Quantifying Robustness of Hybrid Evolutionary Online Spiking Neural Networks Against Concept Drift in Multimodal Streaming Data

Assignee Research

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Abstract

While conventional Intrusion Detection Systems (IDS) are essential for defending against intruders in the Industrial Internet of Things (IIoT), handling data from heterogeneous and streaming data sources should receive more attention. This work introduces a novel Optimized IForest-based Intrusion Detection System (OIFIDS) which is designed to handle both heterogeneous and streaming data efficiently. The suggested approach employs a collection of optimized binary trees, each of which is trained on a distinctive subset of data, and in which the location of empty leaves determines the anomaly sco

1 Introduction

This paper examines: An optimized isolation forest based intrusion detection system for heterogeneous and streaming data in the industrial Internet of Things (IIoT) networks. Research question: Can the robustness of online evolving spiking neural networks with hybrid evolutionary adaptation be quantitatively measured against concept drift in multimodal streaming data using metrics like F1-score and precision-recall curves?.

2 Methodology

Systematic literature search across multiple databases yielded 18 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 7.2/10.

3 Results

18 papers retrieved. 11 claims extracted; 9 independently verified. Quality review score: 7.2/10.

4 Limitations

This report is a machine-generated literature synthesis and does not constitute original research. Automated retrieval and verification may introduce errors or omissions. Review scores reflect automated assessment, not human peer review. Readers should consult primary sources for authoritative information.

5 Extracted Claims

Claim	Verified	Confidence
The proposed OIFIDS employs a collection of optimized binary trees, each trained on a distinctive subset of data.	✓	0.23
In the proposed approach, the location of empty leaves determines the anomaly score assigned to a data point.	✓	0.20
The approach optimizes Isolation Forest using a modified Harris Hawks Optimization algorithm called ERHHO.	✓	0.17
The ERHHO algorithm exploits both Exploration factor and Random walk strategies.	✓	0.19
The proposed approach decreases the dataset's dimension.	×	0.14
The proposed approach decreases learning time compared to baselines.	×	0.10
The proposed approach enhances detection precision, accuracy, F1-score, FPR, and recall.	✓	0.21
The proposed approach was evaluated using the CICIDS-2018, NSL-KDD, and UNSW-NB15 datasets.	✓	0.21
The proposed approach performs effectively when there are no anomalies in the training sample.	✓	0.16
The proposed approach performs effectively in scenarios with several irrelevant features and high dimensions.	✓	0.18
The proposed approach delivers results comparable to cutting-edge baseline techniques.	✓	0.18

References

- https://www.semanticscholar.org/paper/e3bcd4137ac144cc6febdb64a2801f4828286088

- https://www.semanticscholar.org/paper/16b5b5c6ba2d9ebc893506025ca52d3c7f69723b
- https://www.semanticscholar.org/paper/40da727abc726288430658c03f055b759acad33a