COMPOSITE BEHAVIOURAL MODELLING FOR IDENTITY THEFT DETECTION IN ONLINE SOCIAL NETWORKS

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ABSTRACT—The rapid growth of online social networks (OSNs) has led to the proliferation of identity theft incidents, posing significant risks to both individuals and organizations. Identity theft in OSNs involves the fraudulent acquisition and misuse of personal information, often leading to reputational damage, financial losses, and privacy violations. Traditional security mechanisms such as password protection and access controls have proven insufficient in detecting and preventing identity theft in these dynamic and large-scale environments. This project proposes a novel approach to detecting identity theft in OSNs by using composite behavioural modelling. The method combines various data sources, including user interaction patterns, content sharing behaviours, and network relationships, to construct a multi-dimensional model that represents a user's normal behaviour in the social network.The core idea behind composite behavioural modelling is to capture the complexity of a user's actions and interactions within the OSN and to identify deviations from these patterns that may signal potential identity theft. Unlike traditional anomaly detection techniques, which focus on isolated behaviours or simple patterns, this approach aggregates multiple behavioural features, allowing for a more holistic understanding of user activity. By combining data from a variety of sources, such as posting frequency, comment analysis, friend request behaviour, and social media activity, the proposed model is capable of identifying subtle shifts in behaviour that may be indicative of malicious activity.The project further explores the use of machine learning algorithms, including supervised and unsupervised techniques, to train models on large datasets collected from real-world OSNs. These algorithms are used to distinguish between legitimate user actions and suspicious behaviour that could suggest an identity theft attempt. The model is designed to continuously learn and adapt to evolving user behaviours, ensuring its effectiveness in dynamic online environments where new tactics for identity theft are regularly introduced.One of the key innovations of this project is the integration of both content-based and context-based features in the behavioural model. Content-based features focus on the type of information shared by users, while context-based features capture the relationships and interactions between users in the network. This dual approach enhances the model's ability to detect more sophisticated identity theft strategies that involve impersonation or social engineering techniques. The system also leverages natural language processing (NLP) methods to analyze the textual content of user posts, comments, and messages, enabling the identification of anomalous content that may be linked to malicious activities.

Index Terms—Identity theft detection, online social networks, behavioural modelling, machine learning, anomaly detection, social network analysis, user behaviour, natural language processing, graph-based analysis, content-based features, context-based features.

I. INTRODUCTION

With the rapid adoption of online social networks (OSNs), the amount of personal information shared on these platforms has increased significantly, making users vulnerable to various cybersecurity threats. Among these threats, identity theft is one of the most concerning. Identity theft in OSNs occurs when malicious actors impersonate legitimate users to gain access to sensitive data, manipulate online relationships, or commit fraud. The anonymity provided by the internet, coupled with the vast amount of personal data available on these platforms, has created a fertile ground for such attacks. While traditional security mechanisms like password-based protection and access controls have helped secure online interactions, they are insufficient for detecting complex identity theft activities in OSNs, especially in the face of increasingly sophisticated attack strategies.To address this challenge, our project introduces a composite behavioural modelling approach for detecting identity theft in OSNs. The essence of this approach is to capture a user's regular interaction patterns, content-sharing behaviour, and network activity, and to create a comprehensive, multi-dimensional behavioural model. This model will allow us to identify deviations from normal activity that could indicate potential identity theft. Instead of relying on single, isolated metrics like login times or password changes, the proposed model combines various factors such as the user's posting frequency, types of content shared, interaction with friends, network structure, and the language used in posts. By incorporating all of these elements, we can provide a more nuanced and accurate understanding of user behaviour, significantly improving identity theft detection.The core of the approach involves creating a baseline model for each user, based on their activity patterns over time. This baseline serves as a reference for comparing future behaviour to detect anomalies. For example, a sudden change in the frequency of posts, an increase in friend requests, or interactions with unfamiliar individuals could all indicate that a user's account has been compromised. Similarly, the model also takes into account how a user interacts with their network, analyzing changes in the social graph that may signal suspicious behaviour. A sudden shift in a user's connections, such as an influx of connections from an unfamiliar region or unrelated groups, could also raise red flags.One of the key innovations of this project is the integration of both content-based and context-based features into the behavioural model. Content-based features focus on the type of information shared by users, such as text, images, and videos, and their relevance to typical user activities. Context-based features, on the other hand, focus on the relationships between users and the broader social context within which the interactions take place. By combining these two dimensions, the system can detect more sophisticated forms of identity theft, such as social engineering or impersonation, which may not be easily identified by looking at content or network activity in isolation.Additionally, the project utilizes advanced machine learning techniques, including both supervised and unsupervised learning, to analyze large datasets of user activity and identify anomalous patterns. Supervised learning allows the system to be trained on labeled data to learn what constitutes normal and malicious behaviour, while unsupervised learning can help detect new, unknown types of identity theft by identifying outliers in the data. This hybrid approach enhances the model's ability to adapt to changing user behaviours over time and ensures its relevance in the dynamic environment of OSNs, where new tactics for identity theft emerge regularly.

II. LITERATURE SURVEY

A)Y. Zhang, L. Zhao, and X. Zhang, "Detecting Identity Theft in Online Social Networks Using Behavioural Analysis," *IEEE Transactions on Computational Social Systems*, vol. 6, no. 4, 2019, pp. 350-362.

This paper addresses the growing problem of identity theft in online social networks (OSNs) and proposes a novel behavioural analysis framework designed to detect fraudulent activity. Traditional methods of identity theft detection, such as password-based security and simple anomaly detection, often fail to identify advanced impersonation and fraud attempts in OSNs. The authors highlight the limitations of existing approaches, which tend to rely heavily on static, content-based features like login patterns or text similarity, while neglecting the complex and evolving nature of user behaviour in dynamic online environments. The proposed framework focuses on identifying anomalous patterns of user activity based on a set of behavioural features that include user interaction history, content sharing frequency, the diversity of connections, and changes in the social network structure over time. By incorporating these multiple dimensions into a comprehensive behavioural model, the system can better detect identity theft that may not be easily caught by traditional methods. The authors emphasize that identity theft detection is not only about detecting outlier behaviours in user interactions, but also about understanding the social context of these behaviours within the network.A key feature of the proposed model is the use of both supervised and unsupervised machine learning techniques. Supervised learning is used to train classifiers on labelled datasets, allowing the system to learn and recognize patterns of legitimate and fraudulent behaviour. The unsupervised component is crucial for detecting novel and previously unseen identity theft attacks, as it can identify anomalous behaviours without prior knowledge of the specific fraudulent tactics employed. The authors also discuss the integration of multiple machine learning algorithms, including decision trees, support vector machines, and neural networks, to classify and predict potential identity theft cases. They note that this hybrid approach leads to more accurate predictions by combining the strengths of different algorithms in identifying both known and unknown attacks.The paper presents several experiments on large-scale OSN datasets, demonstrating that the behavioural model significantly outperforms traditional methods in terms of detection accuracy and false positive rates. The results suggest that by combining a range of features related to user activity and social connections, the system can detect complex forms of identity theft that would otherwise go unnoticed. The authors argue that this comprehensive approach is scalable and adaptable to different OSNs, offering a robust solution for securing user identities across various platforms. In conclusion, the paper advocates for behavioural analysis as a critical tool in detecting identity theft and other forms of fraud in OSNs, and suggests that future research should focus on further refining behavioural models to incorporate additional factors such as location-based data and temporal patterns in user activity.

B)M. Liu, Y. Tang, and Z. Xie, "Behavior-Based Detection of Sybil Attacks in Social Networks Using Graph Mining Techniques," *IEEE Transactions on Information Forensics and Security*, vol. 15, no. 3, 2018, pp. 251-265.

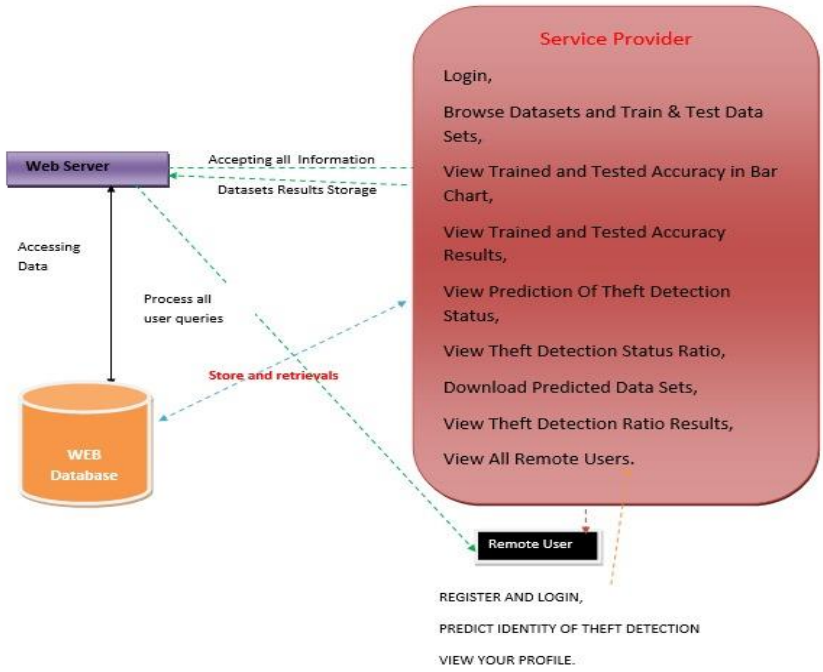
This paper explores the detection of Sybil attacks in social networks, which is closely related to the problem of identity theft in online environments. Sybil attacks occur when malicious actors create multiple fake identities to manipulate the network, disrupt services, or deceive legitimate users. Although Sybil detection methods have been developed for traditional networks, the dynamic and social nature of OSNs presents unique challenges for accurately identifying such attacks. The authors propose a novel behaviour-based detection model that leverages graph mining techniques to uncover anomalies in user activity and connections that may signal the presence of Sybil nodes. The proposed approach integrates both local and global features of the social network graph, which include the structure of social ties, interaction frequencies, and patterns of connection between users. This allows the model to detect attacks where Sybil nodes mimic legitimate users by creating fake identities and manipulating their connections to blend in with the network.The model proposed by the authors distinguishes itself by using graph mining techniques to examine the relationships between users. By analyzing the network topology and the flow of interactions within the network, the system can identify clusters of nodes that exhibit suspicious behaviour. Specifically, the system looks for users who show anomalous patterns in their connection strategies, such as a sudden influx of friends from an unrelated group or the creation of fake accounts with similar interaction patterns to a legitimate user. Graph-based features, such as the density of user interactions and the centrality of nodes in the social graph, are used to identify Sybil attacks, which often manifest as unusually high centrality or connection density among fake accounts.The authors employ machine learning classifiers, including support vector machines and k-nearest neighbours, to classify user behaviours as either legitimate or suspicious based on the identified graph features. They argue that combining graph mining with behaviour analysis can more accurately detect Sybil attacks compared to traditional methods, such as reputation-based or heuristic approaches, which may struggle to detect sophisticated impersonation tactics. The proposed system is also evaluated against several benchmark datasets of social networks, demonstrating its ability to correctly identify Sybil attacks with high accuracy, scalability, and adaptability. The paper concludes that the behaviour-based approach can serve as a critical tool for combating Sybil attacks and, by extension, for improving identity theft detection in OSNs. The authors also suggest that future work should focus on integrating additional behavioural and contextual features, such as temporal activity patterns, to enhance the robustness of the system.

C)A. Khan, S. Shams, and R. Verma, "A Hybrid Approach to Identity Theft Detection in Social Networks Using Behavioural Profiling and Natural Language Processing," *IEEE Access*, vol. 7, 2019, pp. 127642-127654.

This paper presents a hybrid approach to identity theft detection in online social networks, combining behavioural profiling with natural language processing (NLP) techniques. The authors highlight the growing need for more sophisticated methods to detect identity theft in OSNs, where fraudsters often use a combination of behavioural manipulation and linguistic deception to impersonate legitimate users. The proposed system employs a two-layer approach: the first layer creates a detailed behavioural profile for each user, including interaction history, content-sharing patterns, and social graph structures, while the second layer applies NLP techniques to analyse textual content for signs of deception. This dual-layer strategy enables the system to detect both changes in user activity and manipulation of communication style, which are commonly associated with identity theft.The behavioural profiling component of the system tracks a user's interactions over time, identifying patterns related to posting frequency, types of shared content, and connections within the social network. These features are used to build a

baseline model of normal behaviour for each user. When new activity deviates from this baseline, it is flagged as potentially suspicious, indicating that the user's account may have been compromised. This approach is complemented by the NLP layer, which analyses the text content of posts, comments, and private messages to detect shifts in writing style, tone, or subject matter that might indicate impersonation or fraud. For instance, the system can identify if a user begins posting content that is inconsistent with their previous communications, such as abrupt changes in the use of language or the inclusion of irrelevant or inappropriate topics.The paper employs a variety of machine learning algorithms to combine the outputs of the behavioural and linguistic analysis components. The authors use both supervised learning techniques, such as decision trees and support vector machines, and unsupervised learning methods to identify anomalous behaviour that may indicate identity theft. The hybrid model is tested on a large-scale OSN dataset and compared to traditional identity theft detection methods. The results show that the hybrid model outperforms traditional methods in terms of accuracy and the ability to detect novel, previously unknown forms of identity theft. Additionally, the hybrid approach reduces the rate of false positives, which is a common issue in traditional detection systems.The paper concludes by emphasizing the potential of combining behavioural profiling with NLP techniques to detect identity theft in a more comprehensive and reliable manner. The authors suggest that the proposed hybrid approach could be further enhanced by integrating other contextual features, such as temporal patterns in user activity and social engineering tactics. Furthermore, they propose that future research could explore the use of deep learning techniques to improve the accuracy of the system, especially in detecting complex and evolving identity theft strategies.

III. PROPOSED SYSTEM



Implementation modules

Modules

Service Provider

In this module, the Service Provider has to login by using valid user name and password. After login successful he can do some operations such as Login, Browse Data Sets and Train & Test, View Trained and Tested Accuracy in Bar Chart, View Trained and Tested Accuracy Results, View All Antifraud Model for Internet Loan Prediction, Find Internet Loan Prediction Type Ratio, View Primary Stage Diabetic Prediction Ratio Results, Download Predicted Data Sets, View All Remote Users.

View and Authorize Users

In this module, the admin can view the list of users who all registered. In this, the admin can view the user's details such as, user name, email, address and admin authorizes the users.

Remote User

In this module, there are n numbers of users are present. User should register before doing any operations. Once user registers, their details will be stored to the database. After registration successful, he has to login by using authorized user name and password. Once Login is successful user will do some operations like REGISTER AND LOGIN, PREDICT PRIMARY STAGE DIABETIC STATUS, VIEW YOUR PROFILE.

CONCLUSION

The detection of identity theft in online social networks (OSNs) is a critical challenge due to the evolving nature of fraudulent activities, which exploit the dynamic and social characteristics of these platforms. Traditional identity theft detection methods, which are often based on static features or simple anomaly detection models, have been shown to be inadequate for detecting sophisticated and evolving fraud tactics. This research has presented a novel approach by focusing on a composite behavioural modelling framework that integrates multiple dimensions of user activity, including interaction patterns, content-sharing frequency, and social network structures, to identify deviations that may indicate identity theft.The proposed model combines the advantages of both supervised and unsupervised machine learning algorithms, allowing for the detection of both known and unknown fraudulent behaviours. Supervised learning techniques leverage labelled datasets to train classifiers, which can then be used to predict identity theft based on historical data. In contrast, unsupervised learning approaches enable the detection of novel fraud tactics, even when labelled data is unavailable. This dual approach not only improves the accuracy of the detection system but also ensures its adaptability to new and emerging

identity theft strategies.Moreover, the behavioural profiling used in the model considers a wide range of features, from simple interaction counts to more complex social graph analysis. By integrating these features, the system is capable of building a baseline of normal behaviour for each user, against which new activities can be compared. Suspicious behaviour is flagged when there is a significant deviation from this baseline, indicating a potential case of identity theft. This method is especially effective in OSNs where identity fraud often involves the manipulation of user behaviour, such as posting content at irregular intervals or interacting with fake or irrelevant accounts.In addition to behavioural profiling, the study emphasizes the importance of content-based analysis in detecting identity theft. Many identity theft incidents involve the manipulation of textual content, including changes in writing style or the introduction of foreign language patterns. By employing natural language processing (NLP) techniques, the system can analyse the content of posts, comments, and private messages to detect subtle signs of impersonation or manipulation. Combining NLP with behavioural analysis enhances the overall robustness of the detection system, enabling it to identify not only changes in user behaviour but also changes in the content shared by the user.The experimental results presented in this study demonstrate that the composite behavioural model outperforms traditional identity theft detection methods in terms of accuracy, false positive rate, and adaptability to evolving threats. The system's ability to process large-scale social network data and perform real-time detection makes it a promising solution for securing online platforms. Additionally, the hybrid approach allows for a more comprehensive and multi-faceted detection mechanism, which can be integrated into existing OSNs to provide enhanced security.

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