Remark: This document extends the main paper. The content resumes from `App.D`, which first described the datasets (`App.D.1`) and then the hardware platforms (`App.D.2`. We also provide the "full" paper.[a]

a. Available at our repository: https://github.com/hihey54/pragmaticAssessment/blob/main/full_paper.pdf

D.3. Data Availability

Data, especially when labelled, is not cheap to obtain, and thus it is important to consider also cases in which the amount of labelled data is a hard constraint. To ensure fair and consistent comparisons, we always compose the evaluation partition $\mathbb{E}$ by choosing 20% of the available samples for each class in $\mathbb{D}$. Then we consider four 'data availability' scenarios that regulate $\mathbb{T}$:

- *Abundant*: we use all the remaining samples as training (i.e., $\mathbb{T}$ is 80% of $\mathbb{D}$).
- *Modest*: we use half of the remaining data (i.e., $\mathbb{T}$ is 40% of $\mathbb{D}$).
- *Scarce*: the training data is restricted to only a fifth of the remaining samples (i.e., $\mathbb{T}$ is 15% of $\mathbb{D}$)
- *Limited*: we use only 100 samples per class as training data $\mathbb{T}$.

Nevertheless, we set a cap on the maximum amount of samples that are considered for any evaluation. Specifically, whenever we choose a dataset, the amount of benign samples that are put in $\mathbb{D}$ cannot exceed 500k, whereas the amount of malicious samples for each class cannot exceed 166k (i.e., one third of the benign samples). Indeed, some datasets (e.g., `CTU13`) contain millions of samples which are realistically difficult to manage (labelling issues are common in NID [33]). Moreover, we do not want the malicious samples to be more present than benign samples because this is not realistic: in reality, attacks are a "needle in a haystack" [114]. We remark, however, that we perform hundreds of trials—each drawing a different amount of samples from a source dataset to compose $\mathbb{D}$ (and hence $\mathbb{T}$ and $\mathbb{E}$). Hence, we can reasonably assume that all samples in each dataset are analyzed by some ML model (either for training or testing such a model).

D.4. Feature sets

NetFlows exporters can generate diverse features. In some cases, however, some features cannot be computed because the source PCAP data does not contain the necessary pieces of information (see [52]). Hence, we consider two cases of feature sets for each source dataset:

- *Complete*: we use *all* the features provided with each dataset (and, hence, by the respective NetFlow exporter). To avoid classification bias [8], we omit the plain IP address and network ports (we replace the latter with their IANA categories, as done in [175]).
- *Essential*: we use a subset of about half of the original features, which include the essential NetFlow fields (e.g., duration, packets, bytes [51]).

Such distinction is also used to shape the different operational scenarios (described in `App.E`).

D.5. Design of the ML Pipelines

We always focus on ML components that operate as a *detection* engine within the NIDS. We consider a wide array of such detectors, each with its own pipeline, which we now describe. A schematic is given in Fig. 12.

- Binary Detector (`BD`, Fig.12a). It consists of a single binary classifier: a sample is benign or malicious.
- Multiclass Detector (`MD`, Fig.12b). It consists of a single 1+M-class classifier which infers whether a sample is benign, or belongs to one among M classes.
- Binary+Multiclass Detector (`BMD`, Fig.10). This pipeline envisions a cascade of two ML models: the first is a binary classifier (i.e., the `BD`), and the second is an M-class classifier which must determine the family of the malicious samples provided as output by the first classifier.
- Ensemble Detector (Fig.12c). This pipeline consists of an ensemble of M binary classifiers, each specialized on a single type of attack—which is common in NID (e.g., [60]). All such classifiers independently analyze each sample, and the output is produced by a final decision component. In particular, we consider 3 variants—each producing a binary output:
  - Logical Or (`ED-o`), where a sample is considered malicious if at least one classifier says so.
  - Majority Voting (`ED-v`), where a sample is considered malicious if at least M/2 classifiers say so.
  - Stacked (`ED-s`), where an additional ML model analyzes the predictions of all the M classifiers.

We recall (cf. `App.A.4`) that some past works propose ensemble detectors where each classifier receives *only* the malicious samples that it can recognize (e.g., [175]), and the results are taken by averaging the performance of each classifier. Despite the poor pragmatic value, we find instructive to consider also such 'redundant' design, which we denote as `ED` (cf. Fig.11).

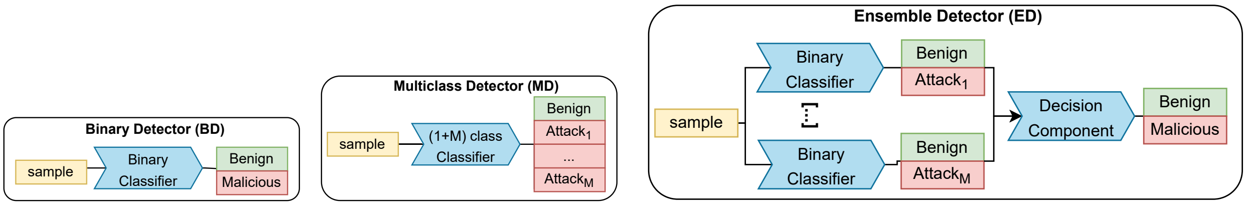
With respect to the NIDS architecture in Fig.2, all our detectors can be placed in the exemplary "ML pipeline", where the preprocessing is done by the NetFlow tool.

D.6. Selected ML Algorithms

We create 4 variants of each detector, each using a specific ML algorithm. Of course, there exist dozens of ML algorithms, and benchmarking all of them is unfeasible and also outside the scope of our paper[39]. Our focus is hence on a select subset of ML algorithms that have found use for ML-NIDS based on NetFlows (and that are known to be 'easy to explain'). In particular, we use:

- *Decision Tree* (DT). One of the most popular classification algorithms for NID (e.g., [31], [32], [196]).
- *Random Forest* (RF). A well-known (e.g., [28]) *ensemble* method, where each estimator is a single DT.
- *Logistic Regression* (LR). Among the most common ML algorithms (also for NID [197]), it relies on different decision mechanisms than tree-based algorithms (i.e., DT and RF).
- *Histogram Gradient-boosting* (HGB). This algorithm leverages a novel boosting technique [198] that

39. In our source-code, changing the ML algorithm is a one-liner.



(a) BD Detector (b) MD Detector (c) Ensembles. The 'decision component' determines ED-o, ED-s, ED-v.

Fig. 12: Design of the ML pipelines entailed in our considered ML-NIDS.

makes training significantly faster with respect to other gradient-based algorithms[40].

From a resource utilization viewpoint, the learning phase for RF, LR and HGB use all cores available on a specific platform; whereas DT only uses a single core. On the other hand, the inference phase always uses a single core.

To the best of our knowledge, we are the first to evaluate detectors using HGB in our testbed, which is why we focus on this ML algorithm in our main paper.

Appendix E. Experiments: Operational Scenarios

For each dataset, all the considered ML-NIDS are assessed in three different scenarios, which include both "closed" and "open" world settings. Specifically:

- **Known Attacks (Baseline)**. This is the optimistic "closed world" setting: we use *all* the available attack classes for both $\mathbb{T}$ and $\mathbb{E}$.
- **Unknown Attacks**. To assess the performance against unknown attacks, we use the exclusion technique presented in §4.2.1: we re-train each detector on *all but one* of the available attack classes in $\mathbb{T}$, and then test it on the leftout class (by using 20% of its samples in $\mathbb{E}$). For simplicity, we do such retraining by considering the 'complete' feature set.
- **Adversarial Attacks**. We carry out adversarial *evasion* attacks based on a well-known prior work [141], which envisions attacks that are both realistically feasible (i.e., the attacker treats the ML-NIDS as a black-box and cannot observe the output because it is accessible only from security administrators [72]) and physically realizable (by extending the communications with junk bytes of data). To comply with the settings in [141], we consider the Essential feature set. More details are in `App.`E.2.

We re-assess every scenario through many trials, each involving a different $\mathbb{T}$ and $\mathbb{E}$. Let us explain.

E.1. Dependencies and Repetitions

All the three scenarios are assessed by assuming both 'static' and 'temporal' data dependencies (§4.2.2).

- **Static dependency.** Under this assumption, we always compose $\mathbb{T}$ and $\mathbb{E}$ by random sampling from $\mathbb{D}$. To ensure statistically significant results that account for randomness, we perform a massive amount of trials for each setting. Specifically, we repeat the training/testing: 100 times for the *Abundant*, *Moderate*, and *Scarce* labelling budgets; and 1000 times for the *Limited* labelling budget.
- **Temporal dependency.** To take into account the potential temporal dependency between samples, we repeat the same 3 operational scenarios, but by changing the way we compose $\mathbb{T}$ and $\mathbb{E}$. Specifically—instead of randomly sampling from $\mathbb{D}$—we compose $\mathbb{E}$ by selecting the *most recent* samples, whereas we compose $\mathbb{T}$ by selecting the *first appearing* samples. Of course, the composition of $\mathbb{T}$ is done according to the considered data availability setting—hence allowing a fair comparison with the 'static' scenarios. As explained in §4.2.2, the temporal scenarios are assessed only once per dataset (because they assume a deterministic 'appearance' of samples).

As an example, consider the *Moderate* data availability setting. For the *static* assumption, we first create $\mathbb{E}$ by randomly choosing 20% of the samples for each class in a given $\mathbb{D}$, and then create $\mathbb{T}$ by choosing 40% of the remaining samples per class. For the *temporal* assumption, we select the last 20% samples for each class for $\mathbb{E}$, and the first 40% samples for $\mathbb{T}$—resulting in a time-gap of 40% samples between $\mathbb{T}$ and $\mathbb{E}$.

E.2. Adaptive "adversarial" Attacks

We describe our adaptive attacks, which resemble the well-known paper by Apruzzese and Colajanni [141].

Threat Model. The *defender* is an organization that adopts a ML-NIDS to detect malicious activities occurring in their network—a deployment scenario similar to the one depicted in Fig. 1. In particular, the NIDS includes an ML component that analyzes NetFlows, outputting whether a NetFlow is benign or malicious according to the data seen during its training stage. The *attacker* is assumed to have already infiltrated the network (by, e.g., exploiting some zero day vulnerability, or by successfully 'phishing' some employees). As such, the attacker is *capable* of controlling some hosts, e.g., by manipulating the network communications. The attacker *knows* that the organization adopts a ML-NIDS, but is agnostic of the exact functionalities of such ML-NIDS; moreover, the attacker cannot observe the output of the ML-NIDS because the attacker has no access to the admin console of the ML-NIDS. The attacker *wants* to maintain access to the network: hence, the attacker is aware that they must operate stealthily and continuously change their activities to avoid being detected, especially if the ML-NIDS is retrained with data pertaining to more recent attacks. The *strategy* adopted by attacker is to

40. We also assessed neural nets, but HGB always outmatched them—which is why we chose HGB as exemplary gradient-based algorithms.

modify the network communications (by, e.g., adding junk payloads) of the controlled machines, which results in 'adversarial perturbations' that will affect the data analyzed by the ML-NIDS. Such an erratic behavior can confuse the ML-NIDS, potentially bypassing its detection.

Such a threat model denotes attacks that are *feasible* to stage [72], and hence likely to occur in reality.

Implementation. We create the adversarial perturbations by manipulating the NetFlows samples. Such perturbations can be considered to be applied in the 'feature space' [104]. To ensure that the resulting adversarial samples are physically realizable [103], we follow strict rules.

- We only perturb NetFlows whose source host is within the internal network. Indeed, our threat model assumes that the attacker has access and can control some machines within the target network.
- We only perturb UDP NetFlows. This is because other protocols may not allow the introduction of perturbations at the network-level.[41]
- The perturbations increase (by tiny amounts) the duration or the exchanged bytes—which are both common NetFlow features (and 'controllable' by our attacker). We do not decrease such features because it may result in corrupted packets. Moreover, we ensure that the resulting 'adversarial NetFlow' does not violate physical constraints (e.g., exceeding the MTU, or the maximum NetFlow duration).
- After applying the perturbation, we re-create the sample by taking into account inter-features dependencies (e.g., we recalculate the 'bytes per second').

Finally, to replicate the scenario considered by Apruzzese and Colajanni [141], we only assess such attacks against the detectors that use the Essential feature set. This choice is also motivated by the fact that it is impossible to predict the effects of our perturbations to some features of the Complete feature set. As such, we consider the Essential setting to ensure that all of our adversarial samples are physically realizable. Nonetheless, a recent work [105] also suggests that our perturbations can be considered as a "worst-case" scenario, wherein an attacker has compromised the NetFlow exporter and is able to manipulate the preprocessing operations of the ML-NIDS.

E.3. Performance Evaluation

We consider several performance metrics. Specifically:

- *False Positive Rate* (fpr), because any security system must exhibit low rates of false alarms.
- *True Positive Rate* (tpr), because our primary focus is on intrusion detection (a positive is a malicious sample, irrespective of its class). Furthermore, our adversarial attacks focus on *evasion*, and hence will affect the tpr.
- *Accuracy* (Acc). Due to the base rate fallacy [8], we only use Acc to assess the multi-classification capabilities for the malicious classes (i.e., only for MD and BMD).
- *Training time*, which is the time (in seconds) to train a given ML model on $\mathbb{T}$.
- *Inference time*, which is the time that a (trained) ML model needs to analyze all samples in $\mathbb{E}$.

For each dataset and data availability setting, we choose an ML algorithm (i.e., either RF, DT, LR, HGB). Then, we proceed by adopting the following workflow.

E.3.1. Training. First, we develop all our detectors, i.e.: BD, MD, BMD, as well as all the 'specialized' detectors of ED (i.e., ED-v, ED-o, ED-s). All such detectors come in three variants: one using the Complete feature set; one using the Essential feature set; and one using the Complete feature set but trained without considering a specific malicious class—i.e., the unknown attacks (The latter yields M-1 sub-variants of each detector.) All such detectors are trained on the same $\mathbb{T}$ (with the appropriate changes of features or classes), and we measure their training time.

E.3.2. Inference. Then, we test each detector on $\mathbb{E}$ by computing the fpr and tpr while measuring the time required to analyze $\mathbb{E}$. For MD, we consider a sample to be detected if it is classified as any attack class. Moreover, because the BMD uses BD as first detection layer, it follows that the fpr and tpr of BMD are always the same as BD. Indeed, to measure the benefit of BMD we measure its Acc on the malicious samples predicted by BD; to allow a fair comparison, we also measure Acc for MD—but only on the malicious samples, otherwise the results would be skewed in favor of the benign samples which are analyzed by MD but not by the multi-class classifier of BMD.

E.3.3. Adversarial Robustness. Next, we craft the adversarial samples (as explained in App.E.2). We isolate from $\mathbb{E}$ the NetFlows that meet our criteria (must be UDP and start from an internal host, and of course be malicious), and re-compute the tpr of all our detectors on such 'clean' samples (which should be different from the initial tpr computed on the whole $\mathbb{E}$). Then, we apply the perturbations and analyze the resulting adversarial samples with all our detectors: if such 'adversarial' tpr is *lower* than the one on the 'clean' malicious samples, then the attack is successful.

E.3.4. Reiterate and finalize. All the procedures above are then repeated 100 times for the Abundant, Moderate and Scarce data availability settings, and 1000 times for the Limited data availability setting. Finally, we repeat all such experiments one last time by considering the temporal dependency (and hence choosing $\mathbb{T}$ and $\mathbb{E}$ accordingly).

Appendix F. Experiments: Benchmark Results

All our results are provided in a series of tables, each reporting the results achieved by all combinations of ML pipelines and ML algorithms for the increasing settings of data availability on a given dataset. The values reported in each table vary depending on the purpose of each table.

F.1. Detection Performance (binary)

We report our results for *binary classification* by distinguishing the "closed" and "open" world settings.

41. For instance, some protocols (e.g., ICMP) have payload restrictions, whereas others perform additional communications (e.g., TCP's three-way handshake) that could result in unreliable adversarial samples.

- **"Closed World"**: CTU13 in Tables 7, GTCS in Tables 9, NB15 in Tables 11, UF-NB15 in Tables 13, CICIDS17 in Tables 15. Each of these tables reports the the *tpr* and *fpr* achieved by all our considered ML models, where we also differentiate the Essential from the Complete feature set. In particular, every table contains two subtables: the former (e.g., Table 7a) reports the results in the absence of temporal dependencies, and hence the values denote the average metric (and standard deviation) across the many trials we performed. Whereas the latter (e.g., Table 7b) reports the results of the single trial in which the samples are assumed to have temporal dependencies.
- **"Open World"**: CTU13 in Tables 8, GTCS in Tables 10, NB15 in Tables 12, UF-NB15 in Tables 14, CICIDS17 in Tables 16. Each of these tables considers the twofold perspective of 'unknown' attacks and 'adversarial' attacks. For the former, which assume detectors using the Complete feature set, we report the *tpr* (on the 'unknown' samples), but also the *fpr* (indeed, by excluding one class from $\mathbb{T}$, the performance on the benign samples can also change). For the latter, which assume the Essential feature set, we report the *tpr* on the 'original' NetFlows (which can vary from the one in the 'open world' scenario because such samples are a subset of $\mathbb{E}$) and on the 'adversarial' NetFlows. Each of these tables contains two subtables, one for the 'static' (e.g., Table 8a) and one for the 'temporal' (e.g., Table 8b) dependency case.

We do not report the results of BMD in any of these tables because they are identical to BD: if a malicious sample 'evades' the BD, then it will logically also evade BMD (whereas benign samples are not analyzed by the multi-class classifier of BMD).

During our experiments, we observed that (especially when the size of $\mathbb{T}$ is huge) detectors based on LR tend to *classify every sample as benign*: in these cases we report a 0 for both *tpr* and *fpr* (the detector is clearly unusable).

F.2. Attack Identification (multiclass)

Next, we focus on the classification performance on the *malicious* samples. Such performance is measured via the *Acc*, which is computed for the MD and BMD detectors and only by taking into account the malicious samples (for the case of MD, because these detectors also analyze benign samples). These values are computed only for the "closed world" settings, because any 'unknown' attack is—by definition—misclassified (and the same can be said for the adversarial attacks). All such results are reported in five tables (one per dataset): CTU13 in Table 17, GTCS in Table 18, NB15 in Table 20, UF-NB15 in Table 20, CICIDS17 in Table 21. All such tables include the *Acc* for both the Essential and Complete feature set, in both the static and temporal dependency scenarios.

F.3. Runtime Performance (high-end platform)

We report the runtime of all our ML models on the *high-end* platform. The runtime for the temporal and static dependency scenarios is always the same.

- *Training.* We provide five tables, one per dataset: CTU13 in Table 22, GTCS in Table 23, NB15 in Table 24, UF-NB15 in Table 25, CICIDS17 in Table 26. In these tables we report both the actual time (in seconds) and the standard deviation across all our trials. The training time of ED is the sum of the training times for all the classifiers that compose the ensemble—which is the same for both ED-v and ED-o. The training time of ED-s is always superior because it also requires training the stacked classifier.
- *Testing.* We provide five tables, one per dataset: CTU13 in Table 27, GTCS in Table 28, NB15 in Table 29, UF-NB15 in Table 30, CICIDS17 in Table 31. In these tables we report only the actual time (in seconds), because variations were almost imperceptible. The testing time of ED is the sum of the testing times for all the classifiers that compose the ensemble—which is the same for both ED-v and ED-o. The testing time of ED-s is not necessarily superior than those of ED because the stacked component can take a decision immediately.

In all cases, the runtime for BMD is (almost) equivalent to the sum of BD and MD.

F.4. Runtime Performance (other platforms)

We report the computational runtime of all our ML models as measured on the *other hardware* platforms. We do this on a single dataset, GTCS, because it was the only one that could be processed by (most) of our machines. Indeed, *the Raspberry Pi4 was not able to run any* of our experiments (aside from those using the Limited data availability), due to a lack of available RAM memory. Such phenomenon motivated us to create a dedicated Virtual Machine (the *low-end* platform) having a computational power similar to a Raspberry Pi4, but with significantly more RAM—enabling the development of ML models trained on GTCS.

We report all such results in Tables 32, which contains four subtables—each dedicated to a specific platform. These experiments are repeated 10 times and we report the average training and testing time.

TABLE 7: CTU13 binary classification results (fpr and tpr) against 'known' attacks seen during the training stage (closed world).

Available Data		Limited (100 per class) [N=1000]				Scarce (15% of $\mathbb{D}$) [N=100]				Moderate (40% of $\mathbb{D}$) [N=100]				Abundant (80% of $\mathbb{D}$) [N=100]			
Features		Complete		Essential		Complete		Essential		Complete		Essential		Complete		Essential	
Alg.	Design	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr
RF	BD	0.090±0.016	0.998±0.002	0.253±0.027	0.987±0.005	0.001±0.000	0.999±0.000	0.016±0.000	0.981±0.001	0.001±0.000	0.999±0.000	0.014±0.000	0.984±0.000	0.001±0.000	0.999±0.000	0.013±0.000	0.985±0.000
	MD	0.081±0.017	0.996±0.003	0.212±0.027	0.972±0.008	0.001±0.000	0.998±0.000	0.015±0.000	0.979±0.001	0.001±0.000	0.999±0.000	0.014±0.000	0.983±0.001	0.001±0.000	0.999±0.000	0.013±0.000	0.984±0.000
	ED-v	0.013±0.009	0.693±0.156	0.039±0.016	0.470±0.100	0.000±0.000	0.348±0.008	0.001±0.000	0.302±0.005	0.000±0.000	0.359±0.007	0.001±0.000	0.302±0.004	0.000±0.000	0.363±0.007	0.001±0.000	0.303±0.004
	ED-s	0.087±0.016	0.997±0.003	0.218±0.027	0.975±0.008	0.001±0.000	0.998±0.000	0.016±0.000	0.979±0.001	0.001±0.000	0.999±0.000	0.014±0.000	0.983±0.001	0.001±0.000	0.999±0.000	0.013±0.000	0.984±0.000
	ED-o	0.094±0.017	0.997±0.003	0.220±0.027	0.975±0.008	0.001±0.000	0.998±0.000	0.016±0.000	0.979±0.001	0.001±0.000	0.999±0.000	0.014±0.000	0.983±0.001	0.001±0.000	0.999±0.000	0.013±0.000	0.984±0.000
	ED	0.024±0.007	0.986±0.007	0.060±0.011	0.942±0.014	0.000±0.000	0.997±0.000	0.003±0.000	0.971±0.001	0.000±0.000	0.998±0.000	0.003±0.000	0.976±0.001	0.000±0.000	0.998±0.000	0.003±0.000	0.979±0.001
DT	BD	0.090±0.024	0.991±0.005	0.243±0.031	0.963±0.010	0.002±0.000	0.998±0.000	0.023±0.001	0.972±0.001	0.002±0.000	0.998±0.000	0.019±0.001	0.976±0.001	0.001±0.000	0.999±0.000	0.017±0.000	0.979±0.001
	MD	0.093±0.023	0.994±0.004	0.256±0.035	0.966±0.011	0.002±0.000	0.998±0.000	0.023±0.001	0.972±0.001	0.002±0.000	0.998±0.000	0.019±0.001	0.976±0.001	0.002±0.000	0.998±0.000	0.017±0.000	0.978±0.001
	ED-v	0.026±0.016	0.820±0.154	0.051±0.018	0.506±0.128	0.000±0.000	0.501±0.101	0.001±0.000	0.310±0.005	0.000±0.000	0.544±0.127	0.001±0.000	0.312±0.006	0.000±0.000	0.508±0.101	0.001±0.000	0.313±0.005
	ED-s	0.104±0.026	0.997±0.003	0.308±0.037	0.979±0.008	0.003±0.000	0.998±0.000	0.025±0.001	0.975±0.001	0.002±0.000	0.999±0.000	0.021±0.001	0.978±0.001	0.002±0.000	0.999±0.000	0.018±0.000	0.981±0.001
	ED-o	0.137±0.029	0.998±0.002	0.325±0.036	0.980±0.008	0.003±0.000	0.998±0.000	0.025±0.001	0.975±0.001	0.002±0.000	0.999±0.000	0.021±0.001	0.978±0.001	0.002±0.000	0.999±0.000	0.018±0.000	0.981±0.001
	ED	0.039±0.010	0.980±0.009	0.088±0.013	0.933±0.015	0.001±0.000	0.996±0.000	0.005±0.000	0.963±0.001	0.001±0.000	0.997±0.000	0.004±0.000	0.969±0.001	0.000±0.000	0.997±0.000	0.004±0.000	0.972±0.001
LR	BD	0.524±0.061	0.954±0.021	0.909±0.100	0.992±0.046	0.195±0.041	0.785±0.091	0.159±0.208	0.546±0.169	0.194±0.031	0.797±0.090	0.149±0.184	0.547±0.176	0.187±0.035	0.788±0.096	0.123±0.183	0.501±0.177
	MD	0.437±0.049	0.853±0.073	0.795±0.255	0.900±0.158	0.007±0.011	0.066±0.136	0.069±0.014	0.510±0.081	0.003±0.005	0.024±0.060	0.069±0.011	0.517±0.074	0.003±0.003	0.020±0.035	0.065±0.015	0.503±0.086
	ED-v	0.132±0.040	0.759±0.107	0.130±0.072	0.660±0.091	0.001±0.001	0.005±0.017	0.001±0.004	0.148±0.182	0.000±0.001	0.004±0.013	0.002±0.004	0.159±0.179	0.000±0.000	0.001±0.006	0.001±0.002	0.116±0.156
	ED-s	0.364±0.068	0.928±0.034	0.509±0.334	0.749±0.422	0.032±0.014	0.606±0.057	0.027±0.020	0.479±0.097	0.027±0.009	0.584±0.047	0.027±0.020	0.474±0.108	0.029±0.011	0.575±0.050	0.034±0.022	0.477±0.103
	ED-o	0.416±0.043	0.934±0.035	0.615±0.228	0.922±0.136	0.034±0.014	0.606±0.057	0.037±0.020	0.486±0.098	0.029±0.009	0.586±0.047	0.036±0.021	0.479±0.107	0.030±0.011	0.577±0.050	0.042±0.021	0.484±0.108
	ED	0.148±0.020	0.883±0.046	0.190±0.070	0.836±0.123	0.007±0.003	0.444±0.073	0.008±0.005	0.366±0.060	0.006±0.002	0.413±0.045	0.008±0.005	0.366±0.058	0.006±0.002	0.400±0.041	0.008±0.004	0.361±0.052
HGB	BD	0.088±0.018	0.999±0.002	0.253±0.025	0.983±0.006	0.002±0.000	0.999±0.000	0.027±0.001	0.972±0.001	0.002±0.000	0.999±0.000	0.026±0.001	0.972±0.001	0.002±0.000	0.999±0.000	0.026±0.001	0.972±0.001
	MD	0.075±0.017	0.998±0.002	0.213±0.025	0.973±0.008	0.005±0.001	0.997±0.001	0.031±0.002	0.960±0.006	0.004±0.001	0.998±0.000	0.030±0.001	0.958±0.006	0.003±0.000	0.998±0.001	0.029±0.001	0.956±0.005
	ED-v	0.018±0.013	0.775±0.149	0.056±0.021	0.505±0.098	0.000±0.000	0.466±0.038	0.001±0.000	0.317±0.004	0.000±0.000	0.472±0.028	0.001±0.000	0.321±0.005	0.000±0.000	0.463±0.028	0.001±0.000	0.322±0.004
	ED-s	0.079±0.018	0.998±0.003	0.238±0.027	0.977±0.008	0.002±0.001	0.999±0.000	0.025±0.001	0.974±0.001	0.002±0.000	0.999±0.000	0.025±0.001	0.974±0.002	0.002±0.000	0.999±0.000	0.025±0.001	0.974±0.002
	ED-o	0.088±0.019	0.998±0.002	0.243±0.028	0.978±0.008	0.002±0.001	0.999±0.000	0.025±0.001	0.974±0.001	0.002±0.000	0.999±0.000	0.025±0.001	0.974±0.002	0.002±0.000	0.999±0.000	0.025±0.001	0.974±0.002
	ED	0.026±0.009	0.991±0.006	0.073±0.013	0.944±0.014	0.001±0.000	0.997±0.000	0.005±0.000	0.965±0.002	0.001±0.000	0.998±0.000	0.005±0.000	0.965±0.002	0.000±0.000	0.998±0.000	0.005±0.000	0.966±0.002

(a) *Static Dependency*: Results by assuming the absence of temporal dependencies among samples ($\mathbb{T}$ and $\mathbb{E}$ are randomly sampled from $\mathbb{D}$).

Available Data		Limited (100 per class) [N=1]				Scarce (15% of $\mathbb{D}$) [N=1]				Moderate (40% of $\mathbb{D}$) [N=1]				Abundant (80% of $\mathbb{D}$) [N=1]			
Features		Complete		Essential		Complete		Essential		Complete		Essential		Complete		Essential	
Alg.	Design	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr
RF	BD	0.107	0.995	0.248	0.986	0.001	0.999	0.016	0.980	0.001	0.999	0.014	0.983	0.001	0.999	0.013	0.986
	MD	0.086	0.995	0.205	0.972	0.001	0.999	0.015	0.979	0.001	0.999	0.013	0.982	0.001	0.999	0.013	0.985
	ED-v	0.010	0.902	0.046	0.811	0.000	0.351	0.001	0.303	0.000	0.361	0.001	0.305	0.000	0.366	0.001	0.308
	ED-s	0.089	0.994	0.211	0.978	0.001	0.999	0.015	0.979	0.001	0.999	0.013	0.982	0.001	0.999	0.013	0.985
	ED-o	0.090	0.995	0.212	0.978	0.001	0.999	0.015	0.979	0.001	0.999	0.013	0.982	0.001	0.999	0.013	0.985
	ED	0.024	0.990	0.061	0.948	0.000	0.996	0.003	0.971	0.000	0.998	0.003	0.976	0.000	0.999	0.003	0.979
DT	BD	0.131	0.982	0.304	0.976	0.002	0.998	0.022	0.971	0.002	0.998	0.020	0.975	0.001	0.999	0.017	0.979
	MD	0.135	0.995	0.272	0.977	0.002	0.997	0.022	0.973	0.002	0.998	0.020	0.977	0.002	0.998	0.018	0.979
	ED-v	0.019	0.939	0.075	0.860	0.000	0.768	0.001	0.319	0.000	0.498	0.001	0.316	0.000	0.484	0.001	0.306
	ED-s	0.187	0.997	0.339	0.979	0.003	0.998	0.025	0.975	0.002	0.999	0.021	0.979	0.002	0.999	0.018	0.981
	ED-o	0.220	0.997	0.341	0.979	0.003	0.998	0.025	0.975	0.002	0.999	0.021	0.979	0.002	0.999	0.018	0.981
	ED	0.057	0.991	0.099	0.940	0.001	0.995	0.005	0.962	0.000	0.997	0.004	0.968	0.000	0.997	0.004	0.973
LR	BD	0.576	0.983	0.989	0.991	0.044	0.105	0.108	0.663	0.224	0.842	0.032	0.359	0.208	0.845	0.154	0.645
	MD	0.419	0.888	0.931	0.981	0.000	0.001	0.073	0.554	0.000	0.001	0.045	0.360	0.000	0.001	0.067	0.554
	ED-v	0.141	0.875	0.105	0.600	0.000	0.000	0.002	0.296	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ED-s	0.448	0.950	0.564	0.977	0.021	0.549	0.022	0.561	0.021	0.554	0.068	0.568	0.023	0.552	0.032	0.414
	ED-o	0.465	0.951	0.606	0.983	0.023	0.550	0.031	0.568	0.022	0.554	0.068	0.568	0.023	0.552	0.035	0.414
	ED	0.148	0.923	0.168	0.930	0.004	0.369	0.008	0.383	0.004	0.370	0.012	0.388	0.006	0.421	0.007	0.316
HGB	BD	0.082	1.000	0.251	0.983	0.003	0.998	0.027	0.971	0.001	0.999	0.026	0.972	0.002	0.999	0.027	0.970
	MD	0.073	0.999	0.202	0.966	0.005	0.998	0.036	0.960	0.005	0.999	0.030	0.957	0.003	0.997	0.030	0.959
	ED-v	0.025	0.938	0.065	0.843	0.000	0.492	0.001	0.316	0.000	0.440	0.001	0.317	0.000	0.455	0.001	0.339
	ED-s	0.097	0.999	0.271	0.976	0.002	0.999	0.025	0.974	0.002	0.999	0.026	0.973	0.002	0.999	0.025	0.971
	ED-o	0.111	1.000	0.277	0.976	0.002	0.999	0.025	0.974	0.002	0.999	0.026	0.973	0.002	0.999	0.025	0.971
	ED	0.033	0.962	0.087	0.938	0.000	0.997	0.005	0.966	0.000	0.998	0.005	0.963	0.000	0.998	0.005	0.962

(b) *Temporal Dependency*: Results by assuming the presence of temporal dependencies among samples (the 'first' samples of $\mathbb{D}$ are put in $\mathbb{T}$, while the last 20% represent $\mathbb{E}$).

TABLE 8: CTU13. Results against adversarial (original tpr and adversarial tpr) and unknown attacks (the tpr is the average on the 'unknown' attacks, while the fpr is due to training on a new $\mathbb{T}$ that does not have the 'unknown' class.).

Available Data		Limited (100 per class) [N=1000]				Scarce (15% of $\mathbb{D}$) [N=100]				Moderate (40% of $\mathbb{D}$) [N=100]				Abundant (80% of $\mathbb{D}$) [N=100]			
Scenario		Adversarial Attacks		Unknown Attacks		Adversarial Attacks		Unknown Attacks		Adversarial Attacks		Unknown Attacks		Adversarial Attacks		Unknown Attacks	
Alg.	Design	tpr (org)	tpr (adv)	fpr	tpr	tpr (org)	tpr (adv)	fpr	tpr	tpr (org)	tpr (adv)	fpr	tpr	tpr (org)	tpr (adv)	fpr	tpr
RF	BD	0.966±0.015	0.924±0.191	0.082±0.015	0.922±0.065	0.964±0.002	0.003±0.000	0.001±0.000	0.741±0.003	0.968±0.001	0.003±0.000	0.001±0.000	0.741±0.014	0.970±0.001	0.003±0.000	0.001±0.000	0.734±0.029
	MD	0.942±0.022	0.716±0.322	0.074±0.016	0.858±0.068	0.961±0.002	0.003±0.000	0.001±0.000	0.738±0.005	0.966±0.001	0.003±0.000	0.001±0.000	0.729±0.022	0.968±0.001	0.003±0.000	0.001±0.000	0.717±0.030
	ED-v	0.378±0.163	0.077±0.202	0.008±0.006	0.540±0.081	0.004±0.002	0.000±0.000	0.000±0.000	0.397±0.007	0.011±0.003	0.000±0.000	0.000±0.000	0.394±0.021	0.017±0.003	0.000±0.000	0.000±0.000	0.386±0.036
	ED-s	0.948±0.021	0.728±0.336	0.078±0.015	0.853±0.074	0.962±0.002	0.002±0.000	0.001±0.000	0.736±0.004	0.967±0.001	0.003±0.000	0.001±0.000	0.737±0.014	0.969±0.001	0.003±0.000	0.001±0.000	0.731±0.026
	ED-o	0.948±0.021	0.728±0.336	0.084±0.017	0.863±0.073	0.962±0.002	0.002±0.000	0.001±0.000	0.736±0.004	0.967±0.001	0.003±0.000	0.001±0.000	0.737±0.014	0.969±0.001	0.003±0.000	0.001±0.000	0.731±0.026
DT	BD	0.920±0.029	0.729±0.368	0.082±0.019	0.902±0.068	0.935±0.002	0.139±0.227	0.002±0.000	0.804±0.064	0.943±0.002	0.186±0.280	0.002±0.000	0.790±0.062	0.948±0.002	0.243±0.313	0.001±0.000	0.791±0.070
	MD	0.927±0.030	0.795±0.357	0.086±0.019	0.910±0.061	0.935±0.003	0.224±0.256	0.002±0.000	0.807±0.065	0.943±0.002	0.238±0.268	0.002±0.000	0.799±0.063	0.948±0.002	0.244±0.260	0.001±0.000	0.784±0.066
	ED-v	0.373±0.159	0.340±0.401	0.018±0.012	0.646±0.104	0.034±0.012	0.002±0.008	0.000±0.000	0.468±0.054	0.044±0.013	0.003±0.015	0.000±0.000	0.477±0.068	0.048±0.010	0.009±0.053	0.000±0.000	0.456±0.064
	ED-s	0.952±0.022	0.907±0.242	0.096±0.022	0.904±0.068	0.943±0.002	0.357±0.318	0.003±0.000	0.794±0.062	0.950±0.002	0.428±0.315	0.002±0.000	0.816±0.063	0.954±0.002	0.504±0.290	0.001±0.000	0.792±0.069
	ED-o	0.954±0.022	0.923±0.220	0.124±0.026	0.932±0.056	0.943±0.002	0.357±0.318	0.003±0.000	0.811±0.061	0.950±0.002	0.428±0.315	0.002±0.000	0.825±0.061	0.954±0.002	0.504±0.290	0.001±0.000	0.801±0.070
LR	BD	0.993±0.048	0.830±0.366	0.479±0.045	0.888±0.050	0.152±0.331	0.001±0.001	0.139±0.021	0.604±0.066	0.150±0.312	0.001±0.000	0.136±0.018	0.600±0.064	0.120±0.292	0.001±0.001	0.133±0.016	0.584±0.065
	MD	0.788±0.359	0.611±0.455	0.422±0.041	0.863±0.080	0.014±0.003	0.007±0.006	0.008±0.010	0.099±0.113	0.014±0.002	0.007±0.005	0.004±0.003	0.060±0.051	0.013±0.003	0.006±0.004	0.003±0.002	0.052±0.036
	ED-v	0.067±0.216	0.417±0.468	0.094±0.028	0.639±0.088	0.000±0.000	0.000±0.000	0.000±0.000	0.007±0.025	0.000±0.000	0.000±0.000	0.000±0.000	0.006±0.022	0.000±0.000	0.000±0.000	0.000±0.000	0.001±0.007
	ED-s	0.984±0.073	0.914±0.260	0.342±0.054	0.897±0.038	0.005±0.005	0.027±0.145	0.028±0.012	0.400±0.071	0.005±0.005	0.036±0.170	0.024±0.008	0.366±0.050	0.006±0.006	0.002±0.004	0.024±0.009	0.368±0.053
	ED-o	0.770±0.393	0.916±0.255	0.388±0.039	0.915±0.026	0.006±0.005	0.027±0.145	0.029±0.012	0.407±0.080	0.007±0.006	0.047±0.182	0.025±0.007	0.371±0.050	0.008±0.005	0.003±0.005	0.026±0.009	0.370±0.053
HGB	BD	0.960±0.018	0.897±0.204	0.079±0.017	0.898±0.068	0.939±0.003	0.015±0.067	0.002±0.000	0.747±0.006	0.940±0.004	0.010±0.020	0.002±0.000	0.751±0.013	0.941±0.003	0.010±0.037	0.001±0.000	0.755±0.022
	MD	0.947±0.022	0.794±0.293	0.069±0.016	0.841±0.072	0.925±0.008	0.109±0.195	0.005±0.001	0.753±0.033	0.921±0.009	0.110±0.203	0.003±0.001	0.765±0.044	0.920±0.007	0.148±0.213	0.003±0.000	0.785±0.058
	ED-v	0.427±0.163	0.649±0.330	0.013±0.010	0.651±0.080	0.020±0.014	0.000±0.000	0.000±0.000	0.456±0.045	0.034±0.015	0.000±0.000	0.000±0.000	0.467±0.037	0.039±0.014	0.000±0.000	0.000±0.000	0.476±0.051
	ED-s	0.951±0.021	0.962±0.091	0.072±0.016	0.880±0.071	0.946±0.004	0.037±0.123	0.002±0.000	0.757±0.031	0.947±0.004	0.046±0.110	0.002±0.000	0.755±0.026	0.948±0.004	0.046±0.080	0.002±0.000	0.760±0.032
	ED-o	0.953±0.021	0.966±0.083	0.080±0.018	0.898±0.066	0.946±0.004	0.037±0.123	0.002±0.000	0.766±0.042	0.947±0.004	0.046±0.110	0.002±0.000	0.758±0.029	0.948±0.004	0.053±0.104	0.002±0.000	0.760±0.032

(a) *Static Dependency*: Results by assuming the absence of temporal dependencies among samples ($\mathbb{T}$ and $\mathbb{E}$ are randomly sampled from $\mathbb{D}$).

Available Data		Limited (100 per class) [N=1]				Scarce (15% of $\mathbb{D}$) [N=1]				Moderate (40% of $\mathbb{D}$) [N=1]				Abundant (80% of $\mathbb{D}$) [N=1]			
Scenario		Adversarial Attacks		Unknown Attacks		Adversarial Attacks		Unknown Attacks		Adversarial Attacks		Unknown Attacks		Adversarial Attacks		Unknown Attacks	
Alg.	Design	tpr (org)	tpr (adv)	fpr	tpr	tpr (org)	tpr (adv)	fpr	tpr	tpr (org)	tpr (adv)	fpr	tpr	tpr (org)	tpr (adv)	fpr	tpr
RF	BD	0.954	0.999	0.095	0.972	0.965	0.003	0.001	0.743	0.968	0.003	0.001	0.746	0.970	0.003	0.001	0.746
	MD	0.933	0.857	0.074	0.937	0.962	0.003	0.001	0.739	0.966	0.003	0.001	0.743	0.968	0.003	0.001	0.739
	ED-v	0.522	0.000	0.007	0.704	0.002	0.000	0.000	0.396	0.010	0.000	0.000	0.402	0.012	0.000	0.000	0.393
	ED-s	0.947	0.234	0.079	0.967	0.963	0.003	0.001	0.737	0.968	0.003	0.001	0.746	0.968	0.003	0.001	0.742
	ED-o	0.947	0.234	0.081	0.969	0.963	0.003	0.001	0.737	0.968	0.003	0.001	0.746	0.968	0.003	0.001	0.742
DT	BD	0.941	0.988	0.105	0.908	0.933	0.005	0.002	0.742	0.942	0.096	0.001	0.876	0.950	0.013	0.001	0.752
	MD	0.947	0.331	0.109	0.905	0.939	0.558	0.002	0.745	0.947	0.160	0.002	0.732	0.949	0.005	0.001	0.865
	ED-v	0.661	0.001	0.012	0.754	0.050	0.000	0.000	0.447	0.051	0.000	0.000	0.563	0.039	0.000	0.000	0.476
	ED-s	0.949	0.982	0.168	0.893	0.944	0.164	0.002	0.866	0.952	0.025	0.002	0.754	0.957	0.026	0.001	0.752
	ED-o	0.949	0.982	0.200	0.906	0.944	0.164	0.002	0.866	0.952	0.025	0.002	0.754	0.957	0.026	0.001	0.757
LR	BD	0.995	0.998	0.516	0.926	0.013	0.001	0.065	0.409	0.009	0.001	0.134	0.630	0.339	0.001	0.150	0.648
	MD	0.994	0.033	0.403	0.818	0.013	0.006	0.004	0.019	0.009	0.001	0.004	0.018	0.014	0.006	0.004	0.068
	ED-v	0.014	0.008	0.093	0.662	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ED-s	0.987	0.020	0.410	0.912	0.001	0.001	0.018	0.346	0.014	0.014	0.018	0.366	0.012	0.001	0.021	0.369
	ED-o	0.987	0.020	0.421	0.915	0.001	0.001	0.019	0.347	0.014	0.014	0.019	0.366	0.012	0.001	0.021	0.369
HGB	BD	0.955	0.998	0.082	0.921	0.939	0.002	0.002	0.752	0.943	0.044	0.002	0.749	0.935	0.003	0.001	0.748
	MD	0.916	0.996	0.070	0.844	0.919	0.419	0.004	0.749	0.922	0.122	0.003	0.747	0.921	0.004	0.002	0.744
	ED-v	0.612	0.006	0.020	0.669	0.008	0.000	0.000	0.462	0.023	0.000	0.000	0.559	0.099	0.000	0.000	0.464
	ED-s	0.940	0.992	0.088	0.937	0.947	0.005	0.002	0.749	0.949	0.021	0.002	0.753	0.943	0.010	0.002	0.752
	ED-o	0.940	0.992	0.100	0.939	0.947	0.005	0.002	0.749	0.949	0.021	0.002	0.753	0.943	0.010	0.002	0.752

(b) *Temporal Dependency*: Results by assuming the presence of temporal dependencies among samples (the 'first' samples of $\mathbb{D}$ are put in $\mathbb{T}$, while the last 20% represent $\mathbb{E}$).

TABLE 9: GTCS binary classification results (fpr and tpr) against 'known' attacks seen during the training stage (closed world).

Available Data		Limited (100 per class) [N=1000]				Scarce (15% of $\mathbb{D}$) [N=100]				Moderate (40% of $\mathbb{D}$) [N=100]				Abundant (80% of $\mathbb{D}$) [N=100]			
Features		Complete		Essential		Complete		Essential		Complete		Essential		Complete		Essential	
Alg.	Design	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr
RF	BD	0.130±0.021	0.977±0.009	0.264±0.039	0.971±0.008	0.033±0.001	0.992±0.001	0.116±0.012	0.974±0.005	0.030±0.001	0.993±0.000	0.119±0.016	0.977±0.004	0.027±0.001	0.994±0.000	0.123±0.007	0.977±0.002
	MD	0.135±0.025	0.974±0.009	0.233±0.037	0.970±0.008	0.032±0.001	0.992±0.001	0.115±0.015	0.975±0.006	0.029±0.001	0.993±0.000	0.121±0.018	0.979±0.004	0.027±0.001	0.994±0.000	0.126±0.009	0.980±0.003
	ED-v	0.005±0.003	0.632±0.160	0.011±0.006	0.587±0.109	0.000±0.000	0.596±0.081	0.000±0.000	0.506±0.021	0.000±0.000	0.574±0.066	0.000±0.000	0.509±0.026	0.000±0.000	0.542±0.055	0.000±0.000	0.506±0.002
	ED-s	0.123±0.022	0.976±0.009	0.231±0.036	0.969±0.008	0.032±0.001	0.992±0.001	0.117±0.013	0.976±0.005	0.029±0.001	0.993±0.000	0.120±0.018	0.979±0.004	0.027±0.001	0.994±0.000	0.124±0.011	0.980±0.004
	ED-o	0.124±0.022	0.977±0.009	0.232±0.036	0.969±0.008	0.032±0.001	0.992±0.001	0.117±0.013	0.976±0.005	0.029±0.001	0.993±0.000	0.120±0.018	0.979±0.004	0.027±0.001	0.994±0.000	0.124±0.011	0.980±0.004
	ED	0.032±0.006	0.974±0.009	0.061±0.010	0.967±0.008	0.008±0.000	0.992±0.001	0.029±0.003	0.976±0.005	0.007±0.000	0.993±0.000	0.030±0.005	0.979±0.004	0.007±0.000	0.994±0.000	0.031±0.003	0.979±0.004
DT	BD	0.131±0.018	0.976±0.007	0.261±0.037	0.955±0.008	0.033±0.001	0.988±0.001	0.100±0.002	0.963±0.001	0.029±0.001	0.990±0.000	0.097±0.009	0.966±0.003	0.026±0.001	0.990±0.000	0.097±0.002	0.966±0.001
	MD	0.143±0.021	0.979±0.008	0.278±0.039	0.955±0.009	0.033±0.001	0.988±0.001	0.100±0.002	0.963±0.001	0.028±0.001	0.990±0.000	0.097±0.009	0.966±0.003	0.026±0.001	0.991±0.000	0.097±0.002	0.966±0.001
	ED-v	0.019±0.013	0.692±0.151	0.024±0.012	0.592±0.129	0.000±0.000	0.488±0.120	0.001±0.000	0.469±0.058	0.000±0.000	0.480±0.106	0.001±0.000	0.449±0.045	0.000±0.000	0.462±0.098	0.001±0.000	0.437±0.015
	ED-s	0.140±0.020	0.978±0.007	0.271±0.037	0.958±0.008	0.033±0.001	0.988±0.001	0.100±0.002	0.963±0.001	0.028±0.001	0.990±0.000	0.096±0.009	0.966±0.003	0.026±0.001	0.991±0.000	0.097±0.002	0.966±0.001
	ED-o	0.149±0.022	0.980±0.007	0.275±0.038	0.959±0.008	0.033±0.001	0.988±0.001	0.100±0.002	0.963±0.001	0.028±0.001	0.990±0.000	0.096±0.009	0.966±0.003	0.026±0.001	0.991±0.000	0.097±0.002	0.966±0.001
	ED	0.042±0.008	0.975±0.007	0.075±0.011	0.949±0.009	0.008±0.000	0.988±0.001	0.025±0.001	0.963±0.001	0.007±0.000	0.990±0.000	0.024±0.002	0.966±0.003	0.006±0.000	0.991±0.000	0.025±0.000	0.966±0.001
LR	BD	0.067±0.250	0.067±0.250	0.610±0.109	0.983±0.045	0.000±0.000	0.000±0.000	0.440±0.046	0.953±0.029	0.000±0.000	0.000±0.000	0.431±0.077	0.932±0.136	0.000±0.000	0.000±0.000	0.439±0.048	0.952±0.029
	MD	0.106±0.279	0.195±0.297	0.532±0.085	0.968±0.040	0.000±0.000	0.000±0.000	0.249±0.040	0.881±0.016	0.000±0.000	0.000±0.000	0.245±0.052	0.863±0.125	0.000±0.000	0.000±0.000	0.245±0.035	0.879±0.016
	ED-v	0.009±0.019	0.199±0.244	0.135±0.051	0.627±0.166	0.000±0.000	0.025±0.072	0.022±0.011	0.353±0.090	0.000±0.000	0.013±0.053	0.022±0.011	0.358±0.109	0.000±0.000	0.000±0.000	0.023±0.010	0.371±0.102
	ED-s	0.028±0.074	0.230±0.384	0.523±0.113	0.958±0.121	0.007±0.043	0.076±0.229	0.207±0.047	0.870±0.018	0.013±0.083	0.062±0.212	0.201±0.069	0.865±0.018	0.000±0.000	0.000±0.000	0.187±0.050	0.861±0.013
	ED-o	0.052±0.066	0.540±0.311	0.543±0.085	0.972±0.036	0.008±0.043	0.306±0.171	0.237±0.028	0.878±0.012	0.002±0.005	0.277±0.131	0.230±0.039	0.867±0.069	0.000±0.000	0.233±0.003	0.234±0.022	0.876±0.012
	ED	0.015±0.017	0.423±0.166	0.173±0.029	0.956±0.043	0.002±0.011	0.274±0.123	0.065±0.008	0.858±0.010	0.000±0.001	0.256±0.104	0.063±0.011	0.848±0.070	0.000±0.000	0.222±0.001	0.064±0.007	0.858±0.012
HGB	BD	0.145±0.023	0.989±0.005	0.259±0.042	0.964±0.007	0.042±0.001	0.997±0.000	0.077±0.004	0.977±0.002	0.041±0.002	0.997±0.000	0.077±0.006	0.978±0.003	0.040±0.001	0.997±0.000	0.078±0.004	0.979±0.002
	MD	0.135±0.024	0.987±0.006	0.233±0.039	0.960±0.008	0.037±0.001	0.997±0.000	0.072±0.003	0.978±0.001	0.035±0.001	0.997±0.000	0.072±0.004	0.980±0.002	0.034±0.001	0.998±0.000	0.073±0.003	0.981±0.001
	ED-v	0.010±0.008	0.732±0.115	0.019±0.011	0.605±0.130	0.000±0.000	0.682±0.048	0.001±0.000	0.516±0.013	0.000±0.000	0.681±0.033	0.000±0.000	0.518±0.022	0.000±0.000	0.699±0.029	0.000±0.000	0.515±0.003
	ED-s	0.147±0.024	0.987±0.006	0.265±0.046	0.961±0.010	0.040±0.001	0.997±0.000	0.073±0.003	0.978±0.001	0.038±0.002	0.997±0.000	0.074±0.005	0.980±0.002	0.038±0.001	0.998±0.000	0.076±0.002	0.981±0.001
	ED-o	0.157±0.026	0.988±0.005	0.266±0.046	0.961±0.010	0.040±0.001	0.997±0.000	0.073±0.003	0.978±0.001	0.038±0.001	0.997±0.000	0.074±0.005	0.980±0.002	0.038±0.001	0.998±0.000	0.076±0.002	0.981±0.001
	ED	0.042±0.008	0.985±0.006	0.072±0.013	0.952±0.011	0.010±0.000	0.997±0.000	0.018±0.001	0.978±0.001	0.010±0.000	0.997±0.000	0.019±0.001	0.980±0.002	0.009±0.000	0.998±0.000	0.019±0.001	0.981±0.001

(a) *Static Dependency*: Results by assuming the absence of temporal dependencies among samples ($\mathbb{T}$ and $\mathbb{E}$ are randomly sampled from $\mathbb{D}$).

Available Data		Limited (100 per class) [N=1]				Scarce (15% of $\mathbb{D}$) [N=1]				Moderate (40% of $\mathbb{D}$) [N=1]				Abundant (80% of $\mathbb{D}$) [N=1]			
Features		Complete		Essential		Complete		Essential		Complete		Essential		Complete		Essential	
Alg.	Design	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr
RF	BD	0.109	0.970	0.272	0.972	0.024	0.983	0.040	0.928	0.030	0.993	0.124	0.978	0.026	0.994	0.121	0.975
	MD	0.098	0.938	0.244	0.958	0.024	0.984	0.039	0.927	0.030	0.993	0.112	0.974	0.026	0.994	0.120	0.977
	ED-v	0.002	0.496	0.004	0.473	0.000	0.524	0.000	0.505	0.000	0.609	0.000	0.508	0.000	0.484	0.000	0.506
	ED-s	0.083	0.954	0.231	0.958	0.024	0.985	0.034	0.926	0.030	0.993	0.127	0.978	0.026	0.994	0.108	0.974
	ED-o	0.083	0.954	0.231	0.958	0.024	0.985	0.034	0.926	0.030	0.993	0.127	0.978	0.026	0.994	0.108	0.974
	ED	0.021	0.951	0.059	0.956	0.006	0.985	0.009	0.926	0.007	0.993	0.032	0.978	0.006	0.994	0.027	0.974
DT	BD	0.123	0.971	0.273	0.960	0.029	0.981	0.084	0.951	0.028	0.988	0.099	0.964	0.026	0.990	0.097	0.964
	MD	0.116	0.949	0.260	0.942	0.029	0.982	0.083	0.951	0.027	0.989	0.099	0.964	0.025	0.990	0.099	0.964
	ED-v	0.012	0.584	0.009	0.571	0.000	0.544	0.001	0.412	0.000	0.534	0.001	0.426	0.000	0.658	0.001	0.441
	ED-s	0.146	0.958	0.250	0.942	0.027	0.981	0.084	0.951	0.027	0.989	0.099	0.964	0.025	0.990	0.098	0.964
	ED-o	0.148	0.958	0.250	0.942	0.027	0.981	0.084	0.951	0.027	0.989	0.099	0.964	0.025	0.990	0.098	0.964
	ED	0.040	0.957	0.065	0.923	0.007	0.981	0.021	0.950	0.007	0.989	0.025	0.964	0.006	0.990	0.025	0.964
LR	BD	0.000	0.000	0.498	0.989	0.000	0.000	0.340	0.915	0.000	0.000	0.488	0.913	0.000	0.000	0.441	0.973
	MD	0.001	0.197	0.430	0.982	0.000	0.000	0.263	0.907	0.000	0.000	0.271	0.875	0.000	0.000	0.273	0.883
	ED-v	0.034	0.772	0.159	0.741	0.000	0.000	0.044	0.535	0.000	0.000	0.019	0.309	0.000	0.000	0.016	0.308
	ED-s	0.061	0.877	0.430	0.983	0.000	0.000	0.266	0.896	0.000	0.000	0.248	0.877	0.000	0.000	0.189	0.876
	ED-o	0.061	0.877	0.449	0.983	0.001	0.239	0.266	0.896	0.001	0.237	0.248	0.877	0.000	0.232	0.189	0.876
	ED	0.024	0.813	0.155	0.961	0.000	0.222	0.078	0.879	0.000	0.222	0.067	0.853	0.000	0.222	0.051	0.856
HGB	BD	0.116	0.990	0.259	0.960	0.036	0.994	0.050	0.964	0.038	0.997	0.086	0.983	0.038	0.998	0.072	0.978
	MD	0.106	0.987	0.215	0.959	0.029	0.993	0.049	0.967	0.033	0.997	0.077	0.983	0.033	0.998	0.071	0.982
	ED-v	0.005	0.695	0.013	0.290	0.000	0.598	0.000	0.521	0.000	0.729	0.000	0.515	0.000	0.687	0.000	0.516
	ED-s	0.111	0.965	0.236	0.942	0.032	0.994	0.044	0.962	0.035	0.997	0.079	0.982	0.036	0.998	0.075	0.981
	ED-o	0.113	0.967	0.236	0.942	0.032	0.994	0.044	0.962	0.035	0.997	0.079	0.982	0.036	0.998	0.075	0.981
	ED	0.030	0.965	0.062	0.926	0.008	0.994	0.011	0.962	0.009	0.997	0.020	0.982	0.009	0.998	0.019	0.981

(b) *Temporal Dependency*: Results by assuming the presence of temporal dependencies among samples (the 'first' samples of $\mathbb{D}$ are put in $\mathbb{T}$, while the last 20% represent $\mathbb{E}$).

TABLE 10: GTCS. Results against adversarial (original tpr and adversarial tpr) and unknown attacks (the tpr is the average on the 'unknown' attacks, while the fpr is due to training on a new $\mathbb{T}$ that does not have the 'unknown' class.).

Available Data		Limited (100 per class) [N=1000]				Scarce (15% of $\mathbb{D}$) [N=100]				Moderate (40% of $\mathbb{D}$) [N=100]				Abundant (80% of $\mathbb{D}$) [N=100]			
Scenario		Adversarial Attacks		Unknown Attacks		Adversarial Attacks		Unknown Attacks		Adversarial Attacks		Unknown Attacks		Adversarial Attacks		Unknown Attacks	
Alg.	Design	tpr (org)	tpr (adv)	fpr	tpr	tpr (org)	tpr (adv)	fpr	tpr	tpr (org)	tpr (adv)	fpr	tpr	tpr (org)	tpr (adv)	fpr	tpr
RF	BD	0.881±0.082	0.211±0.378	0.098±0.016	0.686±0.083	0.817±0.076	0.490±0.480	0.025±0.001	0.574±0.075	0.851±0.052	0.594±0.465	0.022±0.001	0.539±0.066	0.858±0.034	0.674±0.450	0.021±0.001	0.510±0.061
	MD	0.877±0.081	0.221±0.391	0.101±0.018	0.518±0.139	0.856±0.091	0.147±0.337	0.024±0.001	0.525±0.079	0.906±0.063	0.254±0.413	0.022±0.001	0.488±0.069	0.916±0.052	0.266±0.432	0.020±0.001	0.466±0.056
	ED-v	0.000±0.000	0.000±0.000	0.002±0.002	0.022±0.035	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000
	ED-s	0.867±0.088	0.193±0.379	0.094±0.017	0.603±0.135	0.884±0.079	0.170±0.365	0.024±0.001	0.550±0.076	0.913±0.061	0.365±0.463	0.022±0.001	0.533±0.059	0.917±0.059	0.494±0.483	0.020±0.001	0.502±0.055
	ED-o	0.867±0.088	0.193±0.379	0.094±0.017	0.602±0.136	0.884±0.079	0.170±0.365	0.024±0.001	0.550±0.076	0.913±0.061	0.367±0.464	0.022±0.001	0.532±0.060	0.917±0.059	0.494±0.483	0.020±0.001	0.502±0.055
DT	BD	0.762±0.078	0.319±0.457	0.104±0.014	0.658±0.134	0.669±0.011	0.816±0.382	0.025±0.001	0.541±0.107	0.698±0.025	0.944±0.213	0.022±0.001	0.525±0.091	0.703±0.008	0.896±0.298	0.020±0.001	0.500±0.093
	MD	0.766±0.080	0.347±0.462	0.113±0.015	0.606±0.160	0.669±0.011	0.323±0.458	0.025±0.001	0.480±0.121	0.698±0.025	0.427±0.483	0.021±0.001	0.491±0.079	0.702±0.008	0.443±0.487	0.019±0.001	0.491±0.076
	ED-v	0.020±0.038	0.001±0.031	0.010±0.007	0.117±0.137	0.000±0.000	0.000±0.000	0.000±0.000	0.017±0.042	0.000±0.000	0.000±0.000	0.000±0.000	0.008±0.030	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000
	ED-s	0.766±0.079	0.322±0.458	0.112±0.016	0.651±0.137	0.669±0.011	0.554±0.477	0.024±0.001	0.454±0.121	0.698±0.026	0.442±0.479	0.021±0.001	0.453±0.106	0.702±0.008	0.353±0.468	0.019±0.001	0.440±0.097
	ED-o	0.766±0.079	0.322±0.458	0.116±0.018	0.657±0.137	0.669±0.011	0.554±0.477	0.024±0.001	0.454±0.121	0.698±0.026	0.442±0.479	0.021±0.001	0.453±0.106	0.702±0.008	0.353±0.468	0.019±0.001	0.440±0.097
LR	BD	0.949±0.188	0.003±0.054	0.027±0.068	0.042±0.080	0.585±0.478	0.000±0.000	0.002±0.016	0.002±0.018	0.532±0.482	0.000±0.000	0.000±0.000	0.000±0.000	0.551±0.480	0.000±0.000	0.000±0.000	0.000±0.000
	MD	0.847±0.345	0.173±0.374	0.107±0.218	0.165±0.246	0.041±0.191	0.000±0.000	0.002±0.014	0.004±0.025	0.031±0.166	0.000±0.000	0.009±0.032	0.018±0.062	0.040±0.190	0.000±0.000	0.003±0.019	0.008±0.041
	ED-v	0.000±0.000	0.000±0.000	0.005±0.010	0.057±0.122	0.000±0.000	0.000±0.000	0.000±0.000	0.001±0.004	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.001	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000
	ED-s	0.858±0.333	0.171±0.373	0.032±0.053	0.230±0.234	0.001±0.003	0.000±0.000	0.005±0.033	0.047±0.141	0.019±0.132	0.000±0.000	0.013±0.082	0.044±0.158	0.000±0.001	0.000±0.000	0.000±0.000	0.000±0.000
	ED-o	0.836±0.354	0.150±0.353	0.041±0.050	0.282±0.241	0.002±0.003	0.000±0.000	0.006±0.033	0.066±0.137	0.002±0.003	0.000±0.000	0.001±0.004	0.041±0.095	0.001±0.003	0.000±0.000	0.000±0.000	0.015±0.004
HGB	BD	0.814±0.084	0.211±0.394	0.111±0.018	0.725±0.082	0.848±0.023	0.000±0.000	0.031±0.001	0.606±0.044	0.864±0.029	0.006±0.041	0.030±0.001	0.605±0.035	0.868±0.025	0.000±0.000	0.029±0.001	0.618±0.024
	MD	0.804±0.083	0.180±0.369	0.105±0.018	0.644±0.117	0.858±0.011	0.001±0.002	0.027±0.001	0.581±0.053	0.882±0.017	0.020±0.137	0.026±0.001	0.584±0.046	0.890±0.007	0.001±0.002	0.025±0.001	0.590±0.049
	ED-v	0.008±0.020	0.002±0.044	0.005±0.005	0.166±0.146	0.000±0.000	0.000±0.000	0.000±0.000	0.006±0.025	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000
	ED-s	0.814±0.087	0.154±0.334	0.114±0.019	0.680±0.104	0.870±0.018	0.001±0.002	0.030±0.001	0.620±0.042	0.894±0.017	0.028±0.153	0.029±0.001	0.615±0.037	0.905±0.009	0.003±0.020	0.028±0.001	0.634±0.028
	ED-o	0.814±0.087	0.154±0.334	0.120±0.021	0.687±0.103	0.870±0.018	0.001±0.002	0.030±0.001	0.620±0.042	0.895±0.017	0.029±0.159	0.029±0.001	0.616±0.033	0.905±0.009	0.003±0.020	0.028±0.001	0.634±0.028

(a) *Static Dependency*: Results by assuming the absence of temporal dependencies among samples ($\mathbb{T}$ and $\mathbb{E}$ are randomly sampled from $\mathbb{D}$).

Available Data		Limited (100 per class) [N=1]				Scarce (15% of $\mathbb{D}$) [N=1]				Moderate (40% of $\mathbb{D}$) [N=1]				Abundant (80% of $\mathbb{D}$) [N=1]			
Scenario		Adversarial Attacks		Unknown Attacks		Adversarial Attacks		Unknown Attacks		Adversarial Attacks		Unknown Attacks		Adversarial Attacks		Unknown Attacks	
Alg.	Design	tpr (org)	tpr (adv)	fpr	tpr	tpr (org)	tpr (adv)	fpr	tpr	tpr (org)	tpr (adv)	fpr	tpr	tpr (org)	tpr (adv)	fpr	tpr
RF	BD	0.967	0.977	0.073	0.377	0.234	0.014	0.018	0.621	0.909	0.978	0.022	0.457	0.851	0.978	0.020	0.571
	MD	0.968	0.149	0.070	0.132	0.258	0.001	0.017	0.507	0.864	0.978	0.022	0.566	0.881	0.366	0.019	0.476
	ED-v	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ED-s	0.972	0.975	0.063	0.478	0.243	0.001	0.018	0.506	0.915	0.978	0.022	0.565	0.847	0.001	0.019	0.441
	ED-o	0.972	0.975	0.063	0.478	0.243	0.001	0.018	0.506	0.915	0.978	0.022	0.565	0.847	0.001	0.019	0.441
DT	BD	0.742	0.982	0.094	0.560	0.599	0.992	0.021	0.476	0.714	0.993	0.021	0.580	0.698	0.993	0.019	0.377
	MD	0.787	0.000	0.098	0.268	0.598	0.988	0.021	0.545	0.713	0.982	0.021	0.367	0.699	0.989	0.019	0.514
	ED-v	0.000	0.000	0.006	0.249	0.000	0.000	0.000	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ED-s	0.816	0.011	0.112	0.517	0.598	0.000	0.020	0.519	0.713	0.978	0.020	0.475	0.698	0.000	0.019	0.604
	ED-o	0.816	0.011	0.114	0.522	0.598	0.000	0.020	0.519	0.713	0.978	0.020	0.475	0.698	0.000	0.019	0.604
LR	BD	0.979	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.977	0.000	0.000	0.000
	MD	0.981	0.002	0.025	0.087	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.000	0.000	0.000
	ED-v	0.000	0.000	0.018	0.313	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ED-s	0.981	0.002	0.051	0.771	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ED-o	0.981	0.002	0.054	0.772	0.000	0.000	0.001	0.024	0.000	0.000	0.001	0.020	0.000	0.000	0.000	0.014
HGB	BD	0.868	0.683	0.090	0.636	0.732	0.000	0.025	0.498	0.933	0.000	0.028	0.605	0.857	0.000	0.028	0.620
	MD	0.867	0.612	0.082	0.385	0.764	0.000	0.022	0.498	0.930	0.000	0.025	0.513	0.911	0.001	0.024	0.623
	ED-v	0.020	0.000	0.002	0.026	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ED-s	0.859	0.992	0.085	0.634	0.702	0.000	0.024	0.581	0.938	0.002	0.026	0.665	0.923	0.002	0.027	0.622
	ED-o	0.859	0.992	0.086	0.634	0.702	0.000	0.024	0.581	0.938	0.002	0.026	0.665	0.923	0.002	0.027	0.622

(b) *Temporal Dependency*: Results by assuming the presence of temporal dependencies among samples (the 'first' samples of $\mathbb{D}$ are put in $\mathbb{T}$, while the last 20% represent $\mathbb{E}$).

TABLE 11: NB15 binary classification results (fpr and tpr) against ‘known’ attacks seen during the training stage (closed world).

Available Data		Limited (100 per class) [N=1000]				Scarce (15% of $\mathbb{D}$) [N=100]				Moderate (40% of $\mathbb{D}$) [N=100]				Abundant (80% of $\mathbb{D}$) [N=100]			
Features		Complete		Essential		Complete		Essential		Complete		Essential		Complete		Essential	
Alg.	Design	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr
RF	BD	0.021±0.002	1.000±0.000	0.022±0.002	0.997±0.001	0.010±0.000	0.992±0.001	0.010±0.000	0.989±0.001	0.010±0.000	0.991±0.001	0.009±0.000	0.989±0.001	0.009±0.000	0.991±0.001	0.009±0.000	0.989±0.001
	MD	0.020±0.001	0.998±0.001	0.020±0.002	0.995±0.001	0.010±0.000	0.987±0.001	0.009±0.000	0.984±0.001	0.009±0.000	0.988±0.001	0.009±0.000	0.985±0.001	0.008±0.000	0.988±0.001	0.008±0.000	0.986±0.001
	ED-v	0.019±0.002	0.970±0.035	0.018±0.002	0.959±0.040	0.000±0.000	0.531±0.023	0.000±0.000	0.554±0.021	0.000±0.000	0.564±0.019	0.000±0.000	0.575±0.015	0.000±0.000	0.579±0.015	0.000±0.000	0.586±0.013
	ED-s	0.021±0.002	0.999±0.001	0.023±0.002	0.996±0.001	0.010±0.000	0.988±0.001	0.009±0.000	0.985±0.001	0.009±0.000	0.988±0.001	0.008±0.000	0.986±0.001	0.008±0.000	0.988±0.001	0.008±0.000	0.987±0.001
	ED-o	0.022±0.002	1.000±0.001	0.023±0.002	0.997±0.001	0.010±0.000	0.988±0.001	0.009±0.000	0.985±0.001	0.009±0.000	0.988±0.001	0.008±0.000	0.986±0.001	0.008±0.000	0.988±0.001	0.008±0.000	0.987±0.001
	ED	0.018±0.002	0.997±0.002	0.017±0.002	0.991±0.003	0.002±0.000	0.978±0.002	0.002±0.000	0.975±0.002	0.001±0.000	0.981±0.001	0.001±0.000	0.979±0.001	0.001±0.000	0.983±0.001	0.001±0.000	0.982±0.001
DT	BD	0.022±0.004	0.996±0.004	0.028±0.012	0.994±0.004	0.008±0.000	0.958±0.002	0.008±0.000	0.958±0.002	0.008±0.000	0.962±0.002	0.008±0.000	0.962±0.002	0.007±0.000	0.965±0.001	0.007±0.000	0.966±0.001
	MD	0.022±0.004	0.996±0.004	0.028±0.012	0.994±0.004	0.008±0.000	0.959±0.002	0.008±0.000	0.959±0.002	0.008±0.000	0.962±0.002	0.008±0.000	0.963±0.002	0.007±0.000	0.966±0.001	0.007±0.000	0.966±0.001
	ED-v	0.017±0.002	0.932±0.068	0.016±0.002	0.955±0.045	0.000±0.000	0.613±0.028	0.000±0.000	0.641±0.031	0.000±0.000	0.616±0.026	0.000±0.000	0.637±0.027	0.000±0.000	0.610±0.022	0.000±0.000	0.628±0.022
	ED-s	0.022±0.004	0.997±0.003	0.029±0.012	0.995±0.002	0.009±0.000	0.967±0.002	0.008±0.000	0.966±0.002	0.008±0.000	0.969±0.002	0.008±0.000	0.968±0.001	0.007±0.000	0.970±0.001	0.007±0.000	0.971±0.001
	ED-o	0.023±0.005	0.999±0.002	0.030±0.013	0.996±0.002	0.009±0.000	0.967±0.002	0.008±0.000	0.967±0.002	0.008±0.000	0.969±0.002	0.008±0.000	0.968±0.001	0.007±0.000	0.970±0.001	0.007±0.000	0.971±0.001
	ED	0.016±0.002	0.982±0.012	0.017±0.003	0.981±0.011	0.002±0.000	0.946±0.002	0.002±0.000	0.946±0.002	0.001±0.000	0.953±0.002	0.001±0.000	0.953±0.002	0.001±0.000	0.959±0.002	0.001±0.000	0.959±0.002
LR	BD	0.361±0.016	0.973±0.006	0.462±0.199	0.963±0.088	0.002±0.001	0.047±0.007	0.008±0.004	0.450±0.153	0.003±0.001	0.048±0.007	0.008±0.004	0.458±0.157	0.003±0.001	0.046±0.006	0.008±0.005	0.456±0.148
	MD	0.499±0.201	0.873±0.140	0.636±0.295	0.869±0.142	0.001±0.000	0.005±0.002	0.001±0.006	0.022±0.024	0.001±0.000	0.006±0.003	0.001±0.006	0.021±0.031	0.001±0.000	0.006±0.004	0.000±0.000	0.020±0.019
	ED-v	0.147±0.008	0.853±0.021	0.019±0.010	0.673±0.056	0.000±0.000	0.000±0.000	0.001±0.001	0.327±0.024	0.000±0.000	0.000±0.000	0.001±0.001	0.338±0.023	0.000±0.000	0.000±0.000	0.001±0.000	0.335±0.021
	ED-s	0.305±0.053	0.951±0.021	0.169±0.054	0.961±0.024	0.013±0.001	0.201±0.012	0.009±0.003	0.598±0.060	0.013±0.000	0.201±0.007	0.008±0.002	0.578±0.049	0.013±0.000	0.203±0.005	0.007±0.002	0.562±0.045
	ED-o	0.329±0.021	0.960±0.010	0.194±0.057	0.967±0.037	0.013±0.001	0.202±0.012	0.010±0.003	0.605±0.061	0.013±0.000	0.202±0.007	0.010±0.002	0.587±0.049	0.013±0.000	0.203±0.005	0.009±0.002	0.571±0.046
	ED	0.175±0.013	0.924±0.034	0.049±0.015	0.894±0.055	0.002±0.000	0.101±0.007	0.002±0.001	0.436±0.052	0.002±0.000	0.101±0.004	0.003±0.001	0.438±0.048	0.002±0.000	0.101±0.003	0.002±0.001	0.422±0.038
HGB	BD	0.022±0.003	0.999±0.001	0.024±0.006	0.997±0.001	0.010±0.000	0.991±0.002	0.010±0.000	0.991±0.002	0.010±0.000	0.993±0.001	0.010±0.000	0.993±0.001	0.010±0.000	0.994±0.001	0.010±0.000	0.994±0.001
	MD	0.022±0.003	0.999±0.001	0.023±0.003	0.996±0.002	0.012±0.001	0.986±0.003	0.011±0.001	0.983±0.003	0.011±0.001	0.989±0.002	0.011±0.001	0.986±0.002	0.011±0.000	0.990±0.001	0.011±0.001	0.986±0.002
	ED-v	0.016±0.003	0.921±0.074	0.016±0.003	0.936±0.060	0.000±0.000	0.600±0.023	0.000±0.000	0.635±0.027	0.000±0.000	0.618±0.019	0.000±0.000	0.643±0.022	0.000±0.000	0.628±0.017	0.000±0.000	0.653±0.021
	ED-s	0.021±0.003	0.998±0.002	0.023±0.005	0.996±0.002	0.010±0.000	0.986±0.002	0.010±0.000	0.986±0.002	0.010±0.000	0.990±0.001	0.010±0.000	0.990±0.001	0.010±0.000	0.991±0.001	0.010±0.000	0.991±0.001
	ED-o	0.023±0.005	0.999±0.001	0.026±0.008	0.997±0.001	0.010±0.001	0.987±0.002	0.010±0.001	0.987±0.002	0.010±0.000	0.990±0.001	0.010±0.001	0.991±0.001	0.010±0.000	0.992±0.001	0.010±0.001	0.992±0.001
	ED	0.015±0.003	0.992±0.005	0.016±0.003	0.989±0.005	0.002±0.000	0.976±0.002	0.002±0.000	0.975±0.002	0.002±0.000	0.983±0.002	0.002±0.000	0.982±0.002	0.002±0.000	0.986±0.001	0.002±0.000	0.985±0.001

(a) *Static Dependency*: Results by assuming the absence of temporal dependencies among samples ($\mathbb{T}$ and $\mathbb{E}$ are randomly sampled from $\mathbb{D}$).

Available Data		Limited (100 per class) [N=1]				Scarce (15% of $\mathbb{D}$) [N=1]				Moderate (40% of $\mathbb{D}$) [N=1]				Abundant (80% of $\mathbb{D}$) [N=1]			
Features		Complete		Essential		Complete		Essential		Complete		Essential		Complete		Essential	
Alg.	Design	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr
RF	BD	0.019	1.000	0.023	0.997	0.010	0.994	0.010	0.990	0.010	0.991	0.010	0.988	0.009	0.990	0.008	0.988
	MD	0.019	0.997	0.019	0.996	0.009	0.989	0.009	0.984	0.010	0.986	0.009	0.984	0.008	0.988	0.008	0.985
	ED-v	0.020	0.974	0.019	0.982	0.000	0.535	0.000	0.566	0.000	0.563	0.000	0.573	0.000	0.578	0.000	0.582
	ED-s	0.020	1.000	0.024	0.998	0.009	0.987	0.009	0.985	0.009	0.986	0.009	0.985	0.008	0.987	0.008	0.985
	ED-o	0.021	1.000	0.024	0.998	0.009	0.987	0.009	0.985	0.009	0.986	0.009	0.985	0.008	0.987	0.008	0.985
	ED	0.019	0.996	0.019	0.992	0.002	0.977	0.001	0.974	0.001	0.981	0.001	0.980	0.001	0.983	0.001	0.980
DT	BD	0.020	1.000	0.032	0.997	0.008	0.959	0.008	0.959	0.007	0.962	0.007	0.961	0.007	0.966	0.007	0.968
	MD	0.020	1.000	0.029	0.997	0.008	0.962	0.008	0.960	0.007	0.961	0.008	0.962	0.007	0.967	0.007	0.969
	ED-v	0.019	0.990	0.019	0.990	0.000	0.585	0.000	0.585	0.000	0.640	0.000	0.671	0.000	0.571	0.000	0.622
	ED-s	0.020	1.000	0.030	0.997	0.009	0.971	0.008	0.965	0.008	0.969	0.008	0.966	0.007	0.970	0.007	0.971
	ED-o	0.025	1.000	0.030	0.997	0.009	0.971	0.008	0.965	0.008	0.969	0.008	0.966	0.007	0.970	0.007	0.971
	ED	0.019	0.993	0.020	0.992	0.002	0.949	0.002	0.947	0.001	0.954	0.001	0.953	0.001	0.958	0.001	0.959
LR	BD	0.356	0.971	0.341	0.983	0.004	0.045	0.008	0.548	0.004	0.045	0.004	0.306	0.002	0.044	0.008	0.533
	MD	0.397	0.547	0.937	0.963	0.000	0.005	0.000	0.006	0.000	0.005	0.000	0.009	0.000	0.005	0.001	0.035
	ED-v	0.144	0.861	0.017	0.689	0.000	0.000	0.001	0.329	0.000	0.000	0.000	0.314	0.000	0.000	0.001	0.326
	ED-s	0.321	0.957	0.065	0.951	0.012	0.195	0.010	0.630	0.013	0.213	0.004	0.479	0.013	0.198	0.006	0.538
	ED-o	0.321	0.958	0.149	0.980	0.012	0.197	0.010	0.630	0.013	0.213	0.007	0.488	0.013	0.198	0.011	0.558
	ED	0.166	0.914	0.037	0.922	0.002	0.102	0.002	0.474	0.002	0.108	0.002	0.375	0.002	0.097	0.003	0.411
HGB	BD	0.023	1.000	0.028	0.997	0.010	0.990	0.010	0.990	0.010	0.993	0.010	0.992	0.011	0.995	0.011	0.995
	MD	0.024	1.000	0.028	0.997	0.012	0.987	0.011	0.991	0.011	0.989	0.011	0.985	0.012	0.990	0.011	0.987
	ED-v	0.021	0.947	0.020	0.867	0.000	0.581	0.000	0.646	0.000	0.640	0.000	0.682	0.000	0.622	0.000	0.657
	ED-s	0.023	1.000	0.027	0.996	0.010	0.988	0.010	0.986	0.009	0.989	0.010	0.990	0.010	0.992	0.011	0.992
	ED-o	0.023	1.000	0.028	0.997	0.010	0.989	0.010	0.987	0.010	0.989	0.010	0.990	0.010	0.993	0.011	0.992
	ED	0.020	0.996	0.020	0.990	0.002	0.977	0.002	0.976	0.002	0.982	0.002	0.983	0.002	0.986	0.002	0.984

(b) *Temporal Dependency*: Results by assuming the presence of temporal dependencies among samples (the ‘first’ samples of $\mathbb{D}$ are put in $\mathbb{T}$, while the last 20% represent $\mathbb{E}$).

TABLE 12: NB15. Results against adversarial (original tpr and adversarial tpr) and unknown attacks (the tpr is the average on the ‘unknown’ attacks, while the fpr is due to training on a new $\mathbb{T}$ that does not have the ‘unknown’ class.).

Available Data		Limited (100 per class) [N=1000]				Scarce (15% of $\mathbb{D}$) [N=100]				Moderate (40% of $\mathbb{D}$) [N=100]				Abundant (80% of $\mathbb{D}$) [N=100]			
Scenario		Adversarial Attacks		Unknown Attacks		Adversarial Attacks		Unknown Attacks		Adversarial Attacks		Unknown Attacks		Adversarial Attacks		Unknown Attacks	
Alg.	Design	tpr (org)	tpr (adv)	fpr	tpr	tpr (org)	tpr (adv)	fpr	tpr	tpr (org)	tpr (adv)	fpr	tpr	tpr (org)	tpr (adv)	fpr	tpr
RF	BD	0.984±0.007	0.976±0.010	0.021±0.002	1.000±0.001	0.972±0.005	0.998±0.003	0.009±0.000	0.890±0.003	0.974±0.004	1.000±0.001	0.008±0.000	0.886±0.002	0.975±0.003	1.000±0.000	0.008±0.000	0.883±0.003
	MD	0.971±0.006	0.552±0.263	0.020±0.001	0.995±0.005	0.967±0.006	0.989±0.008	0.008±0.000	0.861±0.006	0.972±0.004	0.996±0.003	0.008±0.000	0.863±0.004	0.973±0.003	0.998±0.002	0.007±0.000	0.863±0.003
	ED-v	0.896±0.098	0.171±0.229	0.018±0.002	0.958±0.035	0.349±0.082	0.062±0.054	0.000±0.000	0.547±0.028	0.384±0.086	0.072±0.053	0.000±0.000	0.559±0.027	0.400±0.062	0.064±0.040	0.000±0.000	0.559±0.024
	ED-s	0.975±0.008	0.861±0.154	0.021±0.002	0.998±0.003	0.968±0.005	0.982±0.020	0.008±0.000	0.879±0.004	0.972±0.003	0.993±0.014	0.008±0.000	0.879±0.003	0.974±0.003	0.993±0.016	0.007±0.000	0.879±0.003
	ED-o	0.977±0.006	0.886±0.128	0.022±0.002	0.999±0.002	0.968±0.005	0.982±0.020	0.008±0.000	0.879±0.004	0.972±0.003	0.993±0.014	0.008±0.000	0.879±0.003	0.974±0.003	0.993±0.016	0.007±0.000	0.879±0.003
DT	BD	0.975±0.015	0.973±0.056	0.021±0.003	0.992±0.008	0.916±0.009	0.865±0.127	0.007±0.000	0.866±0.010	0.925±0.006	0.882±0.126	0.007±0.000	0.864±0.007	0.932±0.006	0.877±0.121	0.006±0.000	0.862±0.006
	MD	0.974±0.017	0.982±0.015	0.022±0.003	0.985±0.014	0.918±0.008	0.866±0.271	0.007±0.000	0.863±0.009	0.925±0.006	0.767±0.367	0.007±0.000	0.863±0.009	0.932±0.006	0.716±0.337	0.006±0.000	0.862±0.008
	ED-v	0.914±0.141	0.880±0.223	0.015±0.003	0.905±0.067	0.367±0.079	0.395±0.252	0.000±0.000	0.563±0.027	0.357±0.072	0.378±0.225	0.000±0.000	0.563±0.021	0.336±0.077	0.341±0.186	0.000±0.000	0.560±0.015
	ED-s	0.978±0.012	0.977±0.047	0.021±0.003	0.994±0.006	0.923±0.007	0.972±0.064	0.008±0.000	0.890±0.005	0.930±0.006	0.969±0.058	0.007±0.000	0.886±0.005	0.936±0.005	0.951±0.064	0.007±0.000	0.881±0.004
	ED-o	0.980±0.010	0.982±0.036	0.023±0.004	0.997±0.004	0.923±0.007	0.972±0.064	0.008±0.000	0.890±0.005	0.930±0.006	0.969±0.058	0.007±0.000	0.886±0.005	0.936±0.005	0.951±0.064	0.007±0.000	0.881±0.004
LR	BD	0.958±0.027	0.807±0.355	0.349±0.017	0.975±0.006	0.295±0.256	0.500±0.473	0.003±0.001	0.055±0.005	0.321±0.264	0.545±0.474	0.004±0.001	0.055±0.004	0.322±0.266	0.558±0.469	0.004±0.000	0.055±0.002
	MD	0.984±0.051	0.160±0.254	0.446±0.143	0.910±0.087	0.075±0.097	0.000±0.000	0.001±0.000	0.010±0.003	0.073±0.115	0.000±0.000	0.001±0.000	0.010±0.003	0.075±0.084	0.000±0.000	0.001±0.000	0.010±0.003
	ED-v	0.660±0.120	0.032±0.133	0.145±0.007	0.896±0.020	0.064±0.040	0.000±0.000	0.000±0.000	0.000±0.000	0.080±0.061	0.000±0.000	0.000±0.000	0.000±0.000	0.072±0.050	0.000±0.000	0.000±0.000	0.000±0.000
	ED-s	0.956±0.022	0.863±0.266	0.283±0.044	0.957±0.007	0.567±0.129	0.239±0.373	0.011±0.001	0.143±0.008	0.585±0.108	0.380±0.414	0.011±0.000	0.143±0.005	0.565±0.111	0.313±0.407	0.011±0.000	0.143±0.005
	ED-o	0.961±0.019	0.917±0.189	0.309±0.020	0.963±0.006	0.574±0.127	0.300±0.390	0.011±0.001	0.146±0.008	0.596±0.104	0.455±0.410	0.011±0.000	0.146±0.005	0.577±0.109	0.350±0.411	0.011±0.000	0.146±0.005
HGB	BD	0.983±0.008	0.972±0.060	0.021±0.002	0.997±0.004	0.983±0.005	0.992±0.019	0.009±0.000	0.890±0.003	0.989±0.003	0.992±0.033	0.009±0.000	0.887±0.002	0.990±0.003	0.991±0.024	0.009±0.000	0.886±0.003
	MD	0.979±0.010	0.941±0.111	0.021±0.002	0.993±0.008	0.957±0.011	0.956±0.085	0.010±0.001	0.858±0.012	0.966±0.007	0.962±0.073	0.010±0.000	0.850±0.016	0.967±0.005	0.974±0.027	0.010±0.000	0.846±0.018
	ED-v	0.817±0.217	0.763±0.260	0.014±0.003	0.888±0.064	0.429±0.090	0.458±0.203	0.000±0.000	0.589±0.030	0.457±0.076	0.477±0.196	0.000±0.000	0.596±0.024	0.469±0.065	0.500±0.188	0.000±0.000	0.588±0.018
	ED-s	0.980±0.009	0.963±0.072	0.021±0.002	0.990±0.011	0.978±0.006	0.980±0.030	0.008±0.000	0.881±0.004	0.984±0.004	0.982±0.034	0.008±0.000	0.880±0.003	0.986±0.004	0.983±0.026	0.008±0.000	0.879±0.003
	ED-o	0.982±0.008	0.975±0.032	0.022±0.004	0.995±0.007	0.979±0.005	0.981±0.030	0.009±0.001	0.887±0.005	0.986±0.003	0.984±0.031	0.009±0.000	0.884±0.004	0.987±0.003	0.986±0.023	0.009±0.000	0.882±0.003

(a) *Static Dependency*: Results by assuming the absence of temporal dependencies among samples ($\mathbb{T}$ and $\mathbb{E}$ are randomly sampled from $\mathbb{D}$).

Available Data		Limited (100 per class) [N=1]				Scarce (15% of $\mathbb{D}$) [N=1]				Moderate (40% of $\mathbb{D}$) [N=1]				Abundant (80% of $\mathbb{D}$) [N=1]			
Scenario		Adversarial Attacks		Unknown Attacks		Adversarial Attacks		Unknown Attacks		Adversarial Attacks		Unknown Attacks		Adversarial Attacks		Unknown Attacks	
Alg.	Design	tpr (org)	tpr (adv)	fpr	tpr	tpr (org)	tpr (adv)	fpr	tpr	tpr (org)	tpr (adv)	fpr	tpr	tpr (org)	tpr (adv)	fpr	tpr
RF	BD	0.985	0.983	0.020	1.000	0.967	0.998	0.009	0.890	0.972	1.000	0.009	0.886	0.973	1.000	0.008	0.882
	MD	0.974	0.529	0.019	0.996	0.957	0.960	0.008	0.859	0.969	0.998	0.008	0.865	0.974	1.000	0.007	0.865
	ED-v	0.928	0.407	0.020	0.970	0.416	0.151	0.000	0.583	0.398	0.098	0.000	0.531	0.452	0.161	0.000	0.550
	ED-s	0.982	0.645	0.020	1.000	0.956	0.975	0.008	0.879	0.970	1.000	0.008	0.877	0.972	0.994	0.007	0.877
	ED-o	0.983	0.925	0.021	1.000	0.956	0.975	0.008	0.879	0.970	1.000	0.008	0.877	0.972	0.994	0.007	0.877
DT	BD	0.982	0.982	0.020	1.000	0.914	0.915	0.007	0.872	0.927	0.660	0.007	0.870	0.934	0.955	0.006	0.858
	MD	0.982	0.983	0.021	1.000	0.929	0.991	0.007	0.877	0.935	0.783	0.007	0.834	0.928	0.982	0.006	0.864
	ED-v	0.978	0.978	0.019	0.989	0.306	0.168	0.000	0.541	0.383	0.293	0.000	0.558	0.368	0.013	0.000	0.545
	ED-s	0.982	0.983	0.020	0.998	0.928	0.993	0.008	0.896	0.930	0.987	0.007	0.881	0.937	0.839	0.006	0.885
	ED-o	0.982	0.983	0.024	1.000	0.928	0.993	0.008	0.896	0.930	0.987	0.007	0.881	0.937	0.839	0.006	0.885
LR	BD	0.974	0.993	0.346	0.974	0.563	0.971	0.004	0.058	0.015	0.000	0.004	0.055	0.578	0.999	0.003	0.052
	MD	0.999	0.249	0.219	0.594	0.001	0.000	0.001	0.008	0.007	0.000	0.002	0.012	0.167	0.000	0.001	0.008
	ED-v	0.476	0.005	0.144	0.908	0.062	0.000	0.000	0.000	0.013	0.000	0.000	0.000	0.077	0.000	0.000	0.000
	ED-s	0.937	0.999	0.274	0.951	0.739	0.002	0.011	0.136	0.192	0.883	0.012	0.152	0.555	0.001	0.011	0.139
	ED-o	0.941	1.000	0.298	0.960	0.739	0.002	0.011	0.144	0.210	0.883	0.012	0.154	0.587	0.836	0.011	0.143
HGB	BD	0.979	0.975	0.023	0.999	0.984	0.989	0.009	0.891	0.991	0.999	0.008	0.889	0.989	0.999	0.009	0.887
	MD	0.979	0.975	0.024	0.999	0.988	0.989	0.010	0.825	0.969	0.980	0.010	0.853	0.972	0.979	0.010	0.826
	ED-v	0.972	0.000	0.021	0.942	0.421	0.380	0.000	0.599	0.527	0.244	0.000	0.593	0.507	0.207	0.000	0.603
	ED-s	0.980	0.975	0.023	0.998	0.974	0.965	0.008	0.882	0.988	0.998	0.008	0.883	0.983	0.993	0.009	0.878
	ED-o	0.980	0.975	0.023	0.999	0.976	0.965	0.009	0.891	0.988	0.998	0.008	0.886	0.984	0.993	0.009	0.884

(b) *Temporal Dependency*: Results by assuming the presence of temporal dependencies among samples (the ‘first’ samples of $\mathbb{D}$ are put in $\mathbb{T}$, while the last 20% represent $\mathbb{E}$).

TABLE 13: `UF-NB15` binary classification results (fpr and tpr) against 'known' attacks seen during the training stage (closed world).

Available Data		Limited (100 per class) [N=1000]				Scarce (15% of $\mathbb{D}$) [N=100]				Moderate (40% of $\mathbb{D}$) [N=100]				Abundant (80% of $\mathbb{D}$) [N=100]			
Features		Complete		Essential		Complete		Essential		Complete		Essential		Complete		Essential	
Alg.	Design	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr
RF	BD	0.011±0.003	0.999±0.001	0.060±0.027	0.991±0.006	0.004±0.000	0.994±0.001	0.004±0.000	0.989±0.001	0.003±0.000	0.994±0.001	0.003±0.000	0.990±0.001	0.003±0.000	0.994±0.001	0.003±0.000	0.991±0.001
	MD	0.009±0.002	0.998±0.001	0.050±0.025	0.982±0.009	0.003±0.000	0.990±0.001	0.004±0.000	0.985±0.001	0.003±0.000	0.990±0.001	0.003±0.000	0.986±0.001	0.003±0.000	0.991±0.001	0.003±0.000	0.988±0.001
	ED-v	0.008±0.002	0.913±0.094	0.008±0.003	0.699±0.031	0.000±0.000	0.423±0.022	0.000±0.000	0.389±0.035	0.000±0.000	0.421±0.015	0.000±0.000	0.383±0.025	0.000±0.000	0.420±0.014	0.000±0.000	0.383±0.015
	ED-s	0.011±0.003	0.999±0.001	0.057±0.026	0.984±0.009	0.003±0.000	0.991±0.001	0.004±0.000	0.986±0.001	0.003±0.000	0.991±0.001	0.003±0.000	0.987±0.001	0.003±0.000	0.991±0.001	0.003±0.000	0.988±0.001
	ED-o	0.012±0.003	0.999±0.001	0.058±0.027	0.985±0.009	0.003±0.000	0.991±0.001	0.004±0.000	0.986±0.001	0.003±0.000	0.991±0.001	0.003±0.000	0.987±0.001	0.003±0.000	0.991±0.001	0.003±0.000	0.988±0.001
	ED	0.008±0.001	0.996±0.002	0.018±0.007	0.969±0.011	0.001±0.000	0.979±0.002	0.001±0.000	0.967±0.002	0.001±0.000	0.980±0.001	0.001±0.000	0.972±0.002	0.001±0.000	0.982±0.001	0.001±0.000	0.975±0.001
DT	BD	0.011±0.004	0.997±0.003	0.065±0.027	0.975±0.010	0.003±0.000	0.979±0.002	0.004±0.000	0.974±0.002	0.003±0.000	0.981±0.001	0.003±0.000	0.979±0.001	0.003±0.000	0.983±0.001	0.003±0.000	0.981±0.001
	MD	0.011±0.004	0.997±0.003	0.072±0.031	0.976±0.010	0.003±0.000	0.980±0.002	0.004±0.000	0.975±0.002	0.003±0.000	0.982±0.001	0.003±0.000	0.979±0.001	0.003±0.000	0.983±0.001	0.003±0.000	0.981±0.001
	ED-v	0.008±0.003	0.934±0.085	0.008±0.007	0.698±0.046	0.000±0.000	0.419±0.032	0.000±0.000	0.362±0.042	0.000±0.000	0.413±0.029	0.000±0.000	0.377±0.032	0.000±0.000	0.400±0.028	0.000±0.000	0.379±0.022
	ED-s	0.012±0.004	0.998±0.002	0.094±0.034	0.983±0.009	0.003±0.000	0.985±0.001	0.005±0.000	0.980±0.002	0.003±0.000	0.986±0.001	0.004±0.000	0.983±0.001	0.003±0.000	0.987±0.001	0.004±0.000	0.984±0.001
	ED-o	0.013±0.004	0.999±0.001	0.103±0.034	0.985±0.008	0.003±0.000	0.985±0.001	0.005±0.000	0.980±0.002	0.003±0.000	0.986±0.001	0.004±0.000	0.983±0.001	0.003±0.000	0.987±0.001	0.004±0.000	0.984±0.001
	ED	0.008±0.002	0.993±0.007	0.025±0.009	0.948±0.015	0.001±0.000	0.964±0.002	0.001±0.000	0.950±0.003	0.001±0.000	0.969±0.002	0.001±0.000	0.959±0.002	0.001±0.000	0.971±0.002	0.001±0.000	0.964±0.002
LR	BD	0.701±0.111	0.966±0.052	0.469±0.144	0.890±0.054	0.009±0.018	0.241±0.096	0.007±0.005	0.220±0.048	0.005±0.011	0.268±0.074	0.007±0.005	0.242±0.050	0.005±0.007	0.268±0.080	0.006±0.003	0.259±0.049
	MD	0.579±0.320	0.832±0.167	0.651±0.184	0.922±0.103	0.004±0.001	0.284±0.003	0.014±0.025	0.279±0.065	0.005±0.001	0.284±0.003	0.023±0.033	0.298±0.015	0.005±0.001	0.284±0.003	0.019±0.029	0.297±0.031
	ED-v	0.039±0.019	0.683±0.061	0.029±0.018	0.588±0.059	0.000±0.000	0.081±0.100	0.000±0.000	0.116±0.023	0.000±0.000	0.053±0.084	0.000±0.000	0.123±0.018	0.000±0.000	0.072±0.095	0.000±0.000	0.122±0.017
	ED-s	0.298±0.111	0.922±0.031	0.228±0.064	0.906±0.029	0.008±0.002	0.469±0.051	0.005±0.001	0.419±0.043	0.009±0.002	0.464±0.037	0.005±0.001	0.414±0.046	0.009±0.002	0.463±0.032	0.005±0.001	0.415±0.034
	ED-o	0.460±0.118	0.955±0.048	0.283±0.087	0.914±0.030	0.045±0.035	0.500±0.046	0.007±0.003	0.432±0.042	0.030±0.031	0.491±0.029	0.007±0.003	0.426±0.045	0.019±0.022	0.487±0.024	0.007±0.001	0.426±0.032
	ED	0.129±0.030	0.809±0.071	0.079±0.020	0.807±0.048	0.007±0.005	0.235±0.039	0.002±0.000	0.230±0.033	0.005±0.004	0.233±0.040	0.002±0.000	0.232±0.035	0.003±0.003	0.233±0.036	0.001±0.000	0.227±0.030
HGB	BD	0.011±0.003	0.999±0.001	0.058±0.025	0.988±0.006	0.004±0.000	0.997±0.001	0.005±0.000	0.994±0.001	0.004±0.000	0.998±0.000	0.005±0.000	0.996±0.001	0.004±0.000	0.999±0.000	0.005±0.000	0.997±0.001
	MD	0.011±0.003	0.998±0.001	0.054±0.025	0.984±0.007	0.004±0.000	0.990±0.002	0.006±0.002	0.976±0.004	0.004±0.000	0.992±0.002	0.005±0.001	0.979±0.004	0.004±0.000	0.992±0.001	0.005±0.001	0.980±0.004
	ED-v	0.008±0.002	0.913±0.101	0.012±0.008	0.690±0.057	0.000±0.000	0.462±0.028	0.000±0.000	0.434±0.031	0.000±0.000	0.452±0.028	0.000±0.000	0.426±0.032	0.000±0.000	0.438±0.027	0.000±0.000	0.427±0.027
	ED-s	0.011±0.003	0.999±0.002	0.065±0.031	0.984±0.008	0.004±0.000	0.993±0.001	0.004±0.000	0.989±0.002	0.003±0.000	0.994±0.001	0.004±0.000	0.992±0.002	0.003±0.000	0.995±0.001	0.004±0.000	0.994±0.001
	ED-o	0.011±0.004	0.999±0.001	0.068±0.032	0.985±0.007	0.004±0.001	0.994±0.001	0.005±0.001	0.990±0.002	0.004±0.000	0.995±0.001	0.005±0.001	0.993±0.001	0.004±0.000	0.996±0.001	0.005±0.002	0.995±0.001
	ED	0.007±0.002	0.995±0.003	0.021±0.008	0.960±0.015	0.001±0.000	0.978±0.002	0.001±0.000	0.966±0.005	0.001±0.000	0.983±0.002	0.001±0.000	0.974±0.005	0.001±0.000	0.985±0.004	0.001±0.000	0.978±0.005

(a) *Static Dependency*: Results by assuming the absence of temporal dependencies among samples ($\mathbb{T}$ and $\mathbb{E}$ are randomly sampled from $\mathbb{D}$).

Available Data		Limited (100 per class) [N=1]				Scarce (15% of $\mathbb{D}$) [N=1]				Moderate (40% of $\mathbb{D}$) [N=1]				Abundant (80% of $\mathbb{D}$) [N=1]			
Features		Complete		Essential		Complete		Essential		Complete		Essential		Complete		Essential	
Alg.	Design	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr
RF	BD	0.009	0.999	0.050	0.996	0.004	0.995	0.004	0.992	0.003	0.995	0.003	0.992	0.003	0.994	0.003	0.991
	MD	0.008	0.998	0.052	0.994	0.003	0.992	0.004	0.988	0.003	0.993	0.003	0.988	0.003	0.991	0.003	0.988
	ED-v	0.008	0.997	0.007	0.706	0.000	0.424	0.000	0.341	0.000	0.425	0.000	0.367	0.000	0.427	0.000	0.383
	ED-s	0.009	0.999	0.050	0.995	0.004	0.993	0.004	0.989	0.003	0.993	0.003	0.990	0.003	0.992	0.003	0.988
	ED-o	0.009	0.999	0.050	0.995	0.004	0.993	0.004	0.989	0.003	0.993	0.003	0.990	0.003	0.992	0.003	0.988
	ED	0.007	0.997	0.015	0.985	0.001	0.980	0.001	0.971	0.001	0.983	0.001	0.974	0.001	0.982	0.001	0.975
DT	BD	0.006	0.998	0.050	0.954	0.003	0.978	0.004	0.975	0.003	0.980	0.003	0.980	0.003	0.984	0.003	0.982
	MD	0.010	0.994	0.088	0.962	0.003	0.978	0.004	0.975	0.003	0.983	0.003	0.978	0.003	0.985	0.003	0.983
	ED-v	0.005	0.808	0.003	0.647	0.000	0.492	0.000	0.385	0.000	0.431	0.000	0.398	0.000	0.428	0.000	0.321
	ED-s	0.011	0.996	0.073	0.974	0.003	0.987	0.005	0.981	0.003	0.986	0.004	0.982	0.003	0.987	0.003	0.986
	ED-o	0.011	1.000	0.100	0.991	0.003	0.987	0.005	0.981	0.003	0.986	0.004	0.982	0.003	0.987	0.003	0.986
	ED	0.006	0.983	0.021	0.920	0.001	0.967	0.001	0.951	0.001	0.968	0.001	0.959	0.001	0.974	0.001	0.965
LR	BD	0.603	0.987	0.362	0.928	0.001	0.048	0.013	0.193	0.002	0.298	0.008	0.209	0.003	0.295	0.004	0.294
	MD	0.224	0.737	0.349	0.870	0.003	0.280	0.004	0.285	0.005	0.284	0.004	0.290	0.006	0.286	0.005	0.297
	ED-v	0.062	0.678	0.088	0.703	0.000	0.159	0.000	0.094	0.000	0.005	0.000	0.129	0.000	0.226	0.000	0.129
	ED-s	0.217	0.952	0.299	0.961	0.008	0.469	0.005	0.409	0.008	0.456	0.005	0.409	0.010	0.472	0.003	0.454
	ED-o	0.433	0.985	0.300	0.971	0.080	0.512	0.007	0.413	0.081	0.478	0.006	0.414	0.011	0.482	0.007	0.494
	ED	0.154	0.795	0.141	0.916	0.012	0.241	0.001	0.201	0.012	0.198	0.001	0.231	0.002	0.244	0.002	0.238
HGB	BD	0.012	0.996	0.062	0.986	0.004	0.997	0.005	0.994	0.004	0.998	0.005	0.996	0.004	0.999	0.004	0.997
	MD	0.013	0.996	0.064	0.979	0.004	0.987	0.006	0.973	0.004	0.992	0.005	0.977	0.004	0.993	0.005	0.985
	ED-v	0.005	0.996	0.040	0.765	0.000	0.505	0.001	0.384	0.000	0.492	0.000	0.452	0.000	0.452	0.000	0.448
	ED-s	0.011	0.996	0.065	0.980	0.004	0.993	0.004	0.989	0.004	0.993	0.004	0.991	0.004	0.997	0.004	0.994
	ED-o	0.031	1.000	0.065	0.982	0.004	0.994	0.005	0.989	0.004	0.994	0.005	0.992	0.004	0.997	0.005	0.995
	ED	0.010	0.997	0.032	0.959	0.001	0.979	0.001	0.963	0.001	0.983	0.001	0.972	0.001	0.988	0.001	0.977

(b) *Temporal Dependency*: Results by assuming the presence of temporal dependencies among samples (the 'first' samples of $\mathbb{D}$ are put in $\mathbb{T}$, while the last 20% represent $\mathbb{E}$).

TABLE 14: `UF-NB15`. Results against adversarial (original tpr and adversarial tpr) and unknown attacks (the tpr is the average on the 'unknown' attacks, while the fpr is due to training on a new $\mathbb{T}$ that does not have the 'unknown' class.).

Available Data		Limited (100 per class) [N=1000]				Scarce (15% of $\mathbb{D}$) [N=100]				Moderate (40% of $\mathbb{D}$) [N=100]				Abundant (80% of $\mathbb{D}$) [N=100]			
Scenario		Adversarial Attacks		Unknown Attacks		Adversarial Attacks		Unknown Attacks		Adversarial Attacks		Unknown Attacks		Adversarial Attacks		Unknown Attacks	
Alg.	Design	tpr (org)	tpr (adv)	fpr	tpr	tpr (org)	tpr (adv)	fpr	tpr	tpr (org)	tpr (adv)	fpr	tpr	tpr (org)	tpr (adv)	fpr	tpr
RF	BD	0.987±0.006	0.460±0.395	0.011±0.002	0.999±0.001	0.992±0.003	0.956±0.148	0.003±0.000	0.937±0.007	0.994±0.002	0.996±0.011	0.003±0.000	0.921±0.005	0.995±0.002	0.992±0.051	0.003±0.000	0.911±0.004
	MD	0.982±0.007	0.295±0.293	0.009±0.002	0.997±0.002	0.990±0.003	0.899±0.222	0.003±0.000	0.920±0.008	0.993±0.002	0.972±0.067	0.003±0.000	0.906±0.007	0.995±0.002	0.947±0.123	0.003±0.000	0.897±0.005
	ED-v	0.965±0.025	0.002±0.021	0.007±0.001	0.864±0.057	0.583±0.134	0.000±0.000	0.000±0.000	0.478±0.049	0.576±0.108	0.000±0.000	0.000±0.000	0.474±0.049	0.550±0.077	0.000±0.000	0.000±0.000	0.473±0.045
	ED-s	0.983±0.006	0.143±0.211	0.011±0.002	0.998±0.003	0.990±0.003	0.889±0.222	0.003±0.000	0.928±0.006	0.993±0.002	0.958±0.101	0.003±0.000	0.912±0.005	0.995±0.002	0.922±0.149	0.003±0.000	0.902±0.004
	ED-o	0.985±0.005	0.149±0.214	0.012±0.003	0.999±0.001	0.990±0.003	0.889±0.222	0.003±0.000	0.928±0.006	0.993±0.002	0.958±0.101	0.003±0.000	0.912±0.005	0.995±0.002	0.922±0.149	0.003±0.000	0.902±0.004
DT	BD	0.987±0.010	0.605±0.460	0.011±0.003	0.996±0.005	0.988±0.004	0.727±0.364	0.003±0.000	0.892±0.008	0.992±0.002	0.803±0.315	0.003±0.000	0.883±0.008	0.994±0.002	0.834±0.277	0.002±0.000	0.878±0.006
	MD	0.987±0.012	0.974±0.091	0.011±0.003	0.994±0.007	0.988±0.004	0.948±0.137	0.003±0.000	0.893±0.011	0.992±0.002	0.944±0.127	0.003±0.000	0.878±0.010	0.994±0.002	0.892±0.217	0.002±0.000	0.870±0.009
	ED-v	0.861±0.198	0.076±0.214	0.007±0.002	0.902±0.075	0.383±0.210	0.025±0.110	0.000±0.000	0.442±0.051	0.466±0.153	0.002±0.007	0.000±0.000	0.443±0.042	0.451±0.117	0.006±0.030	0.000±0.000	0.429±0.041
	ED-s	0.989±0.007	0.654±0.391	0.011±0.003	0.997±0.004	0.990±0.003	0.817±0.280	0.003±0.000	0.915±0.008	0.993±0.002	0.740±0.301	0.003±0.000	0.903±0.006	0.994±0.002	0.717±0.292	0.003±0.000	0.896±0.005
	ED-o	0.993±0.005	0.930±0.138	0.012±0.004	0.998±0.003	0.990±0.003	0.818±0.279	0.003±0.000	0.915±0.008	0.993±0.002	0.740±0.301	0.003±0.000	0.903±0.006	0.994±0.002	0.717±0.292	0.003±0.000	0.896±0.005
LR	BD	0.808±0.311	0.324±0.386	0.660±0.084	0.950±0.074	0.300±0.375	0.018±0.008	0.012±0.013	0.409±0.085	0.478±0.431	0.019±0.008	0.008±0.008	0.429±0.063	0.637±0.411	0.020±0.005	0.006±0.005	0.440±0.055
	MD	0.950±0.135	0.961±0.092	0.513±0.282	0.841±0.116	0.897±0.221	0.117±0.236	0.003±0.000	0.451±0.020	0.955±0.007	0.104±0.165	0.003±0.000	0.446±0.014	0.944±0.093	0.103±0.143	0.003±0.000	0.442±0.011
	ED-v	0.776±0.281	0.020±0.085	0.029±0.014	0.730±0.073	0.007±0.022	0.000±0.000	0.000±0.000	0.084±0.118	0.006±0.020	0.000±0.000	0.000±0.000	0.057±0.114	0.002±0.005	0.000±0.000	0.000±0.000	0.079±0.119
	ED-s	0.968±0.011	0.084±0.201	0.265±0.084	0.922±0.020	0.863±0.227	0.002±0.004	0.007±0.001	0.593±0.043	0.874±0.217	0.004±0.007	0.008±0.001	0.593±0.034	0.921±0.133	0.004±0.009	0.008±0.001	0.597±0.026
	ED-o	0.971±0.011	0.212±0.345	0.432±0.106	0.957±0.041	0.871±0.217	0.018±0.005	0.040±0.030	0.630±0.037	0.879±0.215	0.019±0.009	0.026±0.027	0.622±0.026	0.926±0.133	0.020±0.004	0.017±0.019	0.622±0.022
HGB	BD	0.985±0.008	0.566±0.418	0.011±0.003	0.998±0.003	0.995±0.002	0.968±0.091	0.004±0.000	0.930±0.007	0.999±0.001	0.980±0.038	0.004±0.000	0.922±0.005	0.999±0.001	0.984±0.033	0.003±0.000	0.917±0.003
	MD	0.982±0.009	0.471±0.393	0.011±0.003	0.997±0.003	0.958±0.014	0.474±0.363	0.004±0.001	0.913±0.011	0.965±0.012	0.619±0.365	0.004±0.000	0.906±0.010	0.964±0.012	0.644±0.332	0.004±0.001	0.901±0.008
	ED-v	0.796±0.264	0.009±0.044	0.007±0.002	0.877±0.076	0.640±0.089	0.009±0.054	0.000±0.000	0.489±0.044	0.626±0.059	0.023±0.101	0.000±0.000	0.476±0.045	0.620±0.046	0.021±0.092	0.000±0.000	0.478±0.042
	ED-s	0.984±0.008	0.484±0.393	0.011±0.003	0.997±0.004	0.987±0.007	0.821±0.163	0.003±0.000	0.918±0.008	0.992±0.007	0.843±0.199	0.003±0.000	0.908±0.006	0.994±0.005	0.872±0.197	0.003±0.000	0.902±0.005
	ED-o	0.987±0.006	0.536±0.387	0.011±0.004	0.998±0.003	0.990±0.005	0.851±0.129	0.004±0.001	0.929±0.008	0.996±0.004	0.859±0.189	0.003±0.000	0.920±0.007	0.997±0.003	0.887±0.182	0.003±0.000	0.910±0.006

(a) *Static Dependency*: Results by assuming the absence of temporal dependencies among samples ($\mathbb{T}$ and $\mathbb{E}$ are randomly sampled from $\mathbb{D}$).

Available Data		Limited (100 per class) [N=1]				Scarce (15% of $\mathbb{D}$) [N=1]				Moderate (40% of $\mathbb{D}$) [N=1]				Abundant (80% of $\mathbb{D}$) [N=1]			
Scenario		Adversarial Attacks		Unknown Attacks		Adversarial Attacks		Unknown Attacks		Adversarial Attacks		Unknown Attacks		Adversarial Attacks		Unknown Attacks	
Alg.	Design	tpr (org)	tpr (adv)	fpr	tpr	tpr (org)	tpr (adv)	fpr	tpr	tpr (org)	tpr (adv)	fpr	tpr	tpr (org)	tpr (adv)	fpr	tpr
RF	BD	0.988	0.063	0.009	0.999	0.991	1.000	0.003	0.942	0.993	1.000	0.003	0.923	0.994	1.000	0.003	0.909
	MD	0.986	0.241	0.008	0.998	0.990	1.000	0.003	0.928	0.993	1.000	0.003	0.907	0.994	1.000	0.003	0.897
	ED-v	0.979	0.000	0.008	0.994	0.238	0.000	0.000	0.542	0.460	0.000	0.000	0.472	0.434	0.000	0.000	0.447
	ED-s	0.984	0.032	0.009	0.999	0.989	1.000	0.003	0.934	0.993	1.000	0.003	0.915	0.994	0.993	0.003	0.900
	ED-o	0.984	0.032	0.009	0.999	0.989	1.000	0.003	0.934	0.993	1.000	0.003	0.915	0.994	0.993	0.003	0.900
DT	BD	0.976	0.976	0.008	0.995	0.994	0.991	0.003	0.895	0.989	0.980	0.003	0.893	0.994	0.956	0.002	0.883
	MD	0.968	0.986	0.008	0.993	0.988	0.877	0.003	0.904	0.987	0.959	0.003	0.899	0.994	0.999	0.002	0.874
	ED-v	0.694	0.000	0.004	0.813	0.458	0.000	0.000	0.524	0.604	0.000	0.000	0.451	0.043	0.006	0.000	0.449
	ED-s	0.991	1.000	0.011	0.997	0.993	1.000	0.003	0.923	0.990	0.998	0.003	0.914	0.995	0.983	0.003	0.902
	ED-o	0.995	1.000	0.011	0.998	0.993	1.000	0.003	0.923	0.990	0.998	0.003	0.914	0.995	0.983	0.003	0.902
LR	BD	0.987	0.992	0.580	0.963	0.031	0.013	0.012	0.478	0.092	0.024	0.012	0.478	0.953	0.023	0.003	0.333
	MD	0.940	0.998	0.201	0.745	0.949	0.018	0.003	0.479	0.954	0.027	0.003	0.439	0.953	0.022	0.004	0.445
	ED-v	0.945	0.979	0.061	0.799	0.004	0.000	0.000	0.223	0.008	0.000	0.000	0.001	0.000	0.000	0.000	0.274
	ED-s	0.974	0.993	0.230	0.942	0.946	0.000	0.007	0.604	0.947	0.000	0.007	0.545	0.943	0.000	0.009	0.614
	ED-o	0.985	0.995	0.414	0.984	0.949	0.018	0.069	0.649	0.955	0.023	0.070	0.614	0.953	0.022	0.010	0.627
HGB	BD	0.979	0.012	0.012	0.997	0.996	0.979	0.004	0.933	1.000	0.989	0.004	0.926	0.999	1.000	0.003	0.911
	MD	0.976	0.012	0.013	0.997	0.951	0.280	0.004	0.907	0.966	0.589	0.004	0.913	0.975	0.778	0.003	0.891
	ED-v	0.969	0.005	0.004	0.845	0.593	0.000	0.000	0.563	0.660	0.038	0.000	0.558	0.599	0.000	0.000	0.487
	ED-s	0.977	0.008	0.011	0.997	0.985	0.882	0.003	0.919	0.986	0.942	0.003	0.913	0.995	0.991	0.003	0.899
	ED-o	0.980	0.196	0.028	1.000	0.985	0.882	0.004	0.929	0.988	0.942	0.004	0.930	0.996	0.991	0.003	0.906

(b) *Temporal Dependency*: Results by assuming the presence of temporal dependencies among samples (the 'first' samples of $\mathbb{D}$ are put in $\mathbb{T}$, while the last 20% represent $\mathbb{E}$).

TABLE 15: CICIDS17 binary classification results (fpr and tpr) against ‘known’ attacks seen during the training stage (closed world).

Available Data		Limited (100 per class) [N=1000]				Scarce (15% of $\mathbb{D}$) [N=100]				Moderate (40% of $\mathbb{D}$) [N=100]				Abundant (80% of $\mathbb{D}$) [N=100]			
Features		Complete		Essential		Complete		Essential		Complete		Essential		Complete		Essential	
Alg.	Design	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr
RF	BD	0.109±0.029	0.999±0.001	0.102±0.026	0.999±0.001	0.001±0.000	1.000±0.000	0.001±0.000	0.999±0.000	0.001±0.000	1.000±0.000	0.001±0.000	1.000±0.000	0.001±0.000	1.000±0.000	0.001±0.000	1.000±0.000
	MD	0.072±0.021	0.998±0.002	0.064±0.018	0.999±0.001	0.001±0.000	0.999±0.000	0.001±0.000	0.999±0.000	0.001±0.000	1.000±0.000	0.001±0.000	1.000±0.000	0.001±0.000	1.000±0.000	0.001±0.000	1.000±0.000
	ED-v	0.000±0.000	0.002±0.018	0.000±0.000	0.024±0.061	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000
	ED-s	0.076±0.023	0.998±0.002	0.066±0.018	0.998±0.001	0.001±0.000	0.999±0.000	0.001±0.000	0.999±0.000	0.001±0.000	1.000±0.000	0.001±0.000	1.000±0.000	0.001±0.000	1.000±0.000	0.001±0.000	1.000±0.000
	ED-o	0.079±0.024	0.998±0.002	0.066±0.019	0.998±0.001	0.001±0.000	0.999±0.000	0.001±0.000	0.999±0.000	0.001±0.000	1.000±0.000	0.001±0.000	1.000±0.000	0.001±0.000	1.000±0.000	0.001±0.000	1.000±0.000
	ED	0.011±0.004	0.997±0.002	0.009±0.003	0.998±0.001	0.000±0.000	0.999±0.000	0.000±0.000	0.999±0.000	0.000±0.000	1.000±0.000	0.000±0.000	1.000±0.000	0.000±0.000	1.000±0.000	0.000±0.000	1.000±0.000
DT	BD	0.101±0.027	0.995±0.004	0.106±0.026	0.997±0.004	0.001±0.000	0.999±0.000	0.002±0.000	0.999±0.000	0.001±0.000	1.000±0.000	0.001±0.000	1.000±0.000	0.001±0.000	1.000±0.000	0.001±0.000	1.000±0.000
	MD	0.125±0.030	0.997±0.002	0.119±0.025	0.996±0.003	0.001±0.000	0.999±0.000	0.001±0.000	0.999±0.000	0.001±0.000	1.000±0.000	0.001±0.000	1.000±0.000	0.001±0.000	1.000±0.000	0.001±0.000	1.000±0.000
	ED-v	0.000±0.001	0.157±0.184	0.000±0.002	0.113±0.135	0.000±0.000	0.008±0.028	0.000±0.000	0.000±0.003	0.000±0.000	0.004±0.015	0.000±0.000	0.001±0.012	0.000±0.000	0.001±0.003	0.000±0.000	0.000±0.000
	ED-s	0.131±0.031	0.997±0.003	0.118±0.029	0.997±0.003	0.001±0.000	0.999±0.000	0.002±0.000	0.999±0.000	0.001±0.000	1.000±0.000	0.001±0.000	1.000±0.000	0.001±0.000	1.000±0.000	0.001±0.000	1.000±0.000
	ED-o	0.151±0.030	0.997±0.003	0.131±0.030	0.997±0.003	0.001±0.000	0.999±0.000	0.002±0.000	0.999±0.000	0.001±0.000	1.000±0.000	0.001±0.000	1.000±0.000	0.001±0.000	1.000±0.000	0.001±0.000	1.000±0.000
	ED	0.023±0.006	0.994±0.003	0.019±0.006	0.996±0.003	0.000±0.000	0.999±0.000	0.000±0.000	0.999±0.000	0.000±0.000	1.000±0.000	0.000±0.000	0.999±0.000	0.000±0.000	1.000±0.000	0.000±0.000	1.000±0.000
LR	BD	0.482±0.141	0.999±0.001	0.621±0.317	0.995±0.071	0.113±0.002	0.970±0.001	0.012±0.036	0.097±0.289	0.112±0.002	0.970±0.001	0.013±0.037	0.108±0.304	0.113±0.002	0.970±0.001	0.029±0.056	0.221±0.404
	MD	0.640±0.057	0.997±0.015	0.968±0.073	0.980±0.086	0.079±0.003	0.962±0.003	0.001±0.002	0.000±0.001	0.080±0.003	0.962±0.003	0.000±0.001	0.000±0.001	0.079±0.003	0.962±0.003	0.001±0.008	0.004±0.037
	ED-v	0.002±0.004	0.051±0.098	0.005±0.006	0.094±0.124	0.000±0.000	0.000±0.001	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000
	ED-s	0.212±0.106	0.883±0.314	0.312±0.259	0.886±0.315	0.046±0.003	0.986±0.002	0.044±0.027	0.634±0.206	0.047±0.002	0.986±0.001	0.036±0.025	0.563±0.209	0.047±0.002	0.986±0.001	0.045±0.029	0.620±0.194
	ED-o	0.238±0.033	0.995±0.004	0.414±0.285	0.984±0.116	0.050±0.003	0.987±0.001	0.072±0.030	0.642±0.207	0.050±0.002	0.987±0.001	0.072±0.033	0.571±0.209	0.050±0.002	0.987±0.001	0.080±0.030	0.629±0.193
	ED	0.043±0.008	0.978±0.007	0.068±0.038	0.983±0.062	0.006±0.000	0.983±0.001	0.010±0.005	0.611±0.186	0.006±0.000	0.983±0.001	0.010±0.005	0.534±0.164	0.006±0.000	0.983±0.001	0.012±0.005	0.605±0.175
HGB	BD	0.074±0.026	0.999±0.001	0.095±0.024	0.999±0.001	0.001±0.000	1.000±0.000	0.001±0.000	0.999±0.000	0.001±0.000	1.000±0.000	0.001±0.000	1.000±0.000	0.001±0.000	1.000±0.000	0.001±0.000	1.000±0.000
	MD	0.050±0.019	0.998±0.002	0.066±0.019	0.998±0.002	0.006±0.002	0.998±0.001	0.006±0.004	0.998±0.001	0.003±0.002	0.999±0.001	0.003±0.001	0.999±0.000	0.002±0.000	0.999±0.000	0.002±0.000	0.999±0.000
	ED-v	0.000±0.001	0.066±0.119	0.000±0.001	0.045±0.060	0.000±0.000	0.000±0.000	0.000±0.000	0.045±0.075	0.000±0.000	0.000±0.000	0.000±0.000	0.046±0.070	0.000±0.000	0.000±0.001	0.000±0.000	0.063±0.076
	ED-s	0.085±0.027	0.997±0.002	0.093±0.025	0.996±0.003	0.002±0.000	0.999±0.000	0.002±0.000	0.999±0.001	0.001±0.000	1.000±0.000	0.002±0.001	0.999±0.001	0.001±0.000	1.000±0.000	0.001±0.000	0.999±0.001
	ED-o	0.096±0.028	0.998±0.002	0.097±0.026	0.997±0.002	0.002±0.001	0.999±0.000	0.002±0.001	0.999±0.001	0.001±0.000	1.000±0.000	0.002±0.001	0.999±0.001	0.001±0.000	1.000±0.000	0.002±0.001	1.000±0.000
	ED	0.014±0.005	0.995±0.003	0.015±0.005	0.995±0.004	0.000±0.000	0.999±0.000	0.000±0.000	0.999±0.001	0.000±0.000	1.000±0.000	0.000±0.000	0.999±0.001	0.000±0.000	1.000±0.000	0.000±0.000	0.999±0.000

(a) *Static Dependency*: Results by assuming the absence of temporal dependencies among samples ($\mathbb{T}$ and $\mathbb{E}$ are randomly sampled from $\mathbb{D}$).

Available Data		Limited (100 per class) [N=1]				Scarce (15% of $\mathbb{D}$) [N=1]				Moderate (40% of $\mathbb{D}$) [N=1]				Abundant (80% of $\mathbb{D}$) [N=1]			
Features		Complete		Essential		Complete		Essential		Complete		Essential		Complete		Essential	
Alg.	Design	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr	fpr	tpr
RF	BD	0.327	1.000	0.335	1.000	0.010	0.990	0.010	0.990	0.010	0.994	0.010	0.994	0.007	0.994	0.009	0.994
	MD	0.174	0.996	0.317	1.000	0.010	0.989	0.010	0.989	0.010	0.993	0.010	0.994	0.007	0.993	0.009	0.994
	ED-v	0.000	0.044	0.008	0.440	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ED-s	0.166	0.994	0.331	0.999	0.010	0.989	0.010	0.989	0.010	0.992	0.010	0.993	0.007	0.992	0.009	0.993
	ED-o	0.180	0.995	0.335	0.999	0.010	0.989	0.010	0.989	0.010	0.992	0.010	0.993	0.007	0.992	0.009	0.993
	ED	0.028	0.987	0.082	0.990	0.001	0.988	0.001	0.989	0.001	0.992	0.001	0.993	0.001	0.992	0.001	0.992
DT	BD	0.334	0.976	0.336	0.999	0.011	0.990	0.012	0.989	0.009	0.994	0.012	0.988	0.008	0.995	0.010	0.994
	MD	0.144	0.983	0.296	0.992	0.010	0.988	0.010	0.993	0.011	0.996	0.012	0.997	0.009	0.998	0.010	0.994
	ED-v	0.003	0.536	0.034	0.248	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000
	ED-s	0.178	0.995	0.344	1.000	0.011	0.992	0.011	0.992	0.012	0.995	0.013	0.991	0.008	0.994	0.010	0.996
	ED-o	0.191	0.995	0.348	1.000	0.011	0.992	0.011	0.992	0.012	0.995	0.013	0.991	0.008	0.994	0.010	0.996
	ED	0.040	0.980	0.124	0.988	0.001	0.989	0.001	0.992	0.001	0.993	0.001	0.988	0.001	0.993	0.001	0.995
LR	BD	0.289	0.986	0.358	1.000	0.070	0.961	0.072	0.974	0.057	0.965	0.003	0.000	0.059	0.963	0.083	0.972
	MD	0.334	0.675	0.931	0.989	0.037	0.958	0.000	0.000	0.037	0.954	0.000	0.000	0.035	0.954	0.000	0.000
	ED-v	0.062	0.285	0.059	0.599	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000
	ED-s	0.310	0.986	0.354	0.999	0.030	0.984	0.029	0.602	0.028	0.982	0.049	0.596	0.026	0.981	0.014	0.388
	ED-o	0.321	0.988	0.354	0.999	0.035	0.984	0.036	0.603	0.035	0.986	0.052	0.597	0.031	0.985	0.057	0.399
	ED	0.119	0.972	0.115	0.990	0.005	0.977	0.006	0.600	0.005	0.979	0.008	0.593	0.004	0.979	0.008	0.394
HGB	BD	0.336	1.000	0.338	1.000	0.003	0.992	0.012	0.985	0.010	0.999	0.011	0.990	0.007	0.999	0.010	0.995
	MD	0.283	0.999	0.335	1.000	0.007	0.991	0.013	0.988	0.010	0.992	0.013	0.994	0.011	0.996	0.012	0.997
	ED-v	0.022	0.546	0.027	0.192	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.061	0.000	0.000	0.000	0.053
	ED-s	0.300	0.999	0.335	1.000	0.010	0.992	0.012	0.993	0.011	0.994	0.011	0.994	0.008	0.994	0.010	0.993
	ED-o	0.307	1.000	0.365	1.000	0.010	0.992	0.012	0.993	0.011	0.994	0.011	0.994	0.008	0.994	0.010	0.993
	ED	0.077	0.986	0.096	0.975	0.001	0.991	0.001	0.991	0.001	0.993	0.001	0.992	0.001	0.994	0.001	0.992

(b) *Temporal Dependency*: Results by assuming the presence of temporal dependencies among samples (the ‘first’ samples of $\mathbb{D}$ are put in $\mathbb{T}$, while the last 20% represent $\mathbb{E}$).

TABLE 16: CICIDS17. Results against adversarial (original tpr and adversarial tpr) and unknown attacks (the tpr is the average on the ‘unknown’ attacks, while the fpr is due to training on a new $\mathbb{T}$ that does not have the ‘unknown’ class.).

Available Data		Limited (100 per class) [N=1000]				Scarce (15% of $\mathbb{D}$) [N=100]				Moderate (40% of $\mathbb{D}$) [N=100]				Abundant (80% of $\mathbb{D}$) [N=100]			
Scenario		Adversarial Attacks		Unknown Attacks		Adversarial Attacks		Unknown Attacks		Adversarial Attacks		Unknown Attacks		Adversarial Attacks		Unknown Attacks	
Alg.	Design	tpr (org)	tpr (adv)	fpr	tpr	tpr (org)	tpr (adv)	fpr	tpr	tpr (org)	tpr (adv)	fpr	tpr	tpr (org)	tpr (adv)	fpr	tpr
RF	BD	0.999±0.001	0.742±0.221	0.099±0.027	0.787±0.075	0.999±0.000	0.004±0.002	0.001±0.000	0.391±0.021	1.000±0.000	0.004±0.002	0.001±0.000	0.366±0.020	1.000±0.000	0.004±0.001	0.001±0.000	0.338±0.016
	MD	0.999±0.001	0.431±0.190	0.065±0.019	0.580±0.070	0.999±0.000	0.002±0.002	0.001±0.000	0.327±0.017	1.000±0.000	0.002±0.002	0.001±0.000	0.308±0.016	1.000±0.000	0.002±0.002	0.001±0.000	0.288±0.013
	ED-v	0.024±0.061	0.000±0.000	0.000±0.000	0.000±0.003	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000
	ED-s	0.998±0.001	0.496±0.232	0.070±0.021	0.598±0.058	0.999±0.000	0.003±0.002	0.001±0.000	0.325±0.018	1.000±0.000	0.003±0.002	0.001±0.000	0.301±0.020	1.000±0.000	0.002±0.002	0.001±0.000	0.267±0.020
	ED-o	0.998±0.001	0.515±0.219	0.072±0.022	0.600±0.058	0.999±0.000	0.003±0.002	0.001±0.000	0.325±0.018	1.000±0.000	0.003±0.002	0.001±0.000	0.301±0.020	1.000±0.000	0.002±0.002	0.001±0.000	0.267±0.020
DT	BD	0.997±0.004	0.745±0.295	0.095±0.020	0.695±0.097	0.999±0.000	0.015±0.018	0.001±0.000	0.321±0.062	1.000±0.000	0.011±0.008	0.001±0.000	0.325±0.063	1.000±0.000	0.015±0.019	0.001±0.000	0.347±0.064
	MD	0.996±0.003	0.690±0.285	0.117±0.022	0.659±0.091	0.999±0.000	0.532±0.155	0.001±0.000	0.359±0.078	1.000±0.000	0.456±0.232	0.001±0.000	0.360±0.075	1.000±0.000	0.416±0.255	0.001±0.000	0.369±0.072
	ED-v	0.113±0.135	0.027±0.103	0.000±0.001	0.017±0.040	0.000±0.003	0.000±0.000	0.000±0.000	0.000±0.001	0.001±0.012	0.000±0.001	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.001	0.000±0.000	0.000±0.000
	ED-s	0.997±0.003	0.804±0.244	0.123±0.028	0.703±0.077	0.999±0.000	0.788±0.326	0.001±0.000	0.411±0.044	1.000±0.000	0.705±0.371	0.001±0.000	0.385±0.057	1.000±0.000	0.503±0.398	0.001±0.000	0.372±0.048
	ED-o	0.997±0.003	0.856±0.194	0.139±0.029	0.731±0.078	0.999±0.000	0.788±0.326	0.001±0.000	0.411±0.044	1.000±0.000	0.705±0.371	0.001±0.000	0.385±0.057	1.000±0.000	0.503±0.398	0.001±0.000	0.372±0.048
LR	BD	0.999±0.032	0.835±0.351	0.441±0.109	0.864±0.046	0.097±0.289	0.001±0.012	0.100±0.002	0.377±0.017	0.108±0.304	0.000±0.000	0.099±0.001	0.375±0.016	0.221±0.404	0.000±0.000	0.099±0.002	0.371±0.012
	MD	0.980±0.086	0.959±0.141	0.602±0.053	0.829±0.042	0.000±0.001	0.004±0.039	0.076±0.002	0.371±0.022	0.000±0.001	0.000±0.001	0.075±0.001	0.362±0.024	0.004±0.037	0.000±0.000	0.075±0.001	0.361±0.021
	ED-v	0.094±0.124	0.000±0.000	0.001±0.002	0.002±0.009	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000
	ED-s	0.998±0.005	0.581±0.401	0.202±0.072	0.694±0.223	0.634±0.206	0.000±0.000	0.041±0.002	0.381±0.051	0.563±0.209	0.000±0.000	0.042±0.002	0.369±0.038	0.620±0.194	0.000±0.000	0.042±0.002	0.359±0.034
	ED-o	0.997±0.025	0.564±0.389	0.222±0.032	0.768±0.081	0.642±0.207	0.000±0.000	0.045±0.003	0.461±0.055	0.571±0.209	0.000±0.000	0.045±0.002	0.451±0.042	0.629±0.193	0.000±0.000	0.045±0.002	0.434±0.034
HGB	BD	0.999±0.001	0.796±0.270	0.068±0.023	0.748±0.071	0.999±0.000	0.012±0.042	0.001±0.000	0.455±0.021	1.000±0.000	0.019±0.085	0.001±0.000	0.465±0.018	1.000±0.000	0.032±0.113	0.001±0.000	0.468±0.018
	MD	0.998±0.002	0.668±0.246	0.046±0.017	0.685±0.062	0.998±0.001	0.623±0.383	0.005±0.001	0.307±0.043	0.999±0.000	0.777±0.338	0.003±0.000	0.327±0.046	0.999±0.000	0.851±0.271	0.002±0.000	0.315±0.049
	ED-v	0.045±0.060	0.007±0.046	0.000±0.000	0.009±0.022	0.045±0.075	0.000±0.000	0.000±0.000	0.000±0.000	0.046±0.070	0.000±0.000	0.000±0.000	0.000±0.000	0.063±0.076	0.000±0.000	0.000±0.000	0.000±0.000
	ED-s	0.996±0.003	0.768±0.252	0.079±0.025	0.681±0.077	0.999±0.001	0.586±0.443	0.001±0.000	0.354±0.046	0.999±0.001	0.510±0.426	0.001±0.000	0.326±0.049	0.999±0.001	0.604±0.436	0.001±0.000	0.310±0.051
	ED-o	0.997±0.002	0.807±0.235	0.088±0.026	0.692±0.079	0.999±0.001	0.617±0.435	0.002±0.000	0.354±0.046	0.999±0.001	0.510±0.426	0.001±0.000	0.326±0.049	1.000±0.000	0.626±0.428	0.001±0.000	0.311±0.051

(a) *Static Dependency*: Results by assuming the absence of temporal dependencies among samples ($\mathbb{T}$ and $\mathbb{E}$ are randomly sampled from $\mathbb{D}$).

Available Data		Limited (100 per class) [N=1]				Scarce (15% of $\mathbb{D}$) [N=1]				Moderate (40% of $\mathbb{D}$) [N=1]				Abundant (80% of $\mathbb{D}$) [N=1]			
Scenario		Adversarial Attacks		Unknown Attacks		Adversarial Attacks		Unknown Attacks		Adversarial Attacks		Unknown Attacks		Adversarial Attacks		Unknown Attacks	
Alg.	Design	tpr (org)	tpr (adv)	fpr	tpr	tpr (org)	tpr (adv)	fpr	tpr	tpr (org)	tpr (adv)	fpr	tpr	tpr (org)	tpr (adv)	fpr	tpr
RF	BD	1.000	1.000	0.325	0.799	0.990	0.000	0.009	0.363	0.994	0.005	0.009	0.318	0.994	0.005	0.006	0.260
	MD	1.000	0.999	0.171	0.663	0.989	0.000	0.009	0.301	0.994	0.000	0.009	0.202	0.994	0.000	0.007	0.190
	ED-v	0.440	0.570	0.000	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ED-s	0.999	1.000	0.154	0.530	0.989	0.000	0.009	0.265	0.993	0.000	0.009	0.207	0.994	0.000	0.006	0.147
	ED-o	0.999	1.000	0.165	0.578	0.989	0.000	0.009	0.265	0.993	0.000	0.009	0.207	0.994	0.000	0.006	0.147
DT	BD	0.999	0.986	0.330	0.775	0.989	0.027	0.009	0.231	0.988	0.006	0.006	0.241	0.994	0.010	0.006	0.269
	MD	0.993	0.711	0.193	0.823	0.993	0.578	0.009	0.176	0.997	0.390	0.010	0.367	0.994	0.568	0.007	0.312
	ED-v	0.248	0.000	0.002	0.132	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ED-s	1.000	0.628	0.171	0.710	0.992	1.000	0.009	0.372	0.991	0.025	0.011	0.279	0.996	0.035	0.007	0.317
	ED-o	1.000	0.628	0.182	0.710	0.992	1.000	0.009	0.372	0.991	0.025	0.011	0.279	0.996	0.035	0.007	0.317
LR	BD	1.000	0.981	0.294	0.758	0.974	0.000	0.052	0.348	0.000	0.000	0.052	0.367	0.972	0.001	0.055	0.375
	MD	0.989	0.610	0.334	0.792	0.000	0.000	0.043	0.321	0.000	0.000	0.037	0.348	0.000	0.000	0.037	0.337
	ED-v	0.599	0.232	0.030	0.057	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ED-s	0.999	0.924	0.304	0.781	0.602	0.000	0.027	0.514	0.596	0.000	0.025	0.358	0.388	0.000	0.024	0.456
	ED-o	0.999	0.961	0.314	0.788	0.603	0.000	0.031	0.533	0.597	0.000	0.031	0.452	0.399	0.000	0.028	0.549
HGB	BD	1.000	1.000	0.330	0.890	0.985	0.000	0.003	0.336	0.990	0.005	0.007	0.440	0.995	0.000	0.006	0.407
	MD	1.000	0.568	0.292	0.887	0.988	0.668	0.009	0.177	0.994	1.000	0.011	0.264	0.997	0.896	0.009	0.252
	ED-v	0.192	0.000	0.013	0.162	0.002	0.000	0.000	0.000	0.061	0.000	0.000	0.000	0.053	0.000	0.000	0.000
	ED-s	1.000	0.635	0.287	0.861	0.993	1.000	0.009	0.267	0.994	0.006	0.009	0.310	0.993	1.000	0.007	0.152
	ED-o	1.000	0.760	0.295	0.871	0.993	1.000	0.009	0.267	0.994	0.006	0.009	0.310	0.993	1.000	0.007	0.152

(b) *Temporal Dependency*: Results by assuming the presence of temporal dependencies among samples (the ‘first’ samples of $\mathbb{D}$ are put in $\mathbb{T}$, while the last 20% represent $\mathbb{E}$).

TABLE 17: `CTU13` Multi-classification results. Cells report the (average) Accuracy (and std. dev.) computed exclusively on the malicious samples.

Available Data		Limited (100 per class)				Scarce (15% of $\mathbb{D}$)				Moderate (40% of $\mathbb{D}$)				Abundant (80% of $\mathbb{D}$)			
Dependency		Static [N=1000]		Temporal [N=1]		Static [N=1000]		Temporal [N=1]		Static [N=1000]		Temporal [N=1]		Static [N=1000]		Temporal [N=1]	
Alg.	Design	Complete	Essential	Complete	Essential	Complete	Essential	Complete	Essential	Complete	Essential	Complete	Essential	Complete	Essential	Complete	Essential
RF	BMD	0.742±0.021	0.722±0.017	0.734	0.697	0.893±0.001	0.877±0.001	0.895	0.878	0.897±0.001	0.880±0.001	0.899	0.882	0.900±0.001	0.884±0.001	0.900	0.884
	MD	0.741±0.021	0.706±0.018	0.740	0.678	0.892±0.001	0.858±0.001	0.893	0.859	0.896±0.001	0.865±0.001	0.898	0.865	0.900±0.001	0.869±0.001	0.900	0.870
DT	BMD	0.705±0.022	0.691±0.018	0.757	0.703	0.879±0.001	0.864±0.001	0.878	0.864	0.884±0.001	0.869±0.001	0.884	0.869	0.889±0.001	0.874±0.001	0.889	0.874
	MD	0.701±0.022	0.667±0.019	0.728	0.695	0.876±0.001	0.840±0.002	0.876	0.842	0.882±0.001	0.848±0.001	0.883	0.850	0.887±0.001	0.855±0.001	0.887	0.855
LR	BMD	0.429±0.037	0.531±0.111	0.428	0.484	0.774±0.040	0.729±0.085	0.714	0.622	0.776±0.024	0.722±0.081	0.768	0.805	0.776±0.024	0.753±0.091	0.766	0.702
	MD	0.362±0.042	0.508±0.117	0.405	0.476	0.048±0.105	0.354±0.036	0.001	0.370	0.017±0.049	0.354±0.033	0.001	0.290	0.015±0.033	0.350±0.036	0.001	0.374
HGB	BMD	0.727±0.022	0.701±0.020	0.731	0.707	0.906±0.004	0.883±0.026	0.904	0.884	0.907±0.003	0.886±0.006	0.907	0.886	0.907±0.002	0.886±0.002	0.908	0.886
	MD	0.727±0.021	0.686±0.019	0.728	0.694	0.899±0.003	0.846±0.007	0.899	0.842	0.901±0.002	0.845±0.006	0.902	0.841	0.902±0.003	0.844±0.006	0.901	0.846

TABLE 18: `GTCS` Multi-classification results. Cells report the (average) Accuracy (and std. dev.) computed exclusively on the malicious samples.

Available Data		Limited (100 per class)				Scarce (15% of $\mathbb{D}$)				Moderate (40% of $\mathbb{D}$)				Abundant (80% of $\mathbb{D}$)			
Dependency		Static [N=1000]		Temporal [N=1]		Static [N=1000]		Temporal [N=1]		Static [N=1000]		Temporal [N=1]		Static [N=1000]		Temporal [N=1]	
Alg.	Design	Complete	Essential	Complete	Essential	Complete	Essential	Complete	Essential	Complete	Essential	Complete	Essential	Complete	Essential	Complete	Essential
RF	BMD	0.995±0.002	0.990±0.003	0.985	0.972	1.000±0.000	0.997±0.000	1.000	0.997	1.000±0.000	0.997±0.000	1.000	0.997	1.000±0.000	0.997±0.000	1.000	0.997
	MD	0.970±0.009	0.961±0.008	0.935	0.940	0.992±0.001	0.972±0.006	0.984	0.924	0.993±0.000	0.977±0.004	0.993	0.971	0.994±0.000	0.977±0.003	0.994	0.974
DT	BMD	0.991±0.003	0.984±0.005	0.966	0.960	1.000±0.000	0.996±0.000	0.999	0.996	1.000±0.000	0.996±0.000	1.000	0.996	1.000±0.000	0.997±0.000	1.000	0.997
	MD	0.971±0.008	0.940±0.010	0.942	0.918	0.988±0.001	0.960±0.001	0.981	0.947	0.990±0.000	0.963±0.003	0.989	0.960	0.991±0.000	0.963±0.001	0.990	0.961
LR	BMD	0.066±0.220	0.961±0.044	0.000	0.939	0.000±0.000	0.963±0.004	0.000	0.963	0.000±0.000	0.944±0.135	0.000	0.963	0.000±0.000	0.964±0.005	0.000	0.966
	MD	0.030±0.061	0.927±0.048	0.017	0.921	0.000±0.002	0.846±0.016	0.000	0.870	0.000±0.002	0.829±0.120	0.000	0.839	0.000±0.002	0.844±0.015	0.000	0.851
HGB	BMD	0.994±0.003	0.984±0.006	0.972	0.978	1.000±0.000	0.997±0.000	1.000	0.997	1.000±0.000	0.997±0.000	1.000	0.998	1.000±0.000	0.997±0.001	1.000	0.998
	MD	0.982±0.006	0.946±0.009	0.980	0.932	0.996±0.000	0.976±0.001	0.980	0.932	0.997±0.000	0.978±0.002	0.997	0.980	0.998±0.000	0.979±0.001	0.998	0.980

TABLE 19: `NB15` Multi-classification results. Cells report the (average) Accuracy (and std. dev.) computed exclusively on the malicious samples.

Available Data		Limited (100 per class)				Scarce (15% of $\mathbb{D}$)				Moderate (40% of $\mathbb{D}$)				Abundant (80% of $\mathbb{D}$)			
Dependency		Static [N=1000]		Temporal [N=1]		Static [N=1000]		Temporal [N=1]		Static [N=1000]		Temporal [N=1]		Static [N=1000]		Temporal [N=1]	
Alg.	Design	Complete	Essential	Complete	Essential	Complete	Essential	Complete	Essential	Complete	Essential	Complete	Essential	Complete	Essential	Complete	Essential
RF	BMD	0.572±0.014	0.572±0.015	0.571	0.578	0.698±0.003	0.696±0.003	0.571	0.578	0.710±0.003	0.708±0.003	0.571	0.578	0.712±0.003	0.710±0.003	0.712	0.711
	MD	0.572±0.015	0.571±0.016	0.570	0.575	0.688±0.004	0.685±0.004	0.685	0.680	0.701±0.003	0.697±0.004	0.701	0.697	0.703±0.003	0.700±0.003	0.703	0.699
DT	BMD	0.524±0.017	0.519±0.017	0.523	0.527	0.668±0.004	0.668±0.004	0.667	0.666	0.683±0.003	0.683±0.003	0.686	0.684	0.687±0.003	0.686±0.002	0.690	0.691
	MD	0.521±0.018	0.515±0.017	0.518	0.522	0.641±0.005	0.639±0.004	0.641	0.638	0.658±0.004	0.657±0.003	0.660	0.659	0.664±0.003	0.662±0.004	0.668	0.667
LR	BMD	0.224±0.062	0.329±0.076	0.274	0.360	0.266±0.039	0.439±0.024	0.236	0.411	0.267±0.030	0.437±0.023	0.263	0.456	0.261±0.025	0.438±0.026	0.256	0.408
	MD	0.185±0.074	0.260±0.091	0.118	0.313	0.003±0.006	0.011±0.013	0.003	0.004	0.003±0.006	0.009±0.012	0.003	0.002	0.004±0.006	0.011±0.010	0.002	0.017
HGB	BMD	0.568±0.012	0.562±0.013	0.585	0.573	0.721±0.003	0.718±0.003	0.721	0.715	0.731±0.003	0.727±0.003	0.728	0.724	0.737±0.003	0.733±0.003	0.739	0.734
	MD	0.566±0.013	0.558±0.013	0.577	0.569	0.697±0.006	0.691±0.006	0.696	0.698	0.711±0.004	0.704±0.004	0.705	0.698	0.716±0.004	0.708±0.004	0.718	0.711

TABLE 20: `UF-NB15` Multi-classification results. Cells report the (average) Accuracy (and std. dev.) computed exclusively on the malicious samples.

Available Data		Limited (100 per class)				Scarce (15% of $\mathbb{D}$)				Moderate (40% of $\mathbb{D}$)				Abundant (80% of $\mathbb{D}$)			
Dependency		Static [N=1000]		Temporal [N=1]		Static [N=1000]		Temporal [N=1]		Static [N=1000]		Temporal [N=1]		Static [N=1000]		Temporal [N=1]	
Alg.	Design	Complete	Essential	Complete	Essential	Complete	Essential	Complete	Essential	Complete	Essential	Complete	Essential	Complete	Essential	Complete	Essential
RF	BMD	0.676±0.015	0.657±0.015	0.691	0.667	0.784±0.003	0.767±0.003	0.787	0.769	0.791±0.003	0.776±0.003	0.791	0.777	0.788±0.003	0.775±0.003	0.787	0.772
	MD	0.675±0.017	0.645±0.019	0.688	0.662	0.776±0.003	0.757±0.003	0.779	0.760	0.784±0.003	0.767±0.004	0.785	0.766	0.781±0.003	0.766±0.003	0.779	0.763
DT	BMD	0.641±0.018	0.627±0.017	0.657	0.635	0.766±0.003	0.752±0.004	0.768	0.755	0.777±0.003	0.764±0.003	0.779	0.767	0.778±0.003	0.765±0.003	0.774	0.763
	MD	0.639±0.018	0.613±0.019	0.640	0.615	0.751±0.004	0.733±0.005	0.751	0.735	0.763±0.004	0.748±0.004	0.765	0.751	0.764±0.004	0.751±0.004	0.762	0.750
LR	BMD	0.382±0.075	0.322±0.073	0.351	0.316	0.236±0.147	0.214±0.050	0.176	0.261	0.180±0.096	0.198±0.057	0.155	0.258	0.185±0.110	0.180±0.058	0.140	0.140
	MD	0.295±0.100	0.281±0.083	0.221	0.210	0.088±0.007	0.038±0.011	0.087	0.035	0.087±0.006	0.041±0.011	0.087	0.040	0.088±0.006	0.043±0.011	0.090	0.035
HGB	BMD	0.667±0.017	0.646±0.017	0.659	0.644	0.788±0.003	0.768±0.003	0.784	0.762	0.797±0.003	0.778±0.003	0.797	0.777	0.801±0.003	0.782±0.003	0.803	0.786
	MD	0.666±0.017	0.637±0.018	0.659	0.623	0.757±0.006	0.724±0.013	0.752	0.718	0.767±0.005	0.734±0.006	0.764	0.740	0.772±0.007	0.740±0.006	0.775	0.745

TABLE 21: `CICIDS17` Multi-classification results. Cells report the (average) Accuracy (and std. dev.) computed exclusively on the malicious samples.

Available Data		Limited (100 per class)				Scarce (15% of $\mathbb{D}$)				Moderate (40% of $\mathbb{D}$)				Abundant (80% of $\mathbb{D}$)			
Dependency		Static [N=1000]		Temporal [N=1]		Static [N=1000]		Temporal [N=1]		Static [N=1000]		Temporal [N=1]		Static [N=1000]		Temporal [N=1]	
Alg.	Design	Complete	Essential	Complete	Essential	Complete	Essential	Complete	Essential	Complete	Essential	Complete	Essential	Complete	Essential	Complete	Essential
RF	BMD	0.998±0.003	0.998±0.001	0.986	0.985	1.000±0.000	1.000±0.000	0.999	0.999	1.000±0.000	1.000±0.000	0.999	0.998	1.000±0.000	1.000±0.000	0.999	0.999
	MD	0.996±0.003	0.997±0.002	0.984	0.988	0.999±0.000	0.999±0.000	0.989	0.989	1.000±0.000	1.000±0.000	0.992	0.993	1.000±0.000	1.000±0.000	0.993	0.993
DT	BMD	0.997±0.002	0.994±0.003	0.931	0.787	1.000±0.000	1.000±0.000	0.999	0.997	1.000±0.000	1.000±0.000	0.997	0.996	1.000±0.000	1.000±0.000	0.998	0.997
	MD	0.995±0.004	0.991±0.004	0.969	0.972	0.999±0.000	0.999±0.000	0.987	0.992	1.000±0.000	1.000±0.000	0.992	0.993	1.000±0.000	1.000±0.000	0.995	0.991
LR	BMD	0.939±0.010	0.171±0.251	0.883	0.007	0.962±0.005	0.553±0.482	0.960	0.977	0.963±0.004	0.528±0.488	0.966	1.000	0.962±0.004	0.550±0.476	0.971	0.980
	MD	0.938±0.018	0.147±0.229	0.547	0.006	0.907±0.005	0.003±0.003	0.892	0.002	0.908±0.004	0.003±0.002	0.906	0.002	0.907±0.004	0.003±0.002	0.901	0.002
HGB	BMD	0.997±0.003	0.996±0.003	0.978	0.984	0.993±0.003	0.989±0.004	0.993	0.985	0.994±0.002	0.992±0.004	0.994	0.993	0.995±0.003	0.994±0.004	0.991	0.990
	MD	0.995±0.003	0.995±0.003	0.980	0.985	0.996±0.001	0.996±0.002	0.987	0.985	0.997±0.001	0.997±0.002	0.989	0.989	0.998±0.001	0.998±0.002	0.993	0.993

TABLE 22: `CTU13` Runtime (in seconds) for training the ML-NIDS on the *high-end* platform..

Available Data		Limited (100 per class) [N=1000]		Scarce (15% of $\mathbb{D}$) [N=100]		Moderate (40% of $\mathbb{D}$) [N=100]		Abundant (80% of $\mathbb{D}$) [N=100]	
Alg. CPU	Design	Complete	Essential	Complete	Essential	Complete	Essential	Complete	Essential
RF all cores	BD	0.82±0.014	0.33±0.011	1.71±0.036	0.59±0.123	4.94±0.082	1.94±0.783	11.72±0.330	5.67±0.465
	MD	0.86±0.017	0.86±0.014	1.84±0.048	1.70±0.076	5.06±0.075	4.00±0.068	11.57±0.324	9.11±0.305
	ED	4.25±0.047	4.31±0.042	6.84±0.080	6.99±0.107	16.44±0.163	12.83±0.164	37.44±0.957	29.01±0.718
	ED-s	5.92±0.070	5.98±0.067	10.53±0.141	9.72±0.184	23.28±0.187	17.71±0.212	50.05±1.112	37.57±0.796
DT one core	BD	0.00±0.000	0.00±0.000	0.89±0.060	0.16±0.001	2.39±0.175	0.95±0.201	5.58±0.510	1.87±0.653
	MD	0.01±0.000	0.00±0.000	0.85±0.038	0.37±0.023	2.25±0.118	0.97±0.072	5.15±0.435	2.23±0.246
	ED	0.02±0.001	0.01±0.001	2.80±0.126	1.24±0.072	6.94±0.326	3.27±0.223	15.46±1.244	7.62±0.778
	ED-s	0.03±0.001	0.02±0.001	3.85±0.148	1.33±0.075	9.15±0.376	3.52±0.230	20.05±1.537	8.15±0.800
LR all cores	BD	0.08±0.385	0.01±0.001	7.08±0.931	3.44±0.873	23.76±6.714	11.34±4.351	47.84±12.698	21.85±14.564
	MD	0.11±0.026	0.11±0.030	10.04±1.527	9.64±1.729	25.77±6.915	27.96±8.821	52.06±14.071	56.45±15.916
	ED	0.22±0.155	0.18±0.133	30.75±3.091	12.33±1.232	117.02±30.614	35.94±9.819	243.77±66.388	95.58±26.226
	ED-s	0.26±0.186	0.21±0.133	32.45±3.079	12.84±1.231	120.31±31.382	37.07±10.086	249.68±67.708	97.72±26.740
HGB all cores	BD	0.33±0.041	0.01±0.012	1.52±0.136	0.64±0.191	2.75±0.176	0.99±0.033	4.72±0.240	1.95±0.547
	MD	2.25±0.699	1.80±0.120	2.04±0.470	1.93±0.474	3.88±0.679	3.14±0.706	5.94±1.166	4.81±0.857
	ED	0.66±0.063	0.58±0.057	6.90±0.360	5.20±0.341	12.41±0.320	9.23±0.563	19.80±0.458	14.44±0.936
	ED-s	0.76±0.071	0.72±0.067	9.30±0.379	6.32±0.343	17.69±0.364	11.73±0.628	30.29±0.622	19.20±1.033

TABLE 23: `GTCS`: Runtime (in seconds) for training the ML-NIDS on the *high-end* platform..

Available Data		Limited (100 per class) [N=1000]		Scarce (15% of $\mathbb{D}$) [N=100]		Moderate (40% of $\mathbb{D}$) [N=100]		Abundant (80% of $\mathbb{D}$) [N=100]	
Alg. CPU	Design	Complete	Essential	Complete	Essential	Complete	Essential	Complete	Essential
RF all cores	BD	0.79±0.050	0.29±0.043	1.46±0.033	1.63±0.047	4.35±1.474	2.81±0.784	9.69±0.195	5.38±0.334
	MD	0.81±0.053	0.81±0.051	1.41±0.043	1.07±0.043	3.92±1.304	2.40±0.706	8.57±0.165	4.89±0.096
	ED	2.81±0.129	2.87±0.131	4.17±0.056	4.14±0.085	6.41±1.188	4.39±0.636	12.60±0.211	7.14±0.110
	ED-s	4.10±0.203	4.17±0.205	7.40±0.079	6.36±0.092	12.53±1.637	7.65±1.181	23.11±0.383	11.77±0.121
DT one core	BD	0.01±0.001	0.01±0.001	1.11±0.056	0.33±0.074	3.19±0.209	0.94±0.114	7.15±0.576	2.11±0.674
	MD	0.01±0.000	0.00±0.000	1.02±0.048	0.42±0.017	2.90±0.181	1.15±0.081	6.41±0.476	2.52±0.208
	ED	0.02±0.001	0.01±0.000	1.27±0.028	0.54±0.018	3.50±0.230	1.48±0.097	7.63±0.393	3.29±0.262
	ED-s	0.03±0.001	0.01±0.001	2.29±0.049	0.58±0.019	6.39±0.242	1.61±0.173	13.64±0.545	3.55±0.274
LR all cores	BD	0.03±0.176	0.01±0.087	1.58±0.221	2.05±0.712	4.94±0.406	9.04±1.013	10.19±0.683	17.06±1.741
	MD	0.08±0.034	0.09±0.022	5.26±0.581	3.34±0.155	13.00±1.305	8.87±0.318	26.36±2.640	17.19±0.737
	ED	0.10±0.128	0.11±0.086	5.79±0.811	2.45±0.206	20.00±2.969	7.43±1.444	46.23±1.968	20.92±2.338
	ED-s	0.13±0.152	0.13±0.112	7.09±0.818	2.71±0.217	23.20±3.036	7.86±1.726	52.53±1.981	21.62±2.347
HGB all cores	BD	0.32±0.042	0.29±0.026	1.76±0.041	1.03±0.047	3.56±0.474	1.80±0.347	5.80±0.069	2.96±0.143
	MD	1.21±0.119	1.11±0.101	5.81±0.431	4.23±0.210	10.51±1.440	7.08±0.879	16.52±0.211	11.00±0.868
	ED	0.45±0.057	0.43±0.047	4.55±0.148	2.88±0.124	8.46±0.632	4.57±0.464	13.98±0.183	7.30±0.126
	ED-s	0.53±0.061	0.52±0.052	6.53±0.176	3.53±0.142	14.14±0.612	6.02±0.815	24.11±0.279	10.02±0.173

TABLE 24: `NB15`: Runtime (in seconds) for training the ML-NIDS on the *high-end* platform..

Available Data		Limited (100 per class) [N=1000]		Scarce (15% of $\mathbb{D}$) [N=100]		Moderate (40% of $\mathbb{D}$) [N=100]		Abundant (80% of $\mathbb{D}$) [N=100]	
Alg. CPU	Design	Complete	Essential	Complete	Essential	Complete	Essential	Complete	Essential
RF all cores	BD	0.80±0.013	0.33±0.009	1.28±0.027	1.71±0.264	3.58±0.090	3.89±0.074	8.23±0.214	8.85±0.413
	MD	0.90±0.015	0.90±0.017	1.37±0.027	1.23±0.036	3.77±0.088	3.67±0.067	8.62±0.228	9.01±0.154
	ED	4.84±0.075	4.95±0.076	7.74±0.086	8.02±0.106	18.33±0.178	16.28±0.163	42.41±0.527	38.48±0.355
	ED-s	6.66±0.099	6.77±0.101	11.53±0.104	11.23±0.113	24.74±0.207	21.48±0.169	54.48±0.552	47.50±0.441
DT one core	BD	0.00±0.001	0.00±0.001	0.65±0.040	0.60±0.074	2.06±0.860	1.37±0.368	3.89±0.671	3.70±0.234
	MD	0.01±0.000	0.01±0.000	0.70±0.045	0.66±0.070	2.19±0.853	2.19±0.963	4.16±0.788	4.32±0.965
	ED	0.02±0.001	0.02±0.001	3.53±0.180	2.11±0.114	11.31±4.645	7.11±3.002	21.57±3.615	14.09±2.499
	ED-s	0.04±0.001	0.03±0.001	4.67±0.184	2.71±0.117	14.76±6.123	8.94±3.804	28.26±4.703	17.29±3.013
LR all cores	BD	0.05±0.209	0.04±0.111	3.47±0.537	2.94±0.754	12.16±2.188	8.60±1.147	23.88±3.130	21.17±1.411
	MD	0.12±0.023	0.12±0.028	7.39±0.210	5.66±0.519	19.15±0.417	18.07±1.515	37.93±0.818	35.38±2.705
	ED	0.16±0.149	0.29±0.020	24.62±1.390	18.28±0.956	97.78±5.799	79.06±3.903	205.70±13.803	172.12±6.615
	ED-s	0.22±0.175	0.33±0.024	26.40±1.402	19.63±0.955	101.51±5.853	81.64±3.927	213.28±13.881	176.82±6.698
HGB all cores	BD	0.33±0.082	0.31±0.034	1.38±0.091	1.18±0.168	2.76±0.050	2.18±0.085	4.57±0.073	3.67±0.085
	MD	3.36±0.157	3.07±0.134	1.46±0.261	1.06±0.154	2.60±0.053	1.97±0.051	4.15±0.121	3.25±0.068
	ED	0.73±0.174	0.69±0.120	7.37±0.444	5.61±0.454	14.48±0.804	10.62±0.624	23.76±1.494	16.97±0.789
	ED-s	0.84±0.191	0.79±0.139	9.74±0.463	7.30±0.462	20.07±0.917	14.35±0.661	35.56±1.650	24.08±0.949

TABLE 25: `UF-NB15`: Runtime (in seconds) for training the ML-NIDS on the *high-end* platform..

Available Data		Limited (100 per class) [N=1000]		Scarce (15% of $\mathbb{D}$) [N=100]		Moderate (40% of $\mathbb{D}$) [N=100]		Abundant (80% of $\mathbb{D}$) [N=100]	
Alg. CPU	Design	Complete	Essential	Complete	Essential	Complete	Essential	Complete	Essential
RF all cores	BD	0.78±0.014	0.33±0.024	1.20±0.030	1.70±0.054	2.46±0.067	3.46±0.084	5.67±0.115	7.96±0.107
	MD	0.90±0.015	0.90±0.018	1.17±0.026	1.41±0.048	2.51±0.069	3.21±0.062	5.76±0.123	7.90±0.170
	ED	4.74±0.074	5.00±0.062	9.65±0.065	8.98±0.128	14.28±0.236	15.66±0.156	30.22±0.239	36.18±0.478
	ED-s	6.54±0.096	6.81±0.088	13.41±0.084	12.07±0.138	20.50±0.364	20.57±0.184	41.08±0.262	44.56±0.518
DT one core	BD	0.00±0.000	0.01±0.000	0.44±0.033	0.02±0.029	1.30±0.124	0.70±0.111	3.57±0.876	1.66±0.578
	MD	0.01±0.000	0.00±0.000	0.44±0.037	0.30±0.014	1.30±0.118	0.83±0.077	3.52±0.848	2.25±0.572
	ED	0.02±0.001	0.02±0.001	1.85±0.058	1.38±0.039	5.28±0.392	3.80±0.307	14.13±3.225	10.30±2.432
	ED-s	0.03±0.001	0.03±0.001	2.85±0.060	1.88±0.040	8.00±0.585	4.97±0.379	20.45±4.571	13.18±3.021
LR all cores	BD	0.05±0.142	0.27±0.197	4.77±0.554	2.38±0.678	21.43±3.804	11.06±2.987	45.62±5.266	27.78±4.997
	MD	0.12±0.024	0.12±0.025	6.76±0.230	5.85±0.800	18.95±1.235	18.68±3.129	36.81±1.202	39.99±4.944
	ED	0.23±0.141	0.32±0.033	31.27±1.151	13.59±1.249	132.16±10.707	53.76±8.105	292.26±13.293	127.41±14.443
	ED-s	0.28±0.168	0.36±0.035	32.95±1.159	14.79±1.267	136.07±11.071	56.08±8.263	299.48±13.352	131.67±14.515
HGB all cores	BD	0.23±0.090	0.44±0.132	1.20±0.105	1.14±0.087	2.51±0.076	2.04±0.066	4.18±0.055	3.43±0.078
	MD	3.37±0.161	3.09±0.288	1.22±0.071	0.99±0.086	2.47±0.069	1.80±0.053	3.90±0.095	3.15±0.095
	ED	0.60±0.186	0.71±0.075	5.96±0.324	5.00±0.318	13.43±0.457	9.69±0.373	22.14±0.458	16.09±0.879
	ED-s	0.69±0.198	0.84±0.090	8.16±0.364	6.51±0.347	19.52±0.649	12.91±0.441	33.33±0.564	23.01±1.345

TABLE 26: `CICIDS17`: Runtime (in seconds) for training the ML-NIDS on the *high-end* platform..

Available Data		Limited (100 per class) [N=1000]		Scarce (15% of $\mathbb{D}$) [N=100]		Moderate (40% of $\mathbb{D}$) [N=100]		Abundant (80% of $\mathbb{D}$) [N=100]	
Alg. CPU	Design	Complete	Essential	Complete	Essential	Complete	Essential	Complete	Essential
RF all cores	BD	0.84±0.015	0.23±0.008	3.33±0.048	0.94±0.103	10.11±0.157	3.47±0.098	24.20±0.549	13.20±0.341
	MD	0.86±0.016	0.85±0.017	3.73±0.055	1.42±0.055	11.16±0.151	3.58±0.050	26.21±0.656	8.68±0.156
	ED	6.19±0.113	6.21±0.120	13.40±0.165	12.26±0.086	38.33±0.424	16.47±0.159	89.38±1.622	33.09±0.369
	ED-s	8.42±0.178	8.41±0.196	21.10±0.255	16.54±0.090	54.73±0.588	24.19±0.200	121.04±1.665	48.20±0.370
DT one core	BD	0.02±0.003	0.01±0.000	4.85±0.745	0.44±0.013	12.27±1.452	1.26±0.090	24.89±2.915	2.71±0.499
	MD	0.02±0.001	0.00±0.000	4.46±0.557	0.49±0.053	11.27±0.826	1.30±0.094	22.84±4.166	2.77±0.563
	ED	0.03±0.002	0.02±0.001	13.35±1.434	2.19±0.250	37.77±2.280	5.65±0.336	81.49±15.688	12.33±1.905
	ED-s	0.07±0.003	0.04±0.002	18.02±1.835	3.31±0.336	49.31±2.592	8.24±0.442	103.94±17.805	18.16±2.597
LR all cores	BD	0.07±0.153	0.05±0.134	18.57±0.568	13.21±0.645	60.62±7.938	39.45±5.54	129.09±9.790	112.89±11.14
	MD	0.15±0.028	0.16±0.031	19.47±0.844	17.17±3.146	48.32±4.827	46.13±7.626	96.15±5.844	96.44±13.016
	ED	0.37±0.210	0.23±0.030	119.46±3.840	31.92±3.638	376.68±52.504	132.97±22.547	867.38±68.230	275.00±29.632
	ED-s	0.46±0.238	0.29±0.034	125.06±3.860	34.45±3.652	390.13±52.424	138.92±22.410	894.22±69.537	288.14±29.984
HGB all cores	BD	0.55±0.042	0.01±0.012	2.75±0.067	0.52±0.076	5.43±0.124	1.28±0.086	9.53±0.219	2.94±0.486
	MD	3.04±0.626	2.50±1.382	3.08±0.306	1.85±0.453	5.85±0.768	3.40±0.600	9.58±0.788	5.84±0.525
	ED	1.12±0.245	1.00±0.077	14.80±0.512	8.27±0.516	30.81±0.884	16.83±0.784	48.19±1.059	26.91±1.091
	ED-s	1.31±0.249	1.20±0.087	23.38±0.682	10.91±0.543	48.96±0.965	23.21±1.039	79.28±1.198	41.13±1.209

TABLE 27: `CTU13`: Runtime (in seconds) for testing (on $\mathbb{E}$) the ML-NIDS on the *high-end* platform..

Available Data		Limited (100 per class)		Scarce (20% of $\mathbb{D}$)		Moderate (40% of $\mathbb{D}$)		Abundant (80% of $\mathbb{D}$)	
Alg.	**Design**	**Complete**	**Essential**	**Complete**	**Essential**	**Complete**	**Essential**	**Complete**	**Essential**
RF	BD	0.34	0.15	0.37	0.22	0.38	0.25	0.38	0.25
	MD	0.62	0.44	0.63	0.45	0.64	0.48	0.67	0.51
	ED	2.01	0.95	2.06	1.02	2.09	1.09	2.11	1.13
	ED-s	2.15	1.09	2.19	1.13	2.20	1.21	2.24	1.25
DT	BD	0.18	0.01	0.19	0.02	0.19	0.02	0.19	0.02
	MD	0.18	0.02	0.19	0.03	0.19	0.03	0.19	0.03
	ED	1.09	0.09	1.10	0.10	1.10	0.11	1.10	0.11
	ED-s	1.06	0.07	1.08	0.09	1.07	0.10	1.07	0.11
LR	BD	0.23	0.03	0.23	0.01	0.23	0.01	0.23	0.01
	MD	0.24	0.02	0.24	0.02	0.24	0.02	0.24	0.02
	ED	1.39	0.09	1.38	0.09	1.39	0.09	1.39	0.09
	ED-s	1.41	0.07	1.41	0.07	1.40	0.07	1.41	0.08
HGB	BD	0.29	0.06	0.28	0.06	0.27	0.05	0.28	0.06
	MD	0.63	0.38	0.37	0.19	0.31	0.10	0.32	0.09
	ED	1.67	0.28	1.71	0.28	1.72	0.27	1.72	0.08
	ED-s	1.66	0.30	1.73	0.30	1.71	0.30	1.72	0.11

TABLE 28: `GTCS`: Runtime (in seconds) for testing (on $\mathbb{E}$) the ML-NIDS on the *high-end* platform..

Available Data		Limited (100 per class)		Scarce (20% of $\mathbb{D}$)		Moderate (40% of $\mathbb{D}$)		Abundant (80% of $\mathbb{D}$)	
Alg.	**Design**	**Complete**	**Essential**	**Complete**	**Essential**	**Complete**	**Essential**	**Complete**	**Essential**
RF	BD	0.48	0.11	0.50	0.12	0.51	0.13	0.52	0.14
	MD	0.56	0.20	0.55	0.19	0.55	0.19	0.56	0.19
	ED	2.00	0.68	1.97	0.50	1.97	0.49	1.97	0.50
	ED-s	2.14	0.86	2.07	0.64	2.07	0.62	2.08	0.61
DT	BD	0.34	0.01	0.35	0.02	0.35	0.02	0.36	0.02
	MD	0.34	0.01	0.35	0.02	0.35	0.02	0.36	0.02
	ED	1.35	0.04	1.39	0.05	1.38	0.05	1.41	0.05
	ED-s	1.33	0.04	1.35	0.04	1.34	0.05	1.37	0.05
LR	BD	0.39	0.01	0.40	0.01	0.40	0.01	0.40	0.01
	MD	0.40	0.02	0.41	0.02	0.40	0.02	0.41	0.02
	ED	1.57	0.06	1.60	0.06	1.59	0.06	1.61	0.06
	ED-s	1.58	0.04	1.61	0.04	1.59	0.04	1.60	0.05
HGB	BD	0.49	0.04	0.62	0.04	0.60	0.04	0.61	0.04
	MD	0.72	0.17	0.73	0.14	0.57	0.16	0.72	0.17
	ED	2.40	0.13	1.84	0.14	2.09	0.15	2.40	0.15
	ED-s	2.38	0.14	1.84	0.15	2.35	0.16	2.37	0.17

TABLE 29: `NB15`: Runtime (in seconds) for testing (on $\mathbb{E}$) the ML-NIDS on the *high-end* platform..

Available Data		Limited (100 per class)		Scarce (20% of $\mathbb{D}$)		Moderate (40% of $\mathbb{D}$)		Abundant (80% of $\mathbb{D}$)	
Alg.	**Design**	**Complete**	**Essential**	**Complete**	**Essential**	**Complete**	**Essential**	**Complete**	**Essential**
RF	BD	0.32	0.21	0.31	0.23	0.32	0.23	0.32	0.24
	MD	0.52	0.42	0.52	0.42	0.54	0.43	0.54	0.44
	ED	2.34	1.63	2.20	1.54	2.24	1.53	2.15	1.54
	ED-s	2.48	1.82	2.35	1.65	2.33	1.65	2.25	1.67
DT	BD	0.18	0.09	0.19	0.10	0.19	0.10	0.20	0.10
	MD	0.18	0.10	0.19	0.10	0.20	0.10	0.20	0.10
	ED	1.27	0.65	1.30	0.66	1.33	0.66	1.34	0.67
	ED-s	1.25	0.63	1.22	0.64	1.31	0.65	1.33	0.65
LR	BD	0.24	0.16	0.25	0.15	0.25	0.15	0.24	0.15
	MD	0.25	0.16	0.25	0.15	0.25	0.16	0.24	0.16
	ED	1.63	1.07	1.72	1.07	1.74	1.08	1.74	1.08
	ED-s	1.66	1.11	1.75	1.11	1.75	1.11	1.78	1.11
HGB	BD	0.29	0.17	0.30	0.16	0.31	0.16	0.30	0.16
	MD	0.61	0.46	0.36	0.18	0.33	0.18	0.32	0.18
	ED	2.07	1.10	2.12	1.07	2.06	1.07	2.01	1.07
	ED-s	2.00	1.10	2.07	1.07	2.07	1.07	1.94	1.07

TABLE 30: `UF-NB15`: Runtime (in seconds) for testing (on $\mathbb{E}$) the ML-NIDS on the *high-end* platform..

Available Data		Limited (100 per class)		Scarce (20% of $\mathbb{D}$)		Moderate (40% of $\mathbb{D}$)		Abundant (80% of $\mathbb{D}$)	
Alg.	**Design**	**Complete**	**Essential**	**Complete**	**Essential**	**Complete**	**Essential**	**Complete**	**Essential**
RF	BD	0.32	0.19	0.31	0.22	0.30	0.23	0.27	0.23
	MD	0.51	0.38	0.51	0.39	0.50	0.40	0.48	0.39
	ED	2.48	1.47	2.20	1.42	2.13	1.43	2.00	1.45
	ED-s	2.69	1.65	2.30	1.55	2.26	1.55	2.14	1.55
DT	BD	0.17	0.07	0.15	0.08	0.17	0.08	0.19	0.08
	MD	0.17	0.08	0.16	0.08	0.18	0.08	0.19	0.08
	ED	1.18	0.50	1.08	0.53	1.20	0.53	1.23	0.53
	ED-s	1.15	0.49	1.04	0.51	1.17	0.52	1.17	0.52.
LR	BD	0.24	0.14	0.21	0.14	0.24	0.14	0.25	0.14
	MD	0.25	0.14	0.22	0.14	0.25	0.14	0.25	0.14
	ED	1.68	0.94	1.48	0.95	1.72	0.96	1.75	0.96
	ED-s	1.73	0.99	1.48	0.99	1.74	0.99	1.77	0.99
HGB	BD	0.35	0.14	0.34	0.14	0.33	0.14	0.25	0.14
	MD	0.64	0.41	0.37	0.16	0.36	0.16	0.27	0.15
	ED	1.82	0.88	2.03	0.85	2.24	0.87	2.29	0.86
	ED-s	2.29	0.88	1.65	0.86	2.27	0.87	2.41	0.87

TABLE 31: `CICIDS17`: Runtime (in seconds) for testing (on $\mathbb{E}$) the ML-NIDS on the *high-end* platform..

Available Data		Limited (100 per class)		Scarce (20% of $\mathbb{D}$)		Moderate (40% of $\mathbb{D}$)		Abundant (80% of $\mathbb{D}$)	
Alg.	**Design**	**Complete**	**Essential**	**Complete**	**Essential**	**Complete**	**Essential**	**Complete**	**Essential**
RF	BD	0.79	0.29	0.82	0.30	0.83	0.31	0.82	0.31
	MD	1.30	0.81	1.30	0.81	1.31	0.79	1.28	0.77
	ED	7.19	2.73	7.04	2.65	6.96	2.65	7.04	2.68
	ED-s	7.23	2.82	7.03	2.79	7.16	2.80	7.03	2.80
DT	BD	0.61	0.25	0.65	0.14	0.62	0.14	0.62	0.14
	MD	0.61	0.65	0.67	0.14	0.62	0.14	0.62	0.14
	ED	5.47	2.05	5.87	1.20	5.50	1.20	5.52	1.21
	ED-s	5.33	2.04	5.80	1.17	5.35	1.17	5.40	1.17
LR	BD	0.65	0.19	0.63	0.19	0.66	0.19	0.65	0.19
	MD	0.66	0.20	0.64	0.20	0.67	0.20	0.66	0.20
	ED	5.80	1.75	5.64	1.72	5.71	1.71	5.79	1.76
	ED-s	5.77	1.77	5.47	1.74	5.68	1.73	5.78	1.77
HGB	BD	1.10	0.14	1.14	0.23	1.09	0.23	1.09	0.24
	MD	1.59	0.14	1.05	0.29	1.14	0.29	1.13	0.29
	ED	9.57	1.20	9.64	2.01	9.66	1.97	9.61	2.03
	ED-s	9.64	1.17	9.59	2.00	9.62	1.98	9.57	1.94

TABLE 32: Runtime (training and testing) on the other platforms (for the `GTCS` dataset).

Available Data		Limited (100 per class)				Scarce (20% of $\mathbb{D}$)				Moderate (40% of $\mathbb{D}$)				Abundant (80% of $\mathbb{D}$)			
Feature Set		Complete		Essential		Complete		Essential		Complete		Essential		Complete		Essential	
Alg. CPU	Design	Train	Test	Train	Test	Train	Test	Train	Test	Train	Test	Train	Test	Train	Test	Train	Test
RF all cores	BD	0.22	0.51	0.21	0.20	3.04	0.64	1.81	0.26	9.74	0.66	5.55	0.31	23.30	0.68	13.49	0.32
	MD	0.22	0.65	0.21	0.34	2.93	0.75	2.19	0.40	9.01	0.75	6.55	0.40	21.22	0.77	14.74	0.41
	ED	0.82	1.95	0.85	0.82	4.41	2.17	3.26	0.97	11.28	2.13	7.97	0.94	26.94	2.16	17.74	0.95
	ED-s	0.91	2.04	0.97	1.00	5.67	2.24	3.97	1.13	13.45	2.25	10.17	1.11	31.57	2.25	26.41	1.088
DT all cores	BD	0.00	0.32	0.00	0.02	1.02	0.31	0.40	0.02	3.24	0.31	1.09	0.02	6.84	0.31	2.11	0.03
	MD	0.00	0.32	0.00	0.02	1.01	0.31	0.41	0.03	2.76	0.32	1.13	0.03	6.33	0.31	2.51	0.03
	ED	0.01	1.27	0.01	0.07	1.26	1.24	0.54	0.08	3.49	1.23	1.51	0.08	7.39	1.22	3.23	0.08
	ED-s	0.02	1.23	0.01	0.06	1.67	1.19	0.64	0.06	4.97	1.18	1.97	0.06	9.87	1.18	4.21	0.07
LR all cores	BD	0.89	0.36	0.40	0.02	2.30	0.35	3.21	0.01	5.13	0.34	7.42	0.01	9.51	0.34	14.61	0.01
	MD	0.40	0.37	0.42	0.02	5.83	0.35	3.86	0.02	8.94	0.35	8.77	0.02	25.71	0.34	17.41	0.02
	ED	1.51	1.43	0.79	0.06	8.17	1.38	4.93	0.06	24.78	1.36	12.04	0.06	45.98	1.35	21.05	0.06
	ED-s	1.87	1.38	0.97	0.05	10.47	1.35	5.98	0.04	27.87	1.31	16.47	0.04	56.87	1.30	27.14	0.05
HGB one core	BD	1.05	0.45	0.47	0.16	3.97	0.47	1.72	0.17	6.28	0.45	2.77	0.14	10.14	0.45	4.66	0.14
	MD	3.83	0.88	2.13	0.70	14.91	0.96	7.57	0.69	22.49	0.91	11.20	0.61	35.24	0.88	18.32	0.61
	ED	1.22	1.64	0.63	0.44	8.81	1.78	4.53	0.52	14.18	1.74	6.66	0.50	22.87	1.72	10.34	0.52
	ED-s	1.67	1.68	0.87	0.50	11.17	1.86	5.98	0.58	17.84	1.78	9.74	0.56	29.84	1.77	14.64	0.57

(a) *Workstation*: Intel Core-i7 10750HQ@2.6GHz (12 cores) with 32GB RAM. The OS is Windows 10.

Available Data		Limited (100 per class)				Scarce (20% of $\mathbb{D}$)				Moderate (40% of $\mathbb{D}$)				Abundant (80% of $\mathbb{D}$)			
Feature Set		Complete		Essential		Complete		Essential		Complete		Essential		Complete		Essential	
Alg. CPU	Design	Train	Test	Train	Test	Train	Test	Train	Test	Train	Test	Train	Test	Train	Test	Train	Test
RF all cores	BD	0.29	0.29	0.25	0.67	6.88	1.34	4.42	0.69	20.43	1.38	12.63	0.70	44.47	1.35	30.25	0.75
	MD	1.11	0.26	0.26	1.56	6.09	1.44	4.53	0.88	18.35	1.46	12.71	0.86	39.60	1.47	30.45	0.91
	ED	1.04	3.29	0.96	2.15	8.50	4.27	6.14	2.21	21.74	3.91	15.35	2.13	41.26	3.97	37.01	2.18
	ED-s	1.24	3.50	1.07	2.22	10.14	4.58	8.94	2.62	29.87	4.22	19.87	2.50	56.12	4.23	50.65	2.55
DT one core	BD	0.01	0.40	0.01	0.02	1.44	0.47	0.42	0.03	3.44	0.40	1.17	0.03	7.59	0.39	2.50	0.03
	MD	0.00	0.40	0.01	0.03	1.26	0.47	0.45	0.03	3.15	0.41	1.29	0.03	7.18	0.40	2.76	0.03
	ED	0.02	1.60	0.04	0.09	1.64	1.83	0.59	0.10	4.03	1.61	1.67	0.09	8.33	1.58	3.67	0.01
	ED-s	0.02	1.56	0.05	0.07	1.99	1.80	0.75	0.08	6.15	1.55	2.01	0.08	11.45	1.52	4.97	0.08
LR all cores	BD	1.25	0.40	0.03	0.02	2.84	0.46	4.11	0.02	6.78	0.41	8.75	0.02	11.08	0.39	17.61	0.02
	MD	0.92	0.41	0.04	0.02	5.92	0.50	5.71	0.02	15.99	0.41	11.33	0.02	32.88	0.40	22.04	0.02
	ED	0.92	1.60	0.06	0.07	11.81	1.74	6.39	0.08	26.30	1.63	12.78	0.07	49.36	1.58	29.04	0.06
	ED-s	1.26	1.55	0.08	0.05	14.64	1.63	9.45	0.06	33.14	1.56	17.64	0.05	59.45	1.52	37.64	0.05
HGB all cores	BD	0.40	0.67	0.36	0.36	4.13	0.82	1.69	0.41	6.78	0.71	2.72	0.28	12.12	0.68	5.12	0.28
	MD	1.32	1.56	1.34	1.67	14.14	2.05	6.68	1.64	21.67	1.69	9.99	1.27	39.49	1.67	19.24	1.28
	ED	0.46	2.15	0.53	1.07	8.48	3.10	3.82	1.26	12.58	2.66	5.55	1.04	23.81	2.65	10.09	1.05
	ED-s	0.67	2.22	0.77	1.28	12.47	3.40	5.01	1.51	16.97	2.75	8.40	1.18	29.01	3.00	14.57	1.18

(b) *Desktop*: Intel Core i5-4670@3.2GHz (4 cores) and 8GB of RAM. The OS is Windows 10.

Available Data		Limited (100 per class)				Scarce (20% of $\mathbb{D}$)				Moderate (40% of $\mathbb{D}$)				Abundant (80% of $\mathbb{D}$)			
Feature Set		Complete		Essential		Complete		Essential		Complete		Essential		Complete		Essential	
Alg. CPU	Design	Train	Test	Train	Test	Train	Test	Train	Test	Train	Test	Train	Test	Train	Test	Train	Test
RF all cores	BD	0.70	2.55	0.65	3.00	40.83	5.74	23.02	4.31	124.82	6.42	71.92	3.58	263.27	6.27	160.68	4.22
	MD	0.62	3.42	1.20	3.55	35.81	5.92	25.22	4.90	123.11	6.62	72.77	4.45	243.23	6.67	158.24	4.82
	ED	3.76	11.17	4.82	9.09	52.74	16.45	30.36	12.90	152.04	18.23	77.40	12.23	298.37	18.76	192.61	12.15
	ED-s	4.06	14.20	6.74	11.11	66.11	20.18	38.45	14.43	169.45	18.76	86.45	14.73	397.41	19.87	234.10	14.07
DT one core	BD	0.02	0.92	0.01	0.11	4.46	0.93	1.88	0.11	11.68	0.93	4.13	0.08	25.95	0.91	7.31	0.09
	MD	0.02	1.32	0.01	0.11	3.03	0.93	1.06	0.08	8.31	1.16	2.93	0.08	30.29	0.93	6.64	0.09
	ED	0.05	4.22	0.02	0.24	5.04	5.46	1.45	0.27	17.66	5.09	4.03	0.26	38.17	4.99	8.96	0.27
	ED-s	0.07	4.93	0.03	0.19	7.01	5.29	1.98	0.22	23.17	5.29	5.45	0.21	55.64	5.11	13.14	0.22
LR all cores	BD	3.69	1.27	3.43	0.05	9.12	1.55	13.16	0.05	18.15	1.51	28.03	0.05	34.66	1.38	50.68	0.05
	MD	4.43	1.59	2.38	0.07	30.05	1.78	19.44	0.12	54.52	1.49	47.54	0.11	134.30	1.65	92.40	0.07
	ED	2.49	5.10	2.37	0.20	40.57	5.18	22.53	0.36	87.90	5.38	40.22	0.21	154.10	5.90	75.10	0.28
	ED-s	5.01	5.71	4.44	0.20	45.74	5.62	29.78	0.15	101.21	5.31	49.65	0.15	198.45	5.61	101.61	0.22
HGB all cores	BD	2.45	2.99	1.59	1.88	22.27	3.68	5.63	1.92	35.46	3.54	16.23	1.74	66.47	3.46	31.81	1.79
	MD	5.83	8.81	6.40	7.41	68.72	7.90	38.10	7.77	148.65	8.58	69.24	7.26	262.43	8.55	120.57	7.23
	ED	1.91	8.52	1.89	3.88	29.13	12.74	19.86	6.02	71.74	10.22	31.64	5.53	130.34	10.91	48.33	6.33
	ED-s	3.84	9.34	3.98	5.30	39.47	13.50	21.68	8.88	99.87	12.37	40.58	6.63	169.64	12.22	69.14	7.07

(c) *Laptop*: Intel Core i5-430M@2.5GHz (4 cores) and 8GB of RAM. The OS is Windows 10.

Available Data		Limited (100 per class)				Scarce (20% of $\mathbb{D}$)				Moderate (40% of $\mathbb{D}$)				Abundant (80% of $\mathbb{D}$)			
Feature Set		Complete		Essential		Complete		Essential		Complete		Essential		Complete		Essential	
Alg. CPU	Design	Train	Test	Train	Test	Train	Test	Train	Test	Train	Test	Train	Test	Train	Test	Train	Test
RF all cores	BD	0.57	1.68	0.61	0.78	12.46	2.26	8.34	1.07	37.92	2.39	24.72	1.12	88.37	2.53	53.90	1.23
	MD	0.42	2.12	0.51	1.13	11.91	2.43	8.70	1.43	34.03	2.60	24.18	1.44	81.65	2.78	57.79	1.55
	ED	1.91	5.83	1.77	2.57	16.14	6.75	11.71	3.21	42.35	6.92	31.25	3.30	100.05	7.25	70.28	3.48
	ED-s	2.10	6.23	1.98	3.13	20.64	7.14	14.74	3.77	49.43	7.33	39.78	3.90	124.84	7.58	89.21	3.93
DT one core	BD	0.06	0.92	0.00	0.02	2.47	0.91	0.64	0.03	7.75	0.91	2.17	0.04	16.50	0.90	4.97	0.04
	MD	0.00	0.92	0.00	0.03	2.48	0.91	0.92	0.04	6.96	0.89	2.60	0.05	14.57	0.90	5.80	0.06
	ED	0.01	3.65	0.00	0.09	3.04	3.64	1.25	0.13	8.11	3.60	3.28	0.12	18.31	3.60	7.38	0.14
	ED-s	0.04	5.58	0.01	0.08	3.87	3.55	1.87	0.10	11.74	3.53	4.84	0.11	24.15	3.57	9.87	0.11
LR all cores	BD	1.35	0.97	1.46	0.07	6.43	0.97	5.39	0.02	15.31	0.98	20.02	0.07	32.00	0.99	36.10	0.06
	MD	0.86	1.00	1.00	0.07	10.77	0.99	9.80	0.10	28.53	1.02	21.66	0.10	57.55	1.01	42.93	0.09
	ED	1.03	3.96	0.95	0.19	21.85	3.88	6.75	0.13	68.23	3.89	16.02	0.21	140.39	3.97	55.37	0.28
	ED-s	1.94	4.14	1.12	0.12	27.41	3.93	9.99	0.19	81.41	3.94	21.58	0.44	167.64	3.91	75.45	0.06
HGB all cores	BD	29.21	12.76	0.74	1.47	184.45	5.16	123.33	13.44	92.49	6.11	15.50	4.31	260.53	8.88	24.33	3.52
	MD	3.35	26.66	4.26	56.50	167.48	39.03	41.76	16.00	504.85	37.33	578.36	34.91	526.04	59.27	278.97	14.13
	ED	3.53	18.40	14.80	8.24	55.38	66.50	180.47	28.68	552.68	31.09	426.50	5.37	129.22	42.36	854.91	45.37
	ED-s	4.94	26.63	16.41	11.61	67.98	40.61	207.58	38.90	597.84	27.56	504.68	34.52	187.54	20.51	904.65	29.39

(d) *Low-end*: a Virtual Machine that is set up to use only 4 cores and at most 40% of the frequency and 8GB of RAM of the Workstation platform. The OS is Ubuntu 20.04.