SITJOURNAL
Security Intelligence Terrorism Journal

Security Intelligence Terrorism Journal (SITJ), Vol. 02 No. 03 (2025), pp. 312-318
Research Article
doi: https://doi.org/10.70710/sitj.v2i3.67

The Use of Artificial Intelligence in the Integration of Process Intelligence Data Sources Analysis

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Article Info
Received: 15-July-2025
Revised: 30-Aug-2025
Published: 8-Sept-2025

Keywords
Artificial Intelligence; Big Data; Data Integration; Intelligence Analytics; Strategic Decision Making

Abstract
Integrating and analyzing intelligent data is a significant challenge in a digital age characterized by abundant data from various sources. The application of Artificial Intelligence (AI) offers a potential solution to address this complexity. This article explores AI's role in analyzing the integration of intelligence data sources, highlighting its benefits, challenges, and implications for strategic decision-making. The main problem to be addressed in this study is how AI can assist in the intelligence integration analysis process. The method used in this research is a qualitative method based on a literature review. The result of this study is that there are at least 4 (four) mechanisms of Artificial Intelligence (AI) utilization in analyzing the integration of intelligence data sources, namely machine learning mechanisms, search methods and optimization theory, knowledge-based and reasoning, and decision-making algorithms. Evaluation of AI implementation must be accompanied by attention to security challenges, ethics, and technological limitations. With the right approach, AI can be a powerful tool in supporting strategic decision-making and maintaining national security.

1. Introduction

Law No. 17/2011 regulates State Intelligence. The definition of intelligence, based on Law No. 17/2011, is knowledge, organization, and activities related to policy formulation, national strategy, and decision-making based on analysis of information and facts collected through working methods for detection and early warning in the context of preventing, deterring, and overcoming any threat to national security. Within the execution of intelligence activities, a vital process is intelligence analysis, which aims to generate intelligence products for use by decision-makers in formulating appropriate policies. The need for intelligence analysis processes is increasing, considering the quantum leap in the distribution of information due to the times and technology that make it easier for people to communicate and access information. The times and information technology have produced a tremendous surge of data, spanning a variety of formats and sources. In the context of intelligence, data can come from human intelligence (HUMINT), electronic signals (SIGINT), imaginary intelligence (IMINT), and open-source intelligence (OSINT). Integrating and analyzing this diverse data effectively is key to gaining accurate and timely insights. When discussing Artificial Intelligence (AI) in the analysis process, it also relates to the big data collected in conducting the analysis process. Artificial Intelligence (AI) is emerging as a technology that can automate and improve this process, enabling faster, more efficient, in-depth analysis.

Based on a study by Sarjito (2024), findings show that while technological advances and geopolitical shifts have driven substantial changes in defense policy, challenges remain in achieving effective interagency coordination, adapting to rapid technological change, and addressing the root causes of terrorism. The study concluded that continuous adaptation and innovation in defense strategy are critical

in maintaining security and stability in an increasingly complex global landscape. Meanwhile, research by Putro (2024) highlights the implementation of big data and AI to enhance the intelligence capabilities of the Indonesian National Army (TNI). The study shows that developing an efficient and secure big data infrastructure is crucial in strengthening intelligence and supporting strategic decisions. However, challenges such as integration, data security, and personnel skills require investment in advanced technologies and collaboration to optimize data management and improve TNI's response.

The novelty of this research is the discussion of the exploration of the use of Artificial Intelligence (AI) in analyzing intelligence data in the digital era. No previous research discusses Artificial Intelligence (AI) used to analyze the integration of intelligence data. This study will focus on the AI mechanism that can be used to analyze intelligence data. This study is expected to contribute to theoretical understanding and provide insights related to the development of the times and technology towards an increasingly efficient analysis process with the existence of new tools in the form of Artificial Intelligence (AI), especially related to analyzing state intelligence. The main problem to be answered in this study is how Artificial Intelligence (AI) mechanisms can be assisted in analyzing the integration of intelligence data sources. The focus of this research will be divided into several questions: (1) How can Artificial Intelligence (AI) mechanisms be assisted as tools in analyzing the integration of intelligence data sources? (2) How can the evaluations and recommendations be given regarding the use of Artificial Intelligence (AI) in analyzing the integration of intelligence data sources?

This study's primary goal is to examine the potential applications of artificial intelligence (AI) in intelligence data analysis by examining how it operates. In addition, to evaluate and provide appropriate recommendations for the development of Artificial Intelligence (AI) in the context of its utilization as a tool to streamline the process of analyzing data derived from intelligence data sources to assist in making targeted decisions. The results of this research are expected to provide concrete recommendations to improve the efficiency of intelligence data management and analysis, accelerate identification and response to threats, provide insight into the development of the use of Artificial Intelligence (AI) in everyday life, and support more accurate strategic decision-making based on available intelligence data.

2. Methodology

The method used in this research uses a qualitative approach to explore the phenomenon of the times and technological developments on how the process of analyzing intelligence data is carried out. This method was chosen because it can provide an overview of the utilization of AI technology in the analysis process for strategic decision-making regarding state intelligence. The results and discussion are collected as a literature review related to AI-based research in public life and then described and analyzed regarding its potential use for the benefit of state intelligence. With theoretical insights and in-depth understanding, the researcher collected literature studies related to Artificial Intelligence (AI) and its utilization in the integration of intelligence data sources. This allows researchers to provide appropriate recommendations in developing the utilization of Artificial Intelligence (AI), especially in analyzing the integration of intelligence data sources.

3. Result and Discussion

In terms of utilizing Artificial Intelligence (AI) for the analysis process, it is inseparable from the role of big data, which is the source of the data to be analyzed. Based on Furht & Villanustre (2016), Several V's, including Volume, Velocity, Variety, and Veracity, can be used to characterize big data.

1. Volume: This suggests the massive volume of data produced per second. A big data framework can handle this enormous amount of data.
2. Velocity: Shows how quickly data is produced and processed to glean insightful information.
3. Variety: Indicates a range of data forms, including logs, papers, and videos.
4. Veracity: This shows the data's quality factor. In other words, it establishes the biases, noise, anomalies, and other elements in the data.

Based on Aldoseri et al. (2023), there are challenges in using AI. Each of the four key elements of data-driven AI applications—quality, quantity, diversity, and privacy—has unique difficulties. Inaccurate or biased AI models resulting from poor data quality can have major repercussions in healthcare, finance, and care sectors. AI is also starting to be developed for sectors such as analytical processing in the intelligence

space. Intelligence datasets collected can be integrated to make decisions from them. Decision-making model algorithms are created based on which AI mechanism will help determine decisions. Models that are too basic and inadequate to anticipate results can result from a lack of data. Additionally, biased models that do not fairly represent the intended population can result from a lack of diversity in the data. Finally, data privacy is a major concern, as AI models may require access to sensitive data, which raises concerns about data privacy and security.

The results of this research are based on data collected through the literature review method related to Artificial Intelligence (AI) in relation to big data and its utilization in intelligence data analysis. AI technology in analyzing the integration of intelligence data sources is related to analyzing data grouping or classification based on certain mechanisms. There are at least 4 mechanisms of the data analysis process using Artificial Intelligence (AI). The four mechanisms of using AI in the analysis process are:

1. machine learning
2. search methods and optimization theory;
3. knowledge-based and reasoning methods;
4. decision-making algorithms.

3.1. Implementation of AI in the Analysis Process of Intelligence Data Sources Integration

Artificial Intelligence (AI) techniques such as machine learning (ML), search-based, knowledge-based, reasoning procedures, and decision-making models were created to provide quicker and more accurate data analysis findings. Integrating AI approaches with big data tools has opened up new possibilities for faster and more efficient analysis, including the scope of AI used to analyze intelligence data sources. Here is the role of AI in intelligence data integration and analysis:

1. Data Collection and Filtering: AI can automate collecting data from various sources, including social media, electronic communications, and field sensors. Technologies such as natural language processing (NLP) enable AI to understand and filter relevant information from large amounts of text. This improves efficiency and accuracy in identifying significant data for further analysis.
2. Pattern Analysis and Recognition: AI recognizes patterns and anomalies in complex datasets through machine learning techniques. For example, AI can detect suspicious behavior in communications or financial transactions that manual analysis may miss. This capability enables proactive identification of potential threats.
3. Multi-source Data Integration: AI facilitates data integration from multiple formats and sources, creating a comprehensive intelligence picture. Combining geospatial data, communications, and public information allows AI to provide richer and deeper context, supporting more informed decision-making.

Four key qualitative parameters have been established to evaluate each analysis mechanism approach using AI and big data, and identify its advantages and disadvantages. The four qualitative parameters are as follows:

1. Scalability: The mechanism's ability to adapt to rapid changes without compromising the quality of analysis.
2. Efficiency shows the ratio of the method to the overall time and cost requirements.
3. Precision Numerous metrics, including data inaccuracy and the algorithm’s prediction power, are used to identify this.
4. Privacy refers to procedures that limit data usage to its intended use.

3.2. Machine Learning Mechanism

The algorithms that make up AI machine learning mechanisms fall into two primary categories: supervised learning and unsupervised learning. It takes a lot of manual work to format the data for learning algorithms in the initial classification. Large volumes of unlabeled data can contain hidden patterns that unsupervised learning algorithms can uncover. Based on this classification, supervised machine learning can help classify or categorize intelligence data in the process of analysis and decision-making. However,

forming the initial algorithm requires much effort to form the boundaries AI uses to categorize the intelligence data sources. The following is an overview of the supervised learning algorithm model analysis depicted in Figure 1.

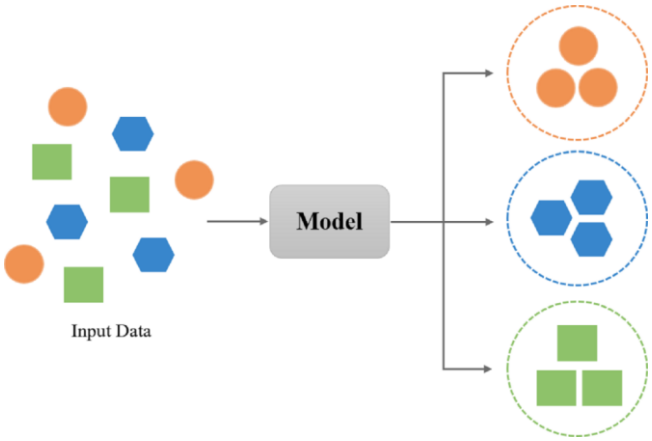

Figure 1. Overview of Supervised Learning Algorithm Model

Unsupervised learning is employed when there are no corresponding output variables for the input data. These algorithms can detect hidden patterns in intelligent data. Data clustering or classification is the main thing that unsupervised learning algorithms do. An overview of unsupervised learning is shown in Figure 2, where groups attached to input objects are discovered based on underlying patterns, based on Bengio, Courville & Vincent (2012). It differs from supervised learning, where the learning algorithm is given certain limitations to cluster the data. Meanwhile, unsupervised learning can cluster based on patterns in a data set. This algorithm can find hidden patterns or patterns from a data set. High-quality data clustering is provided by the unsupervised learning approach that is being discussed. Results show that the unsupervised learning algorithm can also provide high accuracy and scalability.

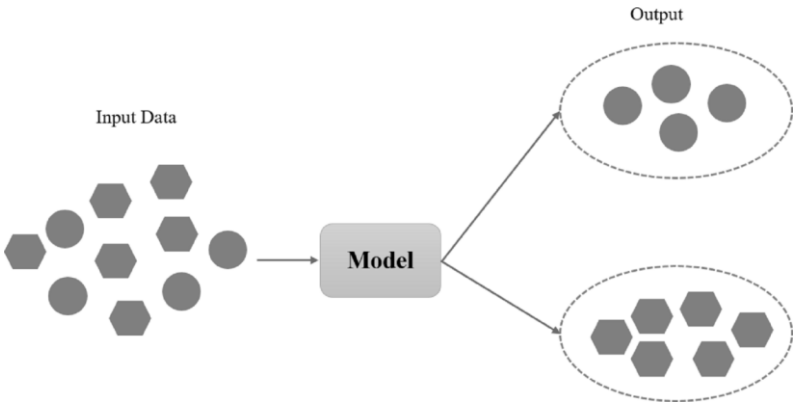

Figure 2. Overview of Unsupervised Learning Algorithm Model

The results of using AI machine learning algorithms for analyzing intelligence data sources can be seen from the research of Feng et al. (2019), where several deep learning and data mining techniques are used to visualize and forecast trends in criminal data. From crime statistics in San Francisco, Chicago, and Philadelphia, Feng et al. discovered several intriguing facts and trends. The LSTM (Long Short Term Memory) network methodology is more complicated than the suggested data mining and deep learning techniques. LSTM is an algorithm that can remember a set of information that has been stored for a long time, as well as delete information that is no longer relevant. LSTM can process, predict, and classify data using a time sequence. AI with machine learning mechanisms can simplify the process of analyzing intelligence data integration due to its implementation with lower complexity than other algorithms, such as LSTM.

In addition, research conducted by Gustina and Ananda (2024) explains that the use of AI / ML (Machine Learning) technology in cybersecurity can increase the effectiveness of SOC (Security Operation Center) analysts in detecting, preventing, by addressing security threats in ways including enhanced threat identification, automated repetitive processes, quicker and more precise data analysis, enhanced attack

response, and decreased burden. Behavioral analysis, log analysis, malware analysis, and threat intelligence analysis are additional security threat detection features of the SOAR (Security Orchestration, Automation, and Response) engine. The SOAR system's artificial neural network-based machine learning makes real-time data analysis and rapid danger detection possible. As a result, applying AI technology and real-time analysis aids in lowering security experts' workloads and increasing their effectiveness in responding to intrusions.

3.3. Search Methods and Optimization Theory Mechanisms

Finding the best answer to an issue can be accomplished using search-based processes. In search-based optimization, the goal with specified constraints determines the best action. In a big data environment, the search's breadth expands. Consequently, it is necessary to develop robust search algorithms and to address large-scale optimization issues (Azhir et al, 2021). AI with search methods and optimization theory mechanisms can be used to find and provide the required intelligence data sources. Based on Munthe et al. (2023), by combining operations research, data optimization, and effective decision making, organizations can achieve their goals more optimally and sustainably in the digital era.

3.4. Knowledge-Based and Reasoning Mechanism

One of the main components of AI is knowledge-based reasoning. Reasoning algorithms can outperform human experts by applying their knowledge base in a given field. For AI to act like and as well as humans, it must also be armed with knowledge and have the ability to reason. The use of AI with a knowledge base and reasoning is expected to be a tool to validate the accuracy of intelligence data sources before the analysis process is carried out.

Providing Natural Language Processing or NLP capabilities allows AI to understand and filter relevant information from large amounts of text. This increases efficiency and accuracy in identifying significant data for further analysis. NLP branches out with natural language processing from computer science and linguistics. This language-giving capability can examine computer-computing interactions with human language. NLP is often considered a branch of artificial intelligence, and the research transition field overlaps with computer languages. The core of natural language processing lies in the parser. The parser reads sentences from the source language, explains and analyzes the words in the sentence, and constructs a matching part with the corresponding grammar. Parser support is a dictionary with vocabulary. The parser version is handled by a part of the knowledge representation that plays a role in interpreting the input rate in the translation application.

3.5. Mechanism of Decision-Making Algorithms

The decision algorithm's objective is to maximize predicted utility. This approach uses a utility function to determine a state's desirability. The utility function is maximized when the agent makes a decision. Research on AI with the mechanism of decision-making algorithms was conducted by Lu et al. (2017) related to the use of programming-based decision-making models with certain constraints. Big data analysis applications must be reapplied when changes occur in Cloud storage at runtime. The research presented a decision-making solution to choose which strategy application is most suitable to be carried out after being analyzed based on certain constraints. In the context of intelligence, the use of AI with decision-making mechanisms can be used to support strategic decisions. The constraints should be based on the actual data conditions in the field and the impact that can be caused. The strategic decisions that will be made must still pay attention to the maximum benefit by minimizing the losses that could occur.

3.6. Benefits of AI in the Analysis Process: Integration of Intelligence Data Sources

The following are the benefits of implementing Artificial Intelligence (AI) in the context of state intelligence:

1. Speed and Efficiency: AI can quickly process and analyze large amounts of data, enabling faster response to threats or incidents.

2. Improved Accuracy: With the ability to learn and adapt, AI can improve analysis accuracy over time, reducing the chances of human error.
3. Resource Savings: AI automation of routine tasks allows intelligence personnel to focus on strategic analysis and decision-making, improving operational efficiency.

3.7. AI Challenges in the Analysis Process of Integrating Intelligence Data Sources

The following are the challenges and evaluation of Artificial Intelligence (AI) implementation in the context of state intelligence:

1. Data Security: Since using AI necessitates access to private information, security and privacy are top priorities. Implementation of strict security protocols is essential to prevent data leakage or misuse.
2. Technology Limitations: While AI has extensive capabilities, understanding certain contexts or nuances that may affect the interpretation of data is still limited.
3. Ethics and Bias: AI can inherit biases from training data or algorithm design, leading to inaccurate or discriminatory conclusions. Ensuring that AI systems are designed and trained with ethical principles is important.

4. Conclusion

The utilization of Artificial Intelligence (AI) in analyzing the integration of intelligence data sources offers great potential to increase the speed, accuracy, and operational efficiency in managing state intelligence. There are at least four AI mechanisms that can be used in the process of analyzing the integration of intelligence data sources, namely machine learning mechanisms that are most often and have long been developed to filter and cluster massive amounts of intelligence data; search methods and optimization theory mechanisms which can be used to search and provide the sources of intelligence data needed; The use of Artificial Intelligence (AI) in the integration analysis process is a knowledge-based and reasoning mechanism that can be used to validate the accuracy of intelligence data sources before the analysis process is carried out; a decision making algorithm mechanism that can be used as an analysis process to produce support for strategic decisions to be made by paying attention to maximizing benefits by minimizing losses that could occur. Second, the evaluation of AI implementation must be accompanied by attention to security challenges, ethics, and technological limitations. With the right approach, AI can be a powerful tool in supporting strategic decision-making and maintaining national security.

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