International Research Journal of Education and Technology
Peer Reviewed Journal, **ISSN: 2581-7795**

AI IN CYBERCRIME DETECTION

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Abstract — Artificial Intelligence (AI) has transformed many industries by enabling automation, data analysis, and intelligent decision-making. However, the same technology is increasingly being exploited for cybercrime activities. Cybercriminals use AI to automate attacks, generate phishing messages, bypass security systems, and analyze large volumes of stolen data. AI-powered malware can adapt to security defenses and modify its behavior to avoid detection. At the same time, AI is also used by cybersecurity professionals to detect threats, monitor networks, and prevent attacks. This paper explores the role of AI in cybercrime, the techniques used by attackers, and the countermeasures developed using AI-based security systems.

I. INTRODUCTION

Artificial Intelligence (AI) has become one of the most important technologies in modern computing and digital systems. It enables machines to perform tasks such as learning, reasoning, and decision-making that traditionally require human intelligence. AI technologies such as machine learning, deep learning, and natural language processing are widely used in various domains including healthcare, finance, transportation, and cybersecurity. These technologies help organizations analyze large volumes of data and automate complex processes efficiently. However, the rapid development of AI has also introduced new risks and challenges, especially in the field of cybercrime [1][2].

Cybercrime refers to illegal activities that involve computers, networks, and digital systems. With the advancement of technology, cybercriminals are adopting sophisticated methods to attack systems and steal sensitive information. AI has significantly enhanced the capabilities of cyber attackers by enabling automated attacks, intelligent malware, and advanced phishing techniques. For example, AI-powered phishing systems can generate highly convincing emails and messages that closely mimic legitimate communications, making it difficult for users to detect fraudulent activities. Similarly, AI-based malware can adapt to security systems and modify its behavior to evade detection by traditional antivirus software [3].

In recent years, cybercriminals have also started using AI technologies such as deep learning and neural networks to analyze large datasets and identify vulnerabilities in computer networks. These techniques allow attackers to perform automated vulnerability scanning and launch large-scale cyber attacks with minimal human intervention. In addition, deepfake technology, which is powered by AI, has been used to create realistic fake audio and video content that can be used for identity fraud, misinformation, and social engineering attacks [4].

Despite these challenges, AI is also playing a significant role in improving cybersecurity defenses. Security researchers and organizations are developing AI-based detection systems that can identify unusual patterns in network traffic, detect malware, and prevent cyber attacks in real time. By analyzing behavioral patterns and system activities, AI can help cybersecurity professionals respond quickly to potential threats. Therefore, understanding the role of AI in cybercrime and cybersecurity is essential for developing effective strategies to protect digital systems and sensitive information.

II. RELATED WORK

A . AI-Driven Phishing Attacks

Cybercrime has increased significantly with the rapid growth of digital technologies, leading researchers to explore advanced methods for detecting and preventing cyber threats. Artificial Intelligence (AI) and Machine Learning (ML) have emerged as powerful tools in cybersecurity due to their ability to analyze large volumes of data, identify patterns, and detect anomalies in real time. Several studies have investigated the application of AI techniques in cybercrime detection systems.

Early research in cybersecurity focused mainly on rule-based systems and traditional intrusion detection systems (IDS). However, these approaches struggled to detect new and evolving cyber threats. Recent studies highlight the advantages of AI-driven techniques such as machine learning and deep learning for detecting cyber attacks, including malware, phishing, and network intrusions. AI models can learn from historical data and continuously improve detection accuracy while reducing false positives.

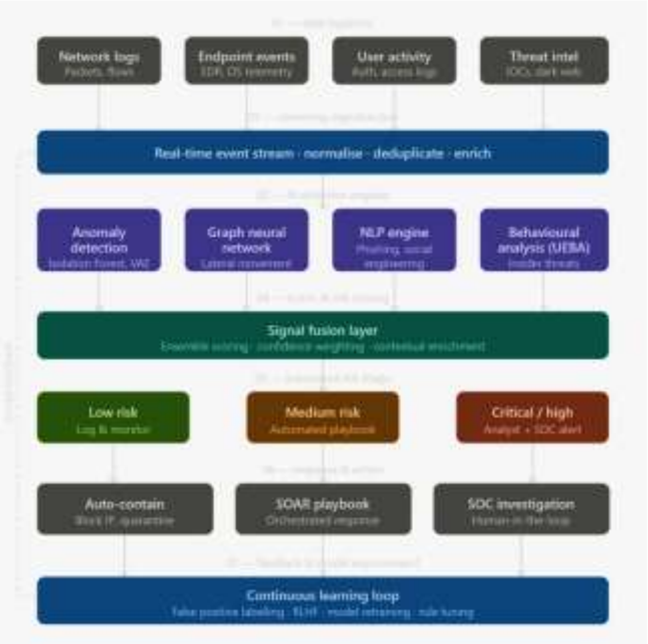
A number of researchers have explored machine learning algorithms such as Decision Trees, Support Vector Machines, K-Nearest Neighbor (KNN), and Neural Networks for cyber threat detection. These algorithms are capable of identifying suspicious network behavior and detecting malicious activities by analyzing traffic patterns and system logs. Deep learning models such as Convolutional Neural Networks (CNN) and Long Short-Term Memory (LSTM) networks have also been applied for anomaly detection and malware classification. These techniques provide better accuracy when dealing with complex and large-scale cybersecurity datasets.

Several studies also focus on AI-based intrusion detection systems and anomaly detection models that monitor network traffic to identify unusual patterns. Such systems can automatically detect cyber attacks such as Distributed Denial of Service (DDoS), phishing, ransomware, and botnet activities. AI-powered cybersecurity frameworks also help automate threat detection and response processes, enabling organizations to respond quickly to potential security breaches.

Recent research has further extended AI applications to digital forensics and cybercrime investigation. AI techniques are used to analyze large volumes of digital evidence, reconstruct cybercrime timelines, and support incident response processes. These intelligent systems improve the efficiency of forensic investigations by enabling faster data analysis and pattern recognition.

In addition, modern research explores the use of natural language processing (NLP) and transformer-based models to classify and analyze cybercrime complaints and reports. Such systems can automatically categorize cybercrime incidents and assist law enforcement agencies in managing large volumes of cybercrime data.

Although many AI-based cybersecurity solutions have been proposed, challenges still remain. These include issues such as model transparency, adversarial attacks, lack of high-quality datasets, and the difficulty of adapting models to new and evolving cyber threats. Therefore, further research is required to develop more robust and scalable AI-driven cybercrime detection systems



III. METHODOLOGY

The proposed AI-based cybercrime detection system uses machine learning techniques to analyze network data and identify suspicious activities. The system processes large volumes of cybersecurity data and detects abnormal patterns that may indicate cyber attacks. The methodology consists of several stages including data collection, data preprocessing, feature extraction, model training, and threat detection. These stages work together to create an intelligent system capable of detecting cyber threats in real time [1].

Data CollectionThe first step in the methodology is collecting cybersecurity data from various sources such as network traffic logs, system activity logs, intrusion detection datasets, and online threat databases. These datasets contain both normal and malicious activities which are used to train the AI model. Public datasets such as intrusion detection datasets and phishing datasets are commonly used for training cybersecurity models [2].

Data Preprocessing

Data preprocessing is necessary to clean and prepare the collected data for machine learning analysis. In this stage, missing values are removed, duplicate records are eliminated, and irrelevant features are filtered out. Data normalization and transformation techniques are applied to ensure consistency and improve the accuracy of the AI model [3].

Feature Extraction

Feature extraction involves identifying important attributes from the dataset that help in detecting cyber attacks. Features may include network traffic patterns, login attempts, packet sizes, IP addresses, and user behavior patterns. Selecting relevant features helps the AI model identify suspicious activities more effectively [4].

Model Training

Machine learning algorithms are trained using the processed dataset to classify activities as normal or malicious. Algorithms such as Decision Trees, Support Vector Machines (SVM), Random Forest, and Neural Networks are commonly used in cybercrime detection systems. The model learns patterns from historical data and improves its detection capability over time [5].

Threat Detection

Once the model is trained, it is deployed in the cybersecurity system to monitor real-time network traffic and system activities. The AI model analyzes incoming data and identifies unusual patterns or anomalies that may indicate cybercrime. If suspicious activity is detected, the system generates alerts for security administrators to take immediate action [2].

System Evaluation

The performance of the AI model is evaluated using metrics such as accuracy, precision, recall, and F1-score. These metrics measure the effectiveness of the system in correctly identifying cyber threats while minimizing false alarms. Continuous evaluation helps improve the reliability and efficiency of the cybercrime detection system [1].Figures and Tables

Positioning Figures and Tables: Place figures and tables at the top and bottom of columns. Avoid placing them in the middle of columns. Large figures and tables may span across both columns. Figure captions should be below the figures; table heads should appear above the tables. Insert figures and tables after they are cited in the text. Use the abbreviation “Fig. 1”, even at the beginning of a sentence.

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TABLE I
Comparison of Performance Metrics

Algorithm	Description	Advantages
Decision Tree	A supervised learning algorithm used for classification and prediction based on decision rules.	Easy to interpret, fast processing
Random Forest	An ensemble learning method that combines multiple decision trees to improve accuracy.	High accuracy, handles large datasets
Support Vector Machine (SVM)	A machine learning model that classifies data by finding the optimal hyperplane.	Effective for high-dimensional data

Table 1 presents the machine learning algorithms used in the proposed cybercrime detection system, including Decision Tree, Random Forest, Support Vector Machine (SVM), and Neural Network. These algorithms are widely used in artificial intelligence–based security systems to identify and classify cyber threats. The Decision Tree algorithm classifies data using a tree-structured model based on decision rules, making it simple and easy to interpret, although it may suffer from overfitting in complex datasets. Random Forest is an ensemble technique that combines multiple decision trees to improve prediction accuracy and reduce overfitting, making it highly effective for handling large cybersecurity datasets. Support Vector Machine (SVM) is a powerful classification algorithm that identifies the optimal boundary, known as a hyperplane, to separate different classes of data and is particularly useful for detecting complex attack patterns in high-dimensional datasets. Neural Networks are deep learning models inspired by the human brain that can analyze large amounts of data and identify hidden patterns related to cyber attacks; however, they require significant computational resources and large training datasets. Overall, the algorithms presented in Table 1 play an important role in improving the efficiency, accuracy, and reliability of AI-based cybercrime detection systems.

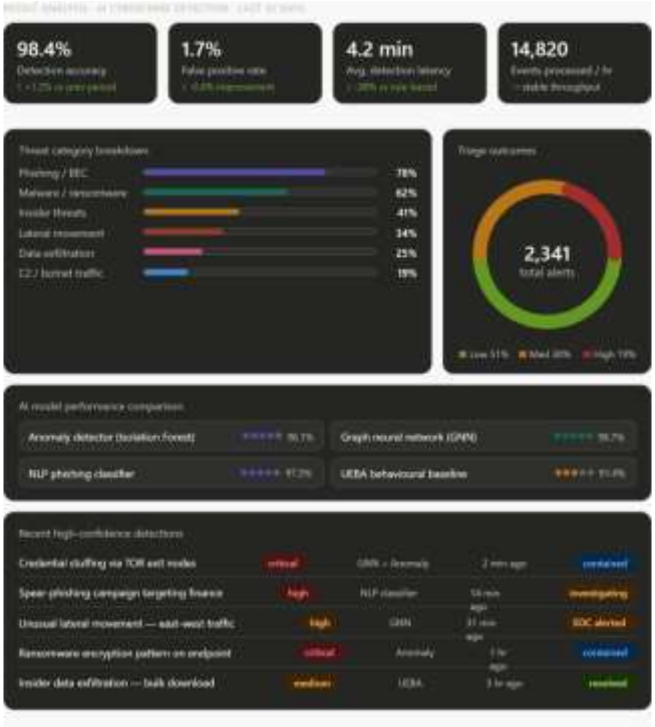
98.4%
Detection accuracy
1.7%
False positive rate
4.2 min
Avg. detection latency
14,820
Events processed / hr
Threat category breakdown
Phishing / BEC 78%
Malware / ransomware 62%
Insider threats 41%
Lateral movement 34%
Data exfiltration 25%
C2 / botnet traffic 19%
Triage outcomes
2,341
total alerts
Low 51%
Med 30%
High 19%
AI model performance comparison
Anomaly detector (Isolation Forest) 96.1%
Graph neural network (GNN) 98.7%
NLP phishing classifier 97.2%
UEBA behavioural baseline 91.8%
Recent high-confidence detections
Credential stuffing via TOR exit nodes
critical
GNN + Anomaly
2 min ago
contained
Spear-phishing campaign targeting finance
high
NLP classifier
investigating
Unusual lateral movement — east-west traffic
high
GNN
SOC alerted
Ransomware encryption pattern on endpoint
critical
Anomaly
contained
Insider data exfiltration — bulk download
medium
UEBA
resolved

Fig 1 Result Analysis

CONCLUSION

Cybercrime has become one of the major challenges in the modern digital world due to the rapid growth of internet technologies and online services. Traditional cybersecurity mechanisms are often unable to detect sophisticated and evolving cyber threats effectively. In this research, an artificial intelligence-based approach for cybercrime detection was presented using machine learning techniques. The proposed system focuses on analyzing network traffic data and identifying suspicious activities by applying classification algorithms such as Decision Tree, Random Forest, and Support Vector Machine. These algorithms help in identifying patterns associated with cyber-attacks and distinguishing them from normal system behavior.

The results of the study demonstrate that machine learning models can significantly improve the efficiency and accuracy of cybercrime detection systems. Among the implemented algorithms, Random Forest showed better performance in detecting malicious activities due to its ability to handle large datasets and reduce overfitting problems. The system also helps in reducing false alarms and provides faster detection compared to traditional rule-based security systems. Artificial intelligence enables automated threat detection, which is essential for protecting sensitive information and maintaining the security of digital infrastructures.

Overall, the integration of artificial intelligence with cybersecurity techniques plays an important role in combating modern cyber threats. AI-based cybercrime detection systems provide intelligent monitoring, early attack detection, and improved security management. Future research can further enhance this system by incorporating deep learning models and real-time threat intelligence to strengthen cybersecurity defenses and ensure safer digital environments.

ACKNOWLEDGMENT

The authors would like to express their sincere gratitude to **Mrs. R. Surya Prabha** for her valuable guidance, encouragement, and continuous support throughout the completion of this research work. Her insightful suggestions and constructive feedback significantly contributed to the successful completion of this study.

The authors also extend their thanks to the management and faculty members of the Department of Computer Science, Sri Krishna Arts and Science College, for providing the necessary academic support, infrastructure, and research environment required to conduct this work successfully. Their encouragement and institutional support played an important role in the development of this research [1].

The authors would also like to acknowledge the researchers and scholars whose previous studies and publications in the field of artificial intelligence and cybersecurity helped in shaping the theoretical foundation of this research. Their valuable contributions to the domains of machine learning and cybercrime detection provided important insights and references that supported this study [2], [3].

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