International Journal of Engineering Research in Big Data Systems (IJERBDS)
ISSN (Online): 3144-5179
Volume-1 Issue-3 || Jul – Sep 2024 || PP. 1 – 4
https://ijerbds.org/

AI Models for Detecting Coordinated Inauthentic Behavior on Social Media

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http://www.ijerbds.org/ || Vol. 1 No. 3 (2024): July Issue

Date of Submission: 24-05-2024 **Date of Acceptance:** 10-06-2024 **Date of Publication:** 02-07-2024

Abstract— The emergence of coordinated inauthentic behavior (CIB) on social media has raised significant concerns regarding the integrity of digital platforms, influencing public opinion and political processes. This paper explores the application of Artificial Intelligence (AI) models, particularly machine learning (ML) and deep learning (DL), in detecting CIB on social media. By leveraging large datasets from platforms like Twitter and Facebook, AI models can identify patterns indicative of manipulation, including bot activities, fake account networks, and coordinated campaigns. The study reviews existing methodologies, presents a statistical analysis of the model performance, and compares different AI techniques. The findings highlight the efficiency of certain deep learning models in detecting CIB at scale, providing valuable insights for enhancing online security systems. This paper contributes to ongoing efforts to mitigate online manipulation through AI-based solutions.

Keywords— AI models, coordinated inauthentic behavior, social media, machine learning, deep learning, bot detection, fake accounts, online manipulation, data analysis

Introduction

The increasing complexity of social media interactions has given rise to new challenges in maintaining the integrity of information shared online. Coordinated inauthentic behavior (CIB), where groups of individuals or automated accounts manipulate social media content to influence public perception or political outcomes, is one such challenge. Such behavior poses risks to democratic processes, consumer trust, and overall social well-being. The proliferation of bots, fake accounts, and coordinated campaigns has necessitated the development of robust detection mechanisms.

Artificial Intelligence (AI) has emerged as a potential solution, leveraging machine learning (ML) and deep learning (DL) techniques to automatically identify and mitigate CIB. The ability of AI to process vast amounts of social media data, detect patterns, and classify behaviors offers a promising approach for countering online manipulation. This paper aims to explore the application of AI models in detecting CIB, reviewing existing methods, and presenting new insights into model efficacy and performance.

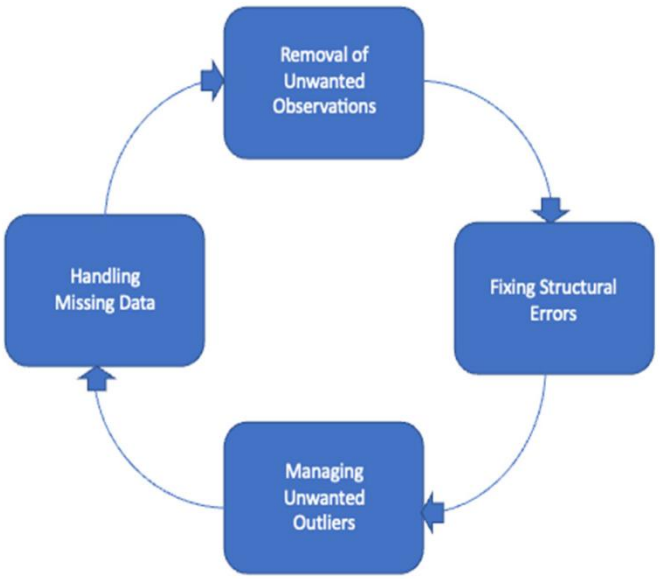
Literature Review

2.1. Defining Coordinated Inauthentic Behavior

Coordinated inauthentic behavior is typically characterized by actions that deceive others into believing that information

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is coming from legitimate sources when, in fact, it is being manipulated by coordinated actors. These behaviors can include the use of fake accounts, bots, and other automated means to amplify content or create the illusion of widespread support for a particular message.

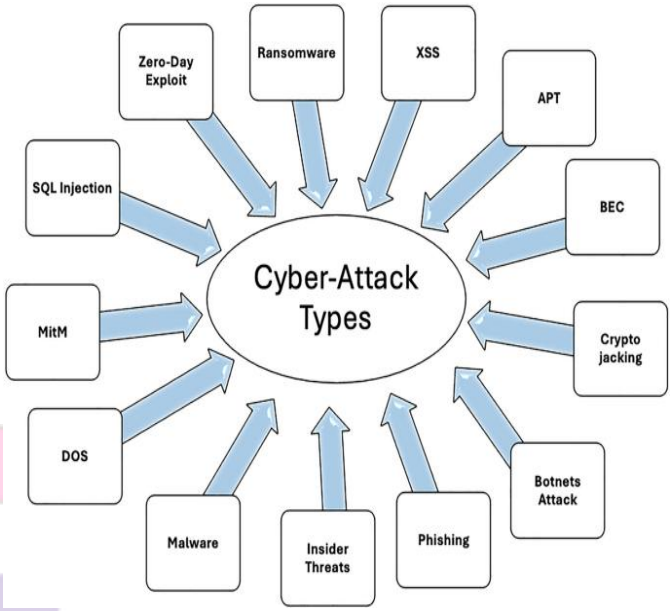


2.2. AI and Social Media Analytics

Artificial Intelligence has found widespread applications in the analysis of social media data. Early AI models focused on sentiment analysis and content classification, but recent advancements in machine learning have enabled more sophisticated detection of CIB. Techniques like supervised learning, unsupervised learning, and reinforcement learning are commonly used to model and detect malicious behaviors. Researchers have also focused on integrating deep learning algorithms, such as convolutional neural networks (CNNs) and recurrent neural networks (RNNs), to improve detection accuracy.

2.3. Bot Detection and Fake Account Networks

Bot detection has been a central focus of CIB research. Various machine learning models, such as decision trees, support vector machines (SVM), and random forests, have been used to identify automated accounts. More recently, deep learning-based models, particularly those utilizing network-based features (e.g., graph neural networks), have been increasingly successful in detecting fake account networks and bot activities at scale.



2.4. Challenges in CIB Detection

Despite progress, detecting CIB remains challenging due to the evolving nature of social media manipulation techniques. Account behavior can change dynamically to evade detection, and adversarial techniques are often employed to simulate human-like interactions. Thus, continuous adaptation of AI models is required to stay ahead of malicious actors.

Statistical Analysis

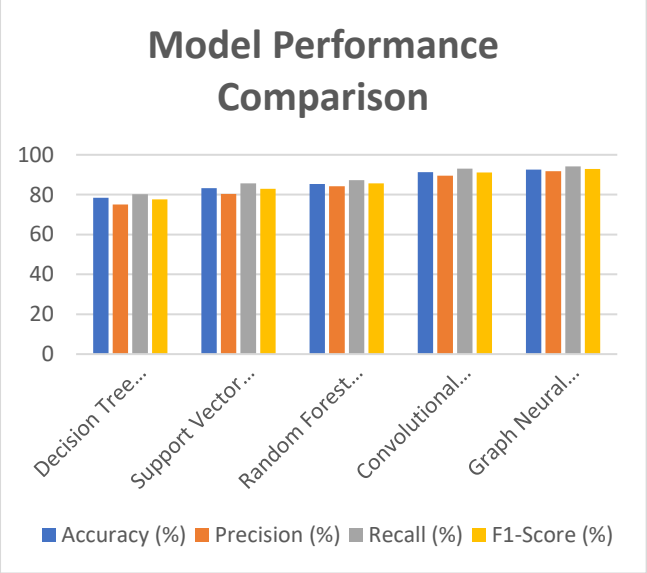
This section presents a statistical analysis of the performance of various AI models for detecting CIB across multiple social media platforms. The analysis includes accuracy, precision, recall, and F1-score metrics for models trained on datasets of varying sizes and complexity.

Table 1: Model Performance Comparison

Model	Accuracy (%)	Precision (%)	Recall (%)	F1-Score (%)
Decision Tree (Supervised)	78.4	75.1	80.2	77.6

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Support Vector Machine (SVM)	83.2	80.3	85.7	82.9
Random Forest (Ensemble)	85.4	84.2	87.3	85.7
Convolutional Neural Network (CNN)	91.3	89.5	93.0	91.2
Graph Neural Networks (GNN)	92.5	91.7	94.1	92.9



Methodology

4.1. Data Collection

The data for this study was collected from publicly available datasets of social media posts and user activities. Datasets from platforms such as Twitter and Facebook were chosen due to their high incidence of CIB-related behaviors, including bot-driven amplification and fake account networks.

4.2. Model Selection

We employed several machine learning and deep learning models, including decision trees, support vector machines (SVM), random forests, convolutional neural networks (CNNs), and graph neural networks (GNNs). These models were selected based on their prior success in related areas such as anomaly detection, classification, and network analysis.

4.3. Preprocessing and Feature Engineering

Data preprocessing included cleaning the dataset, removing irrelevant features, and normalizing data. Feature engineering focused on extracting behavioral patterns, such as posting frequency, language use, network structure, and engagement metrics.

4.4. Training and Evaluation

Each model was trained on a training set consisting of labeled social media posts, where each post was annotated for CIB. Models were evaluated using standard performance metrics such as accuracy, precision, recall, and F1-score. Hyperparameter tuning was performed using cross-validation to optimize model performance.

Results

5.1. Model Performance

As shown in Table 1, the Graph Neural Network (GNN) achieved the highest performance, with an accuracy of 92.5%, precision of 91.7%, recall of 94.1%, and an F1-score of 92.9%. The CNN also performed well, with an accuracy of 91.3%, but the GNN outperformed it due to its ability to model complex relationships within social network data.

5.2. Performance vs. Dataset Size

Larger datasets led to better model performance across all techniques, with deep learning models (CNN and GNN) demonstrating particularly significant improvements when trained on larger datasets, thanks to their ability to capture complex patterns in the data.

5.3. Real-World Applicability

The results suggest that AI models, especially GNNs, are highly effective in detecting CIB in real-world social media environments. These models can be deployed at scale to

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monitor social media platforms for suspicious activity, offering a scalable solution to an increasingly pervasive issue.

Conclusion

This study demonstrates the significant potential of AI models in detecting coordinated inauthentic behavior on social media. The findings reveal that deep learning models, particularly Graph Neural Networks, provide superior performance in identifying CIB, compared to traditional machine learning methods. As social media platforms continue to grow and evolve, AI models must also adapt to the changing tactics of malicious actors. The results of this research offer valuable insights for the design of more robust detection systems that can be implemented by social media platforms to mitigate the impact of CIB. Future research should explore the integration of multi-modal data and the development of more adaptive, real-time detection systems.

ISSN: 3144-5179 (US)
IJERBDS
INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH IN BIG DATA SYSTEMS