Cybersecurity Threat Detection - Abstract

In today's digital landscape, organizations face an ever-increasing volume and complexity of cyber threats that pose significant risks to data confidentiality, system integrity, and business continuity. The Cybersecurity Threat Detection project addresses this challenge by building a robust and intelligent threat detection system that leverages Big Data and Artificial Intelligence (AI) to monitor, analyze, and detect suspicious activities across large-scale networked systems.

Problem Statement & Overview:

With the exponential growth of internet-connected devices and digital services, traditional security systems often fall short in identifying sophisticated and fast-evolving cyberattacks. Static rule-based approaches are unable to adapt to new threat patterns, and analyzing massive volumes of data in real-time becomes infeasible without scalable architectures. This project aims to develop a scalable and intelligent cybersecurity solution capable of detecting both known and unknown threats by analyzing user behavior, system logs, and network data in real time and batch modes.

Tools and Technologies Used:

The project integrates several cutting-edge technologies from the domains of Big Data and AI:

- Hadoop Ecosystem: Used for distributed data storage (HDFS) and parallel processing (MapReduce, Hive).
- Apache Spark: For real-time data analytics and streaming.
- Python: For implementing machine learning algorithms and data preprocessing.
- Scikit-learn: For model development and anomaly detection.
- Flask: For developing the user-facing web interface.
- Kafka: For real-time data ingestion.
- Elasticsearch & Kibana: For logging, visualization, and monitoring.

Project Submodules:

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The project is divided into several key modules, each performing a specific function:

1. Data Ingestion Module: Collects large volumes of system logs, network traffic data, and user activity in real time using Kafka and stores them in HDFS.

2. Data Preprocessing Module: Cleans, formats, and transforms the raw data for analysis, including log parsing and feature extraction.

3. Anomaly Detection Module: Applies machine learning models (e.g., Isolation Forest, K-Means, Decision Trees) to detect outliers and suspicious activities.

4. Classification Module: Identifies the type of threat (e.g., malware, phishing, DDoS) using trained supervised models.

5. Real-time Monitoring Module: Utilizes Spark Streaming and Elasticsearch to provide live dashboards for detected threats.

6. Response Module: Alerts the system administrator and triggers defensive actions (e.g., blocking IP, isolating device).

Design Flow:

The system design follows a modular architecture based on the ETL (Extract, Transform, Load) model integrated with real-time streaming and batch analytics. Data flows from ingestion through Kafka to Hadoop, where it is processed by Spark. Preprocessed data is passed to the ML modules for detection and classification. The final output is visualized through a Flask-based dashboard and Kibana.

Conclusion / Expected Output:

The Cybersecurity Threat Detection project aims to provide a scalable, efficient, and intelligent solution capable of processing large-scale data and identifying cyber threats with high accuracy. It empowers security analysts with real-time visibility into potential threats and automates detection and response mechanisms to reduce reaction time and human error. Ultimately, this project contributes to strengthening digital security infrastructure and proactively mitigating cyber risks in dynamic environments.