## Quality Assessment Scoring for Primary Studies

This document presents the detailed results of the Quality Assessment (QA) phase conducted for the **98** studies at the full text review stage from which **82** were included in this Systematic Literature Review. Each study was evaluated against five technical criteria (QA1–QA5) designed to assess problem clarity, algorithmic rigor, data fidelity, evaluation transparency, and critical discussion. To ensure objectivity and methodological consistency, scoring was performed independently by both researchers using a standardized 0–1 scale, with a minimum cumulative threshold of **3.5 out of 5.0** required for final inclusion. The following table maps the quality performance of each selected study.

**QA1**. How clearly do the authors define and present the insider threat detection problem in the ML context?
**QA2**. How effectively do the authors describe the ML models, algorithms, and learning paradigms used for insider threat detection?
**QA3**. How well does the study describe the source of the dataset, its characteristics, and its distribution (e.g., class balance)?
**QA4**. How do the authors report the performance of ML models using standard metrics (e.g., accuracy, precision, recall, F1-score, and Area Under the Curve AUC)?
**QA5**. How well do the authors discuss the limitations, challenges (e.g. XAI or adversarial training), and future work of their ML-based models??

| | Author (Year) | QA1 | QA2 | QA3 | QA4 | QA5 | Total Score | Decision |
|---|---|---|---|---|---|---|---|---|
| 1 | **Adun (2023)** | 1.0 | 1.0 | 0.5 | 0.5 | 0.5 | **3.5** | **Include** |
| 2 | **Alabdulkareem (2022)** | 1.0 | 1.0 | 1.0 | 1.0 | 0.5 | **4.5** | **Include** |
| 3 | **Ahmadi (2025)** | 1.0 | 0.5 | 0.5 | 1.0 | 1.0 | **4.0** | **Include** |
| 4 | **Alhammadi 2021** | 1.0 | 1.0 | 0.5 | 1.0 | 1.0 | **4.5** | **Include** |
| 5 | **Ali 2025** | 1.0 | 5.0 | 1.0 | 1.0 | 1.0 | **4.5** | **Include** |
| 6 | **Ahmed 2025** | 0.5 | 1.0 | 1.0 | 1.0 | 0.5 | **4.0** | **Include** |
| 7 | **ALmihqani et al (2021)** | 1.0 | 1.0 | 0.5 | 1.0 | 0.0 | **3.5** | **Include** |
| 8 | **almusawi (2024)** | 1.0 | 1.0 | 1.0 | 1.0 | 0.5 | **4.5** | **Include** |
| 9 | **AL-Mihqani (2022)** | 1.0 | 1.0 | 0.5 | 1.0 | 1.0 | **4.5** | **Include** |
| 10 | **Al-Shehari et al. (2024)** | 1.0 | 1.0 | 1.0 | 0.0 | 1.0 | **4.0** | **Include** |
| 11 | **Al-Shehari et al. (2023)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 12 | **Al-Shehari et al. (2024)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| | **AlQadheeb et al. (2022)** | 05 | 0.0 | 1.0 | 0.0 | 0.5 | **2.0** | Exclude |
| 13 | **Al-Shehari et al. (2023)** | 1.0 | 1.0 | 1.0 | 1.0 | 0.5 | **4.5** | Include |
| 14 | **Alshehri Abdul (2022) Relational DL** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 15 | **Amiri-Zarandi (2023)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 16 | **Al-Shehari (2021)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 17 | **Amuda (2022)** | 1.0 | 1.0 | 1.0 | 1.0 | 0.5 | **4.5** | **Include** |
| 18 | **Anju (2024)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 19 | **Anakath (2022)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 20 | **Asha S (2023)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 21 | **Cai X (2024)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| | **Dahiya and Kumar (2024)** | **0.0** | **0.0** | **0.0** | **0.5** | **1.0** | **1.5** | **Exclude** |
| 22 | **Dong et al. (2025)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 23 | **Eshmawi (2026)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 24 | **Feng (2025)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 25 | **Ferraro (2025)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 26 | **Gayathri, R.G. (2025) advers** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 27 | **Gayathri, B. (2025) Cloud** | 1.0 | 1.0 | 0.0 | 1.0 | 1.0 | **4.0** | **Include** |
| 28 | **Gayathri, R.G. (2024) SPCGAN** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 29 | **Gonzales (2025)** | 1.0 | 1.0 | 0.0 | 1.0 | 1.0 | **4.0** | **Include** |
| 30 | **Gupta (2024)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 31 | **Hafizu Rhman (2022)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 32 | **Haq et al (2022)** | 1.0 | 1.0 | 1.0 | 0.5 | 1.0 | **4.5** | **Include** |
| 33 | **He Daojing et al (2022)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 34 | **He Daojing et al (2024)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 35 | **Huang (2025)** | 1.0 | 1.0 | 0.5 | 0.5 | 0.5 | **3.5** | **Include** |
| 36 | **Jaiswal (2024)** | 1.0 | 1.0 | 1.0 | 1.0 | 0.5 | **4.5** | **Include** |
| 37 | **Janjua (2021)** | 1.0 | 1.0 | 1.0 | 0.5 | 0.5 | **4.0** | **Include** |
| 38 | **Kamatchi et al. (2025)** | 1.0 | 0.5 | 1.0 | 0.5 | 0.5 | **3.5** | **Include** |
| 39 | **Kong et al. (2025)** | 1.0 | 1.0 | 1.0 | 1.0 | 0.5 | **4.5** | **Include** |
| 40 | **Kotb et al. (2025)** | 1.0 | 1.0 | 1.0 | 1.0 | 0.5 | **4.5** | **Include** |
| 41 | **Lavanya et al. (2024)** | 1.0 | 1.0 | 1.0 | 1.0 | 0.5 | **4.5** | **Include** |
| 42 | **Lavanya et al. (2025)** | 1.0 | 1.0 | 1.0 | 1.0 | 0.5 | **4.5** | **Include** |
| 43 | **Le & Zincir-Heywood (2021)** | 1.0 | 1.0 | 1.0 | 1.0 | 0.5 | **4.5** | **Include** |
| 44 | **Li et al. (2023) Graph Convolutional Network** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 45 | **Li et al. (2024) Graph Meta-Learning** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| | Li et al. (2024) **Nuclear Security Reasoning** | 0.0 | 0.5 | 0.0 | 1.0 | 1.0 | **2.5** | **Exclude** |
| 46 | **Liu et al. (2025)** | 1.0 | 1.0 | 1.0 | 1.0 | 0.5 | **4.5** | **Include** |
| 47 | **Medvedev et al. (2025)** | 1.0 | 1.0 | 1.0 | 0.5 | 0.5 | **4.0** | **Include** |
| 48 | **Mehmood et al. (2023)** | 1.0 | 1.0 | 1.0 | 0.5 | 0.0 | **3.5** | **Include** |
| 49 | **Mehnaz & Bertino (2021)** | 1.0 | 1.0 | 1.0 | 0.5 | 0.0 | **3.5** | **Include** |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 50 | **Mladenovic et al. (2024)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 51 | **Nasir et al. (2021)** | 1.0 | 1.0 | 1.0 | 1.0 | 0.5 | **4.5** | **Include** |
| | **Nasser et al. (2025) Mobile Crowd Sourcing** | 0.5 | 0.0 | 0.0 | 0.0 | 1.0 | **1.5** | **Exclude** |
| 52 | **Nikiforova et al. (2024)** | 1.0 | 0.5 | 1.0 | 0.0 | 1.0 | **3.5** | **Include** |
| 53 | **Pal et al. (2023)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 54 | **Patel & Iyer (2025)** | 1.0 | 1.0 | 0.5 | 1.0 | 0.0 | **3.5** | **Include** |
| 55 | **Peccatiello et al. (2023)** | 1.0 | 0.5 | 1.0 | 0.5 | 0.5 | **3.5** | **Include** |
| 56 | **Pennada et al. (2024)** | 1.0 | 0.5 | 1.0 | 0.5 | 0.5 | **3.5** | **Include** |
| 57 | **Pennada et al. (2025)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 58 | **Álvarez Muñiz et al. (2025)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 59 | **Qawasmeh & AlQahtani (2025)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| | **Qiu et al. (2025)** | 0.0 | 0.5 | 0.5 | 0.0 | 0.5 | **1.5** | **Exclude** |
| 60 | **Randive et al. (2023)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 61 | **Rauf et al. (2021)** | 1.0 | 1.0 | 0.5 | 1.0 | 1.0 | **4.5** | **Include** |
| | **Rizvi & Williams (2024)** | 1.0 | 0.0 | 0.0 | 0.0 | 1.0 | **2.0** | **Exclude** |
| 62 | **Roy & Chen (2024)** | 1.0 | 1.0 | 0.5 | 1.0 | 1.0 | **4.5** | **Include** |
| 63 | **Sarhan & Altwaijry (2022)** | 1.0 | 0.5 | 1.0 | 1.0 | 1.0 | **4.5** | **Include** |
| 64 | **Senevirathna et al. (2025)** | 1.0 | 1.0 | 0.5 | 1.0 | 0.0 | **3.5** | **Include** |
| 65 | **Song et al. (2024)** | 1.0 | 1.0 | 1.0 | 1.0 | 0.0 | **4.0** | **Include** |
| 66 | **Tabassum et al. (2024)** | 1.0 | 0.5 | 1.0 | 1.0 | 0.0 | **3.5** | **Include** |
| 67 | **Tian T et al. (2025)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 68 | **Tian Z et al. (2024)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 69 | **Villarreal-Vasquez et al. (2023)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 70 | **Wall & Agrafiotis (2021)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 71 | **Wang & El Saddik (2023)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 72 | **Wang Zhi et al. (2024) FedITD** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 73 | **Wang Jiarong et al. (2023) Deep Cluster** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 74 | **Wei Yichen et al. (2021)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 75 | **Wei Zhiyuan et al. (2024)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 76 | **Wen et al. (2023)** | 1.0 | 0.5 | 1.0 | 1.0 | 1.0 | **4.5** | **Include** |
| 77 | **Xiao Junchao et al. (2023)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 78 | **Xiao Fengrui et al. (2025)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 79 | **Xiao Haitao et al. (2024)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 80 | **Ye Xiaoyun et al. (2025)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 81 | **Yildirim & Anarim (2022)** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | **5.0** | **Include** |
| 82 | **Zhu et al. (2024)** | 1.0 | 1.0 | 0.5 | 1.0 | 1.0 | **4.5** | **Include** |

The list below has the 10 studies that were identified as secondary (survey or review) work:

| | **Author (Year)** | **Decision** |
|---|---|---|
| **1** | Gong et al. (2024) | **Exclude but keep as a reference** |
| **2** | Kamatchi & Uma (2025) | |
| **3** | Alketbi & Mehmood (2025) | |
| **4** | Kundiya & Haribhakta (2025) | |
| **5** | Rauf et al. (2023) | |
| **6** | Yuan & Wu (2021) | |
| **7** | Alzaabi & Mehmood (2024) | |
| **8** | Aloraini et al. (2022) | |
| **9** | Al-Muntaser et al. (2023) | |
| **10** | Ofori et al. (2025) | |