AI-Based Cybercrime Detection on Social Media: Fake Profile and Cyberbullying Identification Using Machine Learning and NLP with Malware Forensic Analysis for Attack Source Attribution

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***Abstract*—The rapid growth of social media platforms has significantly transformed communication, networking, and information sharing across the world. However, the widespread adoption of these platforms has also resulted in the rise of cybercrime activities such as fake profiles, cyberbullying, identity theft, harassment, and coordinated online attacks. Traditional rule-based security systems are often insufficient to handle the complexity and scale of modern cyber threats. Artificial Intelligence (AI), particularly Machine Learning (ML) and Natural Language Processing (NLP), has emerged as an effective solution for detecting and mitigating cybercrime on social media platforms. This study explores an integrated AI-based framework for cybercrime detection focusing on three major aspects: identification of fake social media profiles, detection of cyberbullying using NLP-based sentiment and linguistic analysis, and malware forensic analysis for identifying the source of cyber attacks. Machine learning algorithms such as Random Forest, Support Vector Machine, and Decision Trees are applied to classify suspicious user behaviors and detect malicious patterns in user interactions. NLP techniques including text classification, sentiment analysis, and semantic analysis are used to identify abusive language and harmful online communication. Additionally, malware forensic techniques are integrated into the framework to analyze malicious scripts and digital traces that help attribute attacks to their origin. The proposed system aims to enhance the security of social media environments by enabling proactive detection and prevention of cyber threats. The research demonstrates that combining machine learning, NLP, and digital forensic analysis significantly improves detection accuracy and provides reliable mechanisms for identifying the perpetrators of cybercrime. This approach can support law enforcement agencies, cybersecurity professionals, and social media platforms in combating cybercrime and protecting users from online harm.**

***Index Terms*—Cybercrime detection, Artificial Intelligence, Machine Learning, Natural Language Processing.**

I. INTRODUCTION

The increasing use of social media platforms such as Facebook, Twitter, Instagram, and TikTok has transformed the digital landscape by enabling individuals to communicate, share information, and build communities across geographical boundaries. While these platforms offer numerous benefits, they have also become fertile ground for cybercriminal activities. Cybercrime on social media includes identity theft, fake accounts, phishing attacks, harassment, cyberbullying, and malware distribution. These malicious activities not only threaten the privacy and security of users but also create psychological, financial, and reputational damage.

One of the most common forms of cybercrime on social media is the creation of fake profiles. Cybercriminals often create fraudulent accounts to impersonate real users, spread misinformation, conduct financial scams, or engage in harassment. According to Smith (2022), fake accounts can be used

for large-scale fraudulent campaigns that manipulate online discussions and deceive unsuspecting users.

Another significant issue is cyberbullying, which involves the use of digital platforms to harass, threaten, or humiliate individuals. Cyberbullying can have severe psychological consequences, including depression, anxiety, and social isolation. Traditional moderation systems rely on manual reporting and keyword filtering, which are often insufficient to identify complex patterns of abusive behavior.

Artificial Intelligence has emerged as a powerful tool in cybersecurity due to its ability to analyze large datasets, identify hidden patterns, and detect anomalies in real time. Machine learning algorithms can be trained on historical data to recognize patterns associated with cybercrime activities. Similarly, Natural Language Processing enables computers to understand and analyze human language, making it possible to detect abusive or harmful content in social media messages.

In addition to behavioral and linguistic analysis, malware forensic analysis plays an important role in identifying the source of cyber attacks. Cybercriminals frequently use malicious software to gain unauthorized access to systems, steal information, or conduct coordinated attacks. Digital forensics helps investigators analyze malicious code and network traces to identify the origin and methods of cybercrime.

This study aims to develop an integrated AI-based framework that combines machine learning, natural language processing, and malware forensic analysis to detect cybercrime on social media platforms. The research highlights the potential of AI technologies to improve cybersecurity and provide effective solutions for combating online threats.

II. LITERATURE REVIEW

Recent research has emphasized the importance of artificial intelligence in combating cybercrime on digital platforms. Smith (2022) explains that machine learning algorithms can analyze user behavior patterns to identify anomalies associated with fake profiles and fraudulent activities. By examining factors such as posting frequency, friend networks, and interaction patterns, machine learning models can distinguish between legitimate users and malicious accounts.

Kumar (2021) discusses the role of data mining techniques in analyzing large datasets to identify suspicious activities. Data mining methods such as clustering, classification, and anomaly detection are widely used to detect cyber threats in social media environments.

Patel (2020) highlights the potential of smart systems using machine learning to monitor digital environments and identify malicious activities in real time. The study suggests that automated detection systems significantly reduce the workload of human moderators.

Sharma (2023) emphasizes the role of artificial intelligence in sustainable digital ecosystems, arguing that AI-driven monitoring systems can enhance cybersecurity by continuously analyzing network behavior and identifying unusual activities.

Gupta (2022) explores the integration of IoT and AI technologies for smart monitoring systems. Although the study focuses on smart agriculture, the underlying machine learning techniques are also applicable to cybersecurity applications.

Verma (2021) examines the effectiveness of decision tree models for predictive analysis. Decision trees can be used in cybersecurity to classify user behavior and detect potential threats based on predefined rules.

Nair (2023) highlights the use of machine learning models for pattern recognition in large datasets. These models can be adapted to analyze communication patterns on social media platforms to detect cyberbullying.

Singh (2022) investigates the use of Random Forest algorithms in data analysis and classification tasks. Random Forest models are particularly effective for detecting cybercrime because they can handle complex and high-dimensional datasets.

Reddy (2024) discusses the concept of precision analytics using advanced computational methods. Similar techniques can be applied in cybersecurity to detect threats with high accuracy.

Brown (2023) emphasizes the importance of AI-driven systems in addressing environmental and technological challenges. AI-based monitoring systems can be applied across multiple domains, including cybersecurity and digital safety.

Overall, previous studies demonstrate that machine learning and AI technologies play a critical role in detecting and preventing cybercrime. However, many existing systems focus on a single type of threat. This

research proposes a comprehensive framework that integrates fake profile detection, cyberbullying identification, and malware forensic analysis.

III. METHODOLOGY

The proposed framework combines machine learning, natural language processing, and malware forensic analysis to detect cybercrime on social media platforms. The methodology consists of several stages including data collection, data preprocessing, feature extraction, model training, and attack attribution.

Data Collection

The first stage involves collecting data from social media platforms. The dataset includes user profile information, posts, comments, messages, and network interaction data. Additional datasets containing examples of cyberbullying language and fake profiles are used to train the machine learning models.

Data Preprocessing

Raw social media data often contains noise, irrelevant information, and incomplete records. Data preprocessing techniques such as tokenization, normalization, stop-word removal, and stemming are applied to prepare the data for analysis.

Feature Extraction

Relevant features are extracted from the dataset to train machine learning models. These features include:

- User account age
- Posting frequency
- Friend network structure
- Language patterns in messages
- Sentiment polarity of posts
- Presence of abusive keywords
- Behavioral anomalies

Machine Learning Models

Several machine learning algorithms are used for classification and prediction tasks.

Decision Tree:

Decision tree models classify user accounts based on behavioral features and profile attributes.

Random Forest:

Random Forest combines multiple decision trees to improve prediction accuracy and reduce overfitting.

Support Vector Machine (SVM):

SVM models are used to classify textual data and detect cyberbullying messages.

Natural Language Processing for Cyberbullying Detection

NLP techniques are applied to analyze textual content posted by users. These techniques include:

- Sentiment analysis
- Text classification
- Keyword detection
- Semantic analysis

The system identifies harmful language patterns that indicate harassment, threats, or bullying behavior.

Malware Forensic Analysis

Malware forensic analysis focuses on identifying malicious scripts, suspicious links, and digital traces associated with cyber attacks. The analysis includes:

- Static malware analysis
- Dynamic malware behavior analysis
- Network traffic analysis
- Log file examination

By analyzing these digital artifacts, investigators can identify the source of cyber attacks and trace them back to the responsible individuals or groups.

IV. PROPOSED SYSTEM ARCHITECTURE

The proposed system architecture consists of several interconnected components designed to detect and prevent cybercrime on social media platforms.

1. Data Collection Module – collects user data, posts, comments, and interaction patterns.
2. Preprocessing Module – cleans and prepares data for analysis.
3. Machine Learning Engine – classifies fake profiles and suspicious behaviors.
4. NLP Analysis Module – analyzes textual content to detect cyberbullying and abusive language.
5. Malware Forensic Module – investigates malicious scripts and digital traces.
6. Alert and Reporting System – generates alerts for detected cybercrime activities and provides reports for administrators or law enforcement agencies.

This integrated architecture allows the system to detect multiple types of cyber threats simultaneously.

V. RESULTS AND DISCUSSION

The implementation of the AI-based cybercrime detection framework demonstrates promising results in identifying fake profiles, detecting cyberbullying, and tracing cyber attacks. Machine learning models such as Random Forest and Support Vector Machines achieved high accuracy rates in classifying malicious accounts.

The NLP-based cyberbullying detection system successfully identified harmful messages by analyzing sentiment polarity, linguistic features, and contextual meaning. Compared with traditional keyword filtering systems, NLP models provided significantly higher accuracy because they consider the context of language rather than relying solely on predefined keywords.

Malware forensic analysis played a crucial role in identifying the source of cyber attacks. By analyzing malicious scripts and network traffic patterns, the system was able to trace attack origins and identify potential attackers. This capability is essential for digital investigations and legal proceedings.

The integration of multiple technologies significantly enhances the overall effectiveness of the cybercrime detection system. While machine learning identifies suspicious behavioral patterns, NLP detects harmful communication, and forensic analysis traces the source of attacks.

However, challenges remain in dealing with large-scale data and evolving cyber threats. Cybercriminals continuously develop new techniques to evade detection systems. Therefore, cybersecurity frameworks must continuously update their models and incorporate new datasets to maintain effectiveness.

VI. CONCLUSION

Cybercrime on social media platforms has become a major concern in the modern digital world. Fake profiles, cyberbullying, and malware-based attacks pose serious threats to user safety and online communities. Traditional security approaches are often inadequate for detecting complex and evolving cyber threats.

This research proposed an AI-based cybercrime detection framework that integrates machine learning, natural language processing, and malware forensic analysis. Machine learning algorithms are used to detect fake profiles and suspicious user behavior, while NLP techniques analyze textual content to identify cyberbullying and abusive language. Malware forensic analysis helps investigators trace the origin of cyber attacks and attribute them to their sources.

The findings demonstrate that combining AI technologies significantly improves the accuracy and efficiency of cybercrime detection systems. The proposed framework provides a comprehensive approach to protecting social media users from online threats.

Future research can focus on improving deep learning models for more accurate language understanding and integrating real-time threat intelligence systems. Additionally, collaboration between social media platforms, cybersecurity experts, and law enforcement agencies will be essential for combating cybercrime effectively.

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