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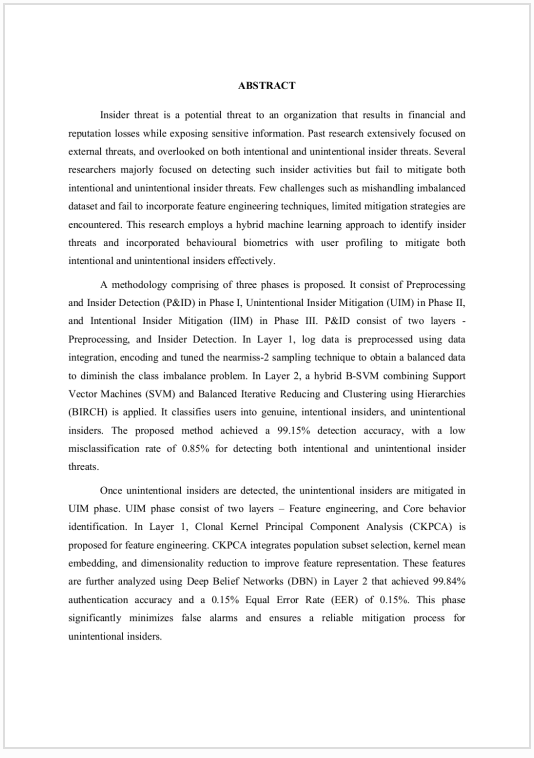

ABSTRACT

Insider threat is a potential threat to an organization that results in financial and reputation losses while exposing sensitive information. Past research extensively focused on external threats, and overlooked on both intentional and unintentional insider threats. Several researchers majorly focused on detecting such insider activities but fail to mitigate both intentional and unintentional insider threats. Few challenges such as mishandling imbalanced dataset and fail to incorporate feature engineering techniques, limited mitigation strategies are encountered. This research employs a hybrid machine learning approach to identify insider threats and incorporated behavioural biometrics with user profiling to mitigate both intentional and unintentional insiders effectively.

A methodology comprising of three phases is proposed. It consist of Preprocessing and Insider Detection (P&ID) in Phase I, Unintentional Insider Mitigation (UIM) in Phase II, and Intentional Insider Mitigation (IIM) in Phase III. P&ID consist of two layers - Preprocessing, and Insider Detection. In Layer 1, log data is preprocessed using data integration, encoding and tuned the nearmiss-2 sampling technique to obtain a balanced data to diminish the class imbalance problem. In Layer 2, a hybrid B-SVM combining Support Vector Machines (SVM) and Balanced Iterative Reducing and Clustering using Hierarchies (BIRCH) is applied. It classifies users into genuine, intentional insiders, and unintentional insiders. The proposed method achieved a 99.15% detection accuracy, with a low misclassification rate of 0.85% for detecting both intentional and unintentional insider threats.

Once unintentional insiders are detected, the unintentional insiders are mitigated in UIM phase. UIM phase consist of two layers – Feature engineering, and Core behavior identification. In Layer 1, Clonal Kernel Principal Component Analysis (CKPCA) is proposed for feature engineering. CKPCA integrates population subset selection, kernel mean embedding, and dimensionality reduction to improve feature representation. These features are further analyzed using Deep Belief Networks (DBN) in Layer 2 that achieved 99.84% authentication accuracy and a 0.15% Equal Error Rate (EER) of 0.15%. This phase significantly minimizes false alarms and ensures a reliable mitigation process for unintentional insiders.

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A Hybrid Machine Learning Approach for Detecting Intentional and Unintentional Insider Threats with Mitigation Through Behavioral Biometrics and User Profiling Mechanisms

by Central Library Avinashilingam

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