Anomaly Detection in File Access Patterns

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WHY MONITOR FILE ACCESS?

- **Motivation:** Data security is crucial in corporate networks, where unauthorized file access can lead to data breaches, financial losses, and reputational damage, making anomaly detection a crucial security measure
  - **Example:** In 2022, more than 30% of companies suffered internal attacks that exposed sensitive data

- **Objective:** Implement a system to detect anomalous access patterns effectively, helping to prevent threats

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DATA SOURCES

- Acquisition of Google Drive usage data captures from users with two different profiles: student and teacher
- Bot script development to access Google Drive (basic and advanced)
  - Basic: simple simulation with a fixed time interval
  - Advanced: introduces more randomness and unpredictability

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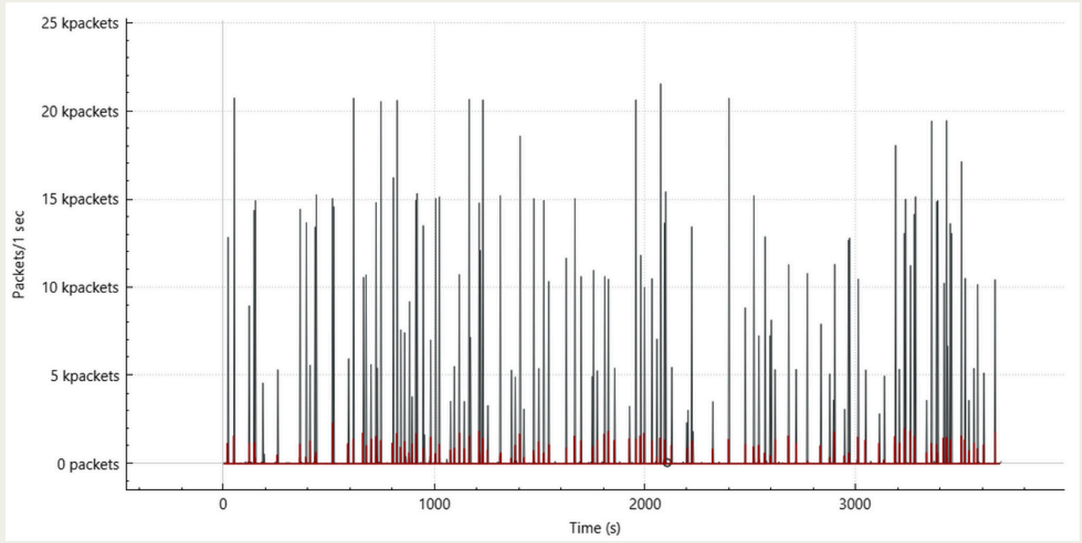
WIRESHARK I/O GRAPHS FROM BOTH BOTS

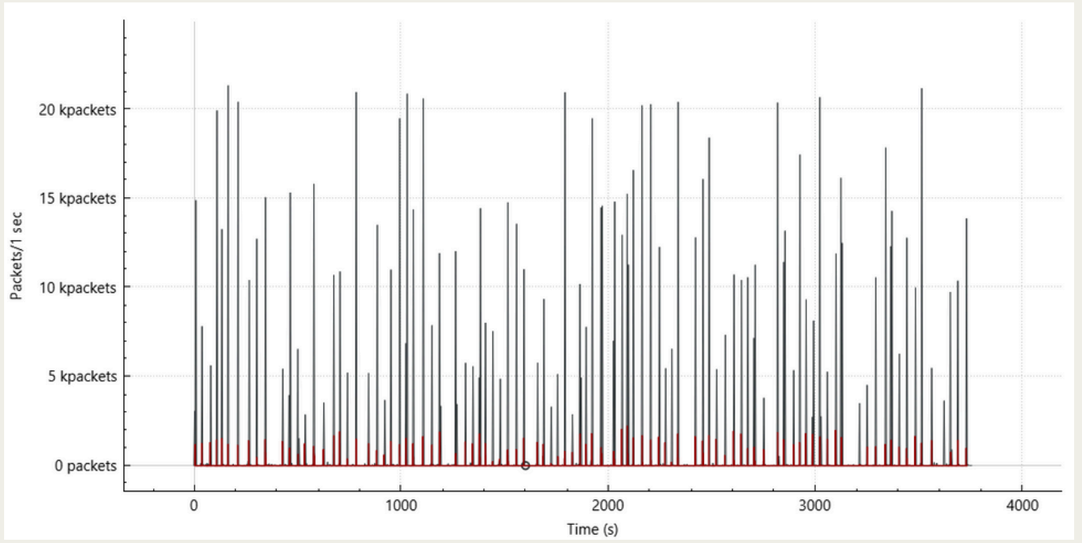
Basic Bot

- Aggressive and irregular spikes
- Easier Detection - abnormal spikes



Advanced Bot

- More balanced and controlled
- Harder Detection - disguised



METRICS EXTRACTED

- Number of packets for upload and download
- Volume of bytes for upload and download

FEATURES TO EXTRACT

- For each metric defined:
  - Mean, median, standard deviation
  - Percentiles(75%/80%/90%/98%)

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TRAINING AND TEST FEATURES

Initial approach

- Train using 70% of each user's features (student & teacher)
- Test on the remaining 30% of user features (same users)
- Test on bot features(Basic and Advanced bots)

Second approach

- Train using 50% of each user's features (student & teacher)
- Test on the remaining 50% of user features (same users)
- Test on bot features(Basic and Advanced bots)

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ANOMALY DETECTION TECHNIQUES USED

- **Statistical Analyses:**
  - Centroids distances
  - Centroids distances with PCA features
  - Multivariate with PCA features
- **Machine Learning:**
  - One Class Support Vector Machine (Linear, RBF and Poly Kernels)
  - One Class Support Vector Machine with PCA features (Linear, RBF and Poly Kernels)
- **Anomaly Detection:**
  - Isolation Forest with PCA features
  - Isolation Forest without PCA features

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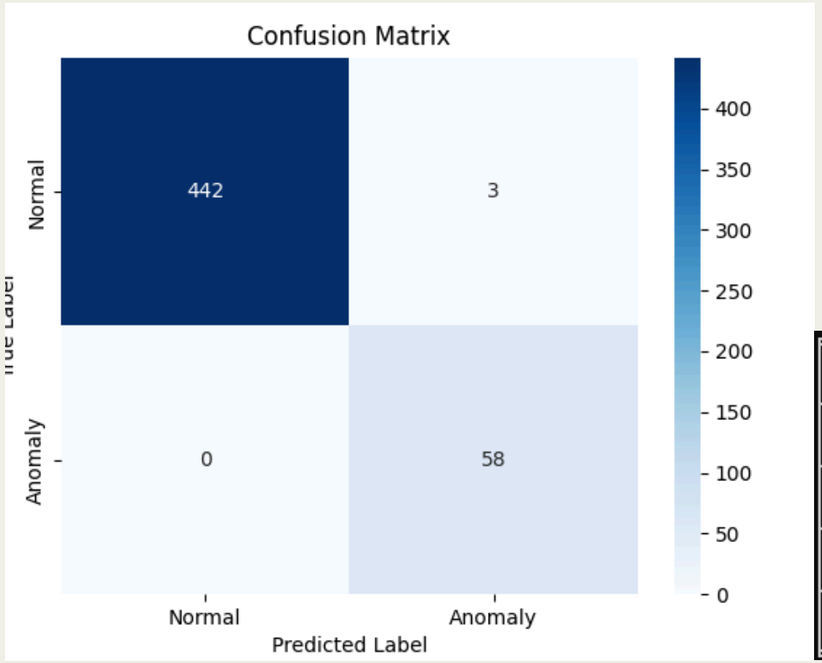
BEST RESULTS FROM INITIAL APPROACH

Isolation Forest with PCA

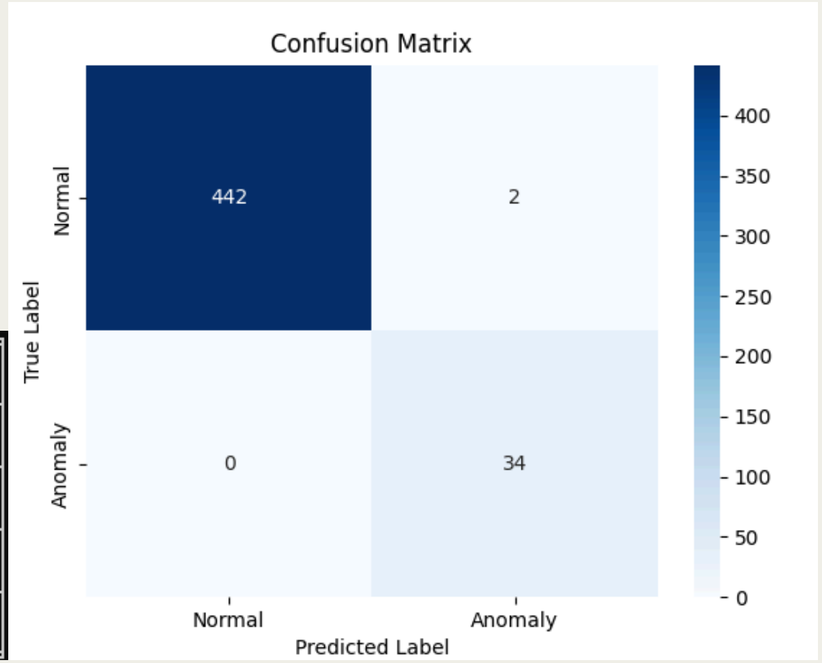
Basic Bot



Metric	Value
Accuracy	99.40%
Precision	95.08%
Recall	100.00%
F1-Score	0.97

Advanced Bot

Metric	Value
Accuracy	99.58%
Precision	94.44%
Recall	100.00%
F1-Score	0.97



CONCLUSION FOR INITIAL APPROACH

The Isolation Forest model, when using PCA-transformed features, proves to be the most effective in identifying anomalies across all bot traffic in the dataset

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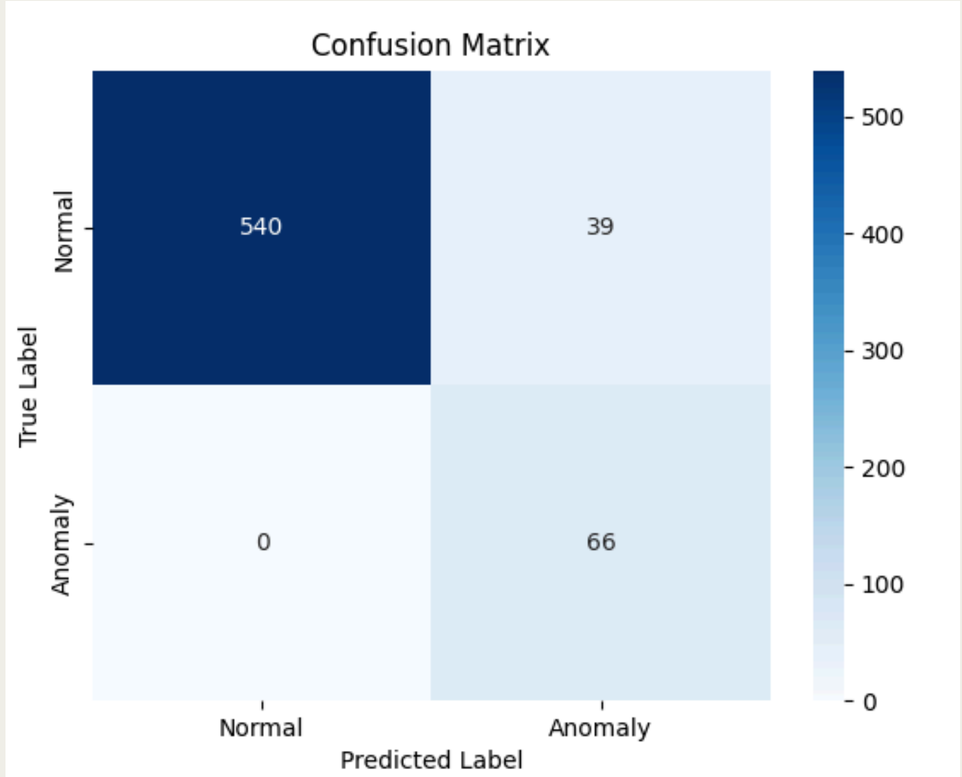
BEST RESULTS FROM SECOND APPROACH

Multivariate with PCA



Metric	Value
Accuracy	93.95%
Precision	62.86%
Recall	100.00%
F1-Score	0.77

CONCLUSION FOR SECOND APPROACH

The most effective models is Multivariate with

PCA achieving an F1-score of 77%.

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CONCLUSION

- The Isolation Forest model with PCA features proves to be the most effective in detecting anomalies across different bot behaviors

- Multivariate analysis perform well when analyzing activity-based features

- The user-based approach yields more consistent results, suggesting that user similarity plays a crucial role in anomaly detection

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Thank you!

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