861–883. https://doi.org/10.1007/s10479-023-05352-z

Udochukwu, E., Christian, Su. I., & Adebayo, A. (2014). The Application of Geospatial Intelligence in National Security for Sustainable Development to combat Terrorism Insurgence in Nigeria. IOSR Journal of Environmental Science, Toxicology and Food Technology, 8(9), 11–16. https://doi.org/10.9790/2402-08931116

Veerasamy, N., Moolla, Y., & Dawood, Z. (2022). Application of Geospatial Data in Cyber Security. European Conference on Information Warfare and Security, ECCWS, 2022-June, 305–313. https://doi.org/10.34190/eccws.21.1.447

Zhao, M., & Liu, X. (2018). Development of decision support tool for optimizing urban emergency rescue facility locations to improve humanitarian logistics management. Safety Science, 102(September 2017), 110–117. https://doi.org/10.1016/j.ssci.2017.10.007