Supplementary material for "Going Offline: An Evaluation of the Offline Phase in Stream Clustering"

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This appendix expands upon the paper "Going Offline: An Evaluation of the Offline Phase in Stream Clustering". It includes an expansion on related work in Appendix A, a more formalized description of the different CluStream variants in Appendix B, and an expansion on the experiments in Appendix C.

A Expanded Related Work

The offline phases proposed for online-offline stream clustering methods are usually part of a small selection of traditional offline clustering algorithms, a specific technique building upon one of those, or some summary-specific post-processing. In Table 1, we describe the offline processing methods for various methods that directly derive from CluStream [2]. The proposed summarization processing techniques of various stream clustering approaches are listed in Table 2. Here, EHCF refers to Exponential Histogram of Cluster Features [79]. The majority of the listed approaches use k-Means [48], DBSCAN [26] or DPC [65]. While some approaches use offline clustering techniques that fall outside these three, these typically are approaches that aim to bring these offline clustering techniques into the stream setting.

Table 1: Micro-Cluster Processing of selected variants of CluStream

Name	Micro-Cluster Processing
CluStream (2003) [2]	(weighted) k-Means [48]
Spark-CluStream (2016) [12]	(Fake weighted) k-Means [48, 12]
CluStream-OMRk (2016) [10]	Ordered Multiple Runs of k-Means [58]
CluStream-BkM (2016) [10]	Bisecting k-Means [70]
Clustream-hybrid (2017) [42]	k-Means++ [11]
INB-CluStream (2019) [72]	(weighted) k-Means [48]
CluStream-GT (2019) [32]	k-Means [48]
Online CluStream (in River (2021) [56])	Incremental k-Means [67]
DynamicCluStream (2023) [4]	Merging of overlapping micro-clusters

Table 2: Properties of selected Stream Clustering methods that utilize processing of summaries to produce clusters

Name	Summary Type	Clustering Processing
STREAM (2000) [33]	Prototype	k-Median [45]
STREAMLSEARCH (2002) [60]	Prototype	k-Median [45]
STREAMKmeans (2002) [60]	Prototype	k-Means [48]
CluStream (2003) [2]	Micro-Cluster	(weighted) k-Means [48]
SWClustering (2005) [79]	EHCF [79]	k-Means [48]
DenStream (2006) [18]	Micro-Cluster	DBSCAN [26]
D-Stream (2007) [23]	Density Grid	Combination of neighboring dense grids
SDStream (2009) [64]	EHCF [79]	DBSCAN [26]
ClusTree (2011) [40]	Micro-Cluster	Variable
LiarTree (2011) [41]	Micro-Cluster	Variable
DGClust (2011) [30]	Distributed Grid	k-Means [48]
StreamKM++ (2012) [1]	Coreset Tree	k-Means++ [11]
PreDeConStream (2012) [35]	Micro-Cluster	PreDeCon [15]
LeaDen-Stream (2015) [8]	Micro-Cluster	DBSCAN [26]
HDC-Stream (2014) [7]	Density Grid	modified DBSCAN [7]
StreamXM (2015) [9]	Coreset [52]	X-Means [62, 52]
MuDiStream (2016) [6]	Micro-Cluster & Density Grid	adapted DBSCAN (M-DBSCAN [6])
DBSTREAM (2016) [34]	Micro-Cluster	Thresholding of Connectivity Graph
EDDS (2017) [5]	Surface Core-Points	DBSCAN [26]/EDBSCAN [5]
MicroGRID (2018) [73]	Micro-Cluster & Density Grid	Combination of neighboring dense grids
DFPS-Clustering (2019) [77]	Data Chunk [53]	FPS-Clustering [75]
CVD-Stream (2020) [57]	Micro-Cluster	DBCAP [57]
GeoDenStream (2020) [44]	Micro-Cluster	DBSCAN [26]
DGStream (2020) [3]	Density Grid	DBSCAN [26]
DWDP-Stream (2022) [22]	Micro-Cluster	modified DPC [22]
ARD-Stream (2023) [27]	Micro-Cluster	Connected MCs in graph
EMCStream (2023) [81]	UMAP Embedding [55]	k-Means [48]
MCMSTStream (2024) [25]	Micro-Cluster	Minmum Spanning Tree [31]
OCEAN (2024) [28]	Density Grid	Grid-based DPC [28]
GB-FuzzyStream (2024) [76]	Fuzzy Granular/Micro-Balls	DPC [65]

B Formalization of CluStream Variants

Let mc_i^t be a micro-cluster at timestep t with identifier i, mean μ_i^t, weight w_i^t, and assignment radius $r_i^{+,t}$, which corresponds to the radius (here, average deviation) r times a maximum boundary factor mbf. The collection of all m microclusters for a stream dataset D at time step t is denoted as $MC(D^t)$. Here, let μ^t, w^t, and $r^{+,t}$ be the collections of means, weights, and assignment radii for the micro-clusters in $MC(D^t)$, respectively. Let $\mathcal{L}$ be the set of cluster labels (typically numbers). The identifiers of the micro-clusters are also from the same space.
The clustering produced by **CluStream-O** for the stream data D at timestep t can then be defined as $C_o(D^t) : D^t \to \mathcal{L}, d \mapsto iNN(d, \mu^t)$, where $iNN(d, \mu^t)$ is the identifier i of the micro-cluster with the closest mean μ_i^t to the data point

d. That means the clustering of CluStream-O assigns each data point in D^t to its closest micro-cluster and considers its identifier i as its cluster label.
The clustering of **CluStream-C** for the stream data D at timestep t is $C_c(D^t, \psi) : D^t \to \mathcal{L}, d \mapsto C_{\text{Offline}}(\mu^t, \psi)(\mu^t_{iNN(d,\mu^t)})$, where $iNN(d, \mu^t)$ is the identifier i of the micro-cluster with the closest mean μ^t_i to the data point d and $C_{\text{Offline}}(Z, \psi)$ is an offline clustering performed on the dataset Z given parameters ψ. That means the clustering of CluStream-C assigns each data point in D^t to the cluster of its closest micro-cluster, where the clusters are determined by a separate offline clustering algorithm applied to the means of the micro-clusters. A special case is Wk-Means, which also incorporates the weights w^t into C_{Offline}.
For **CluStream-W**, the clustering for the stream data D at timestep t corresponds to $C_w(D^t, Z, \psi) : D^t \to \mathcal{L}, d \mapsto C_{\text{Offline}}(Z, \psi)(NN(d, Z))$ with $Z = ms(w^t, \mu^t)$. Here, $ms((w^t_1, ..., w^t_m), (\mu^t_1, ..., \mu^t_m))$ is a function that replicates the instances of μ^t_i according to the corresponding weight w^t_i. Furthermore, $NN(d, Z)$ returns the data point within a dataset Z that is closest to the data point d, and $C_{\text{Offline}}(Z, \psi)$ is an offline clustering performed on the dataset Z given parameters ψ. Ultimately, this translates to the approach of CluStream-W being similar to CluStream-C, but using a set that contains a number of instances of the means of the micro-clusters corresponding to the weight of those micro-clusters as input for the offline clustering algorithm.
$DG(Cen, Rad, Wht, n)$ is a data generator that generates data around m centroids $Cen = (cen_1, ..., cen_m)$ within the respective radii $Rad = (rad_1, ..., rad_m)$. The weights $Wht = (wht_1, ..., wht_m)$ scale the number of instances per centroid to reach an overall number of data points that is approximately n.
In the case of **CluStream-S**, the clustering for the stream data D at timestep t can be described as $C_s(D^t, Z, \psi,) : D^t \to \mathcal{L}, d \mapsto C_{\text{Offline}}(Z, \psi)(NN(d, Z))$ with $Z = DG(Cen = \mu^t, Rad = \overrightarrow{0}, Wht = w^t, n)$. Once again, $NN(d, Z)$ returns the data point within a dataset Z that is closest to the data point d, and $C_{\text{Offline}}(Z, \psi)$ is an offline clustering performed on the dataset Z given parameters ψ. This formalization is similar to CluStream-W; however, the overall number of instances of the means of the micro-clusters used for offline clustering in CluStream-S is approximately n, rather than $\sum w^t$.
Finally, for **Clustream-G** the clustering for the stream data D at timestep t is defined as $C_g(D^t, Z, \psi) : D^t \to \mathcal{L}, d \mapsto C_{\text{Offline}}(Z, \psi)(NN(d, Z))$ with a $Z = DG(Cen = \mu^t, Rad = r^{+,t}, Wht = w^t, n)$. As before, $NN(d, Z)$ returns the data point within a dataset Z that is closest to the data point d, and $C_{\text{Offline}}(Z, \psi)$ is an offline clustering performed on the dataset X given parameters ψ. As with CluStream-S, the number of instances for offline clustering is approximately n, though the instances are generated within the micro-cluster assignment radius rather than just at the position of the means of the micro-cluster.

C Expanded Experiments

C.1 Experiment Setup

The usage of AutoML techniques for stream clustering has been touched upon before in other work [19]. The typical state-of-the-art methods were not perfectly suited to a practical application as they need to be applied in a prequential and offline manner. While there are AutoML approaches for the stream setting that allow for dynamic tuning of the parameters on the stream [20], the used implementations of the stream clustering algorithms do not allow for this. Instead, we apply the SOTA hyperparameter optimization strategy SMAC3 [46][5] on a subset of the datasets for all evaluated algorithms. Previous research has shown that performing AutoML on downsampled data rather than the full dataset does not harm the selection process and can even improve full dataset performance [80]. As described in the paper, we use uniform random subsampling to get the subsampled datasets. The settings and dataset properties are in Table 3. Since we operate in a clustering setting rather than classification, we did not perform k-fold cross-validation and instead used the full dataset for subsampling and final evaluation. We still used five different subsampled sets as a stand-in. Per the described pipeline, we used the subset to preselect the most promising candidate for each subset and then applied it to the full dataset. For scoring, we used the sum of adjusted rand index (ARI) [38] and adjusted mutual information (AMI) [59], which we also used to determine the best-performing runs. Corresponding to the setup in [68], we set a five-hour limit to the parameter optimization process per subset. For the online-offline CluStream variants, we used 20% of the time to select parameters for the online phase (based on offline evaluation of default CluStream with weighted k-Means). Then, we used the micro-clusters for the subset produced with the best parameter settings as the basis for the offline optimization for the remaining 80% of the time budget. We do not optimize the parameters for the offline clustering for each offline phase, but instead maintain one set of parameters for all offline phases of a run. For fairness, we repeated the data point generation for each parameter run, so no time was saved compared to fully running the CluStream algorithm. All variants of online-offline CluStream used the same micro-cluster sets. CluStream-O with a fixed or variable k were optimized separately as they typically did not have the same number of micro-clusters. The online phase of CluStream-O used the full time to perform parameter optimization, rather than just 20%.

The exceptions to the splitting into subsets were Complex-9 [13] and Fertility-vs-Income [74], for which we did not perform subsampling and instead used a single 24-hour run of SMAC3 on the full dataset. The parameter optimizations are summarized in Tables 6 and 7. A score of $-inf$ means that the parameter optimization failed. This was the case only for Projected Dip-Means [21] for CluStream-S and CluStream-W for high-dimensional data. As a result, Projected Dip-Means was excluded from the experiments for these reconstruction

[5] `https://github.com/automl/SMAC3`, last accessed 30.01.2025

methods for all datasets aside from the two-dimensional ones. Additionally, GB-FuzzyStream [76] failed to terminate on the Fertility-vs-Income dataset during optimization and did not produce any parameters. The default configuration also failed to terminate on the dataset.

Outside of some experiments where some parameters failed to produce results, this setup resulted in 6 parameter options for datasets, which were split, and two parameter options for Complex-9 and Fertility-vs-Income. Parameter setups were not necessarily unique. For the experiments, each online and offline parameter setup was repeated for 5 seeds each, leading to 10 runs for Complex-9 and Fertility-vs-Income and 30 for any others. Deterministic offline methods were not repeated. Furthermore, there were some additional configurations, specifically the combinations of default parameters with optimized ones for both directions for online-offline CluStream variants (optimized online with default offline parameters and default online with offline parameters specifically optimized for the default online phase).

For the examination of the best-case performance, the offline parameters were fixed to the ones for the online phase, they were determined with to ensure fairness to non-split methods. The exception here is the default parameter set. While an optimization for the default parameters was performed, this was not included when determining the best parameters. Instead, the pure default case was included (as was the case for all methods). The number of ground truth clusters k was set according to the number of classes in the full dataset.

GB-FuzzyStream [76] reports clusters on a timestep basis, and as such, the data was processed so that the evaluation batches each correspond to a timestep. The batch size of 1000 also corresponds to the example setup used in the code for GB-FuzzyStream.

There was a hard 7-day limit on the experiments per online configuration. For the online-offline CluStream variants, different offline algorithms had a separate 7-day limit. While most experiments finished within the allotted time, there were some experiments that failed. Specifically, this was the case for GB-FuzzyStream [76] on KDDCUP99 [69] and Fertility-vs-Income [74] for all tested parameters. In the case of the Fertility-vs-Income dataset, only the default case was tested, as parameter optimization had also failed. Some experiments for CluStream variants were performed using intermediary results by utilizing the stored micro-clusters or generated data. Still, care was taken to ensure that they would have finished within the 7-day limit if they had been run regularly, taking into account the runtime required to produce the intermediary results. The runtime was taken across all configurations of the offline method (default and optimized, for all seeds) for each online configuration for CluStream variants, as done in the regular execution. While most experiments were completed within these constraints, some parameter settings for some offline algorithms had to be excluded from the final results. Specifically, the runs for DPC [65], SNNDPC [47], and Spectral Clustering (SC) [49] failed for CluStream-W on one set of online parameters for RBF-3. Due to runtime issues and only appearing in this supplementary file, SCAR [37] was also excluded for this online parameter con-

figuration. It should be noted that preliminary results for individual seeds show that this configuration underperforms compared to the other configurations and would not have an impact on the best result. The problems on RBF-3 were specifically due to the known scalability issues related to CluStream-W, where the weights can potentially grow much larger than in CluStream-S or CluStream-G. These specific online parameters resulted in the weight of almost 90% of the full dataset being retained in the last batch, drastically increasing the runtime of the offline methods. Furthermore, SCAR [37] had to be excluded for some parameters for KDDCUP99 for similar reasons, though the weight retention was much less extreme. However, given the large size of KDDCUP99, even a moderate increase in runtime per batch already results in a significant increase in overall runtime. It should be noted that in all these cases, there were configurations that yielded results for CluStream-W with the affected offline algorithms on those datasets for the required number of seeds. The excluded runs were treated as failed when determining the best-performing parameter configurations.

Table 3: Subset settings for used datasets for parameter optimization

Name	Key	Type	Shuffled?	# Dimensions	# Samples	# Classes	Subset size
Complex-9 [13]	Comp-9	Synthetic	Yes	2	3031	9	-
DENSIRED-10 [39]	DEN-10	Synthetic	Yes	10	5000	11	2500 (50%)
RBF-3 40000[6]	RBF-3	Synthetic	No	2	40000	8	8000 (20%)
Fertility-vs-Income[7] [74]	FvI	Real-World	No	2	4014	2	-
KDDCUP99 [69]	KDD99	Real-World	No	41	494021	23	4940 (1%) [80]
Gas Sensor Array [69]	Gas	Real-World	No	128	13910	6	6955 (50%)

[6] `https://github.com/CIG-UFSCar/DS_Datasets/tree/master`, last accessed 25.02.2025, based on data generation from MOA [14]

[7] Dataset created from data from the Gapminder data repository `https://www.gapminder.org/data/`, last accessed: 05.06.2025

Table 4: Stream Clustering Parameter Optimization options. The note (log) means that the parameter was sampled based on the logarithm to prevent skew for wide parameter ranges.

Method	Parameter Name	Parameter Options	Default
STREAMKmeans [60]	chunk_size	[10, 1000]	10
	sigma	[0, 1]	0.5
	mu	[0, 1]	0.5
DenStream [18]	decaying_factor	[0.1, 1]	0.25
	beta	[0,1]	0.75
	mu	[1, 100000] (log)	2
	epsilon	[0.001, 0.5] (log)	0.02
	n_samples_init	5, 10, 25, 50, 75, 100, 250, 500, 750, 1000	1000
	stream_speed	1, 10, 100	100
DBSTREAM [34]	clustering_threshold	[0.05, 1]	1
	fading_factor	[0.005, 0.015] (log)	0.01
	cleanup_interval	2, 5, 10, 100, 1000	2
	intersection_factor	[0.1, 0.5]	0.3
	minimum_weight	[1, 5]	1)
EMCStream [81]	horizon	[10, 1000]	100
	ari_threshold	[0.5, 1]	1.0
	ari_threshold_step	[0.0001, 0.01] (log)	0.001
MCMSTream [25]	W	[100, 2000]	235
	N	[2, 15]	5
	r	[0.001, 0.25] (log)	0.033
	n_micro	[2, 25]	2
GB-FuzzyStream [76]	lam	[0.1, 5]	1
	batchsize	1000	1000
	threshold	[0.1, 0.8]	0.3
Clustream [2]	time_window	1000, 1500, 2000, 2500, 5000, 10000	1000
	micro_cluster_r_factor	[1.0, 5.0]	2.0
Clustream-O - fixed / var. k	time_window	1000, 1500, 2000, 2500, 5000, 10000	1000
	micro_cluster_r_factor	[1.0, 5.0]	2.0
	max_micro_clusters	max[1, 100]	100

Table 5: Offline Clustering Parameter Optimization options. The note (log) means that the parameter was sampled based on the logarithm to prevent skew for wide parameter ranges.

Method	Parameter Name	Parameter Options	Default
k-Means/W*k*-Means [48]	init	k-means++ [11]	k-means++
SubKMeans [54]	outliers	1, 0	0
	mdl_for_noisespace	1, 0	0
	check_global_score	default, mdl	default
	n_init	[1, 10]	1
X-Means [62]	n_clusters_init	[2, 20]	2
	check_global_score	True, False	True
	allow_merging	True, False	False
	n_split_trials	[2, 50]	10
P-DipM [21]	significance	[0.0001, 0.01] (log)	0.001
	n_random_projections	[0, 5]	0
	n_split_trials	[2, 50]	10
	allow_merging	table, function, bootstrap	table
SC [49]	affinity	rbf, nearest_neighbors	rbf
	gamma	[0,5]	1.0
	n_neighbors	[2,100]	10
SCAR [37]	normalize	0,1	0
	weighted	0,1	0
	alpha	[0,1]	0.5
	nn	[2,100]	32
	theta	[1,1000]	50
	m	[0,1]	0.5
	laplacian	0,1,2	0
SpectACl [36]	epsilon	[0,2]	1
	normalize_adjacency	0,1	0
DBSCAN [26]	eps	[0,0.5]	0.5
	min_samples	[1,100]	5
HDBSCAN [17]	cluster_selection_epsilon	[0,0.1]	0.0
	min_cluster_size	[1,100]	5
	allow_single_cluster	0,1	0
	cluster_selection_method	eom, leaf	eom
	alpha	[0,1]	1
RNNDBS [16]	n_neighbors	[2,100]	5
MDBSCAN [63]	n_neighbors	[2,100]	5
	eps	[0,0.5]	0.5
	min_samples	[1,100]	5
DPC [65]	dc	Auto (<0), [0,0.5]	Auto
	density_threshold	Auto (<0), [0,0.5]	Auto
	distance_threshold	Auto (<0), [0,0.5]	Auto
	gauss_cutoff	0,1	1
	anormal	0,1	1
	distance_metric	euclidean, cosine	euclidean
SNN-DPC [47]	n_neighbors	[2,100]	5
DBHD [24]	min_cluster_size	[2,100]	5
	beta	[0,1]	0.1
	rho	[0,5]	1.2

Table 6: Summaries of stream clustering parameter optimization. The count is the average number of examined parameter settings per subset, score is the average score (ARI+AMI) achieved (the maximal possible score is 2). CluStream was optimized for Wk-Means. GB-FuzzyStream [76] failed to produce results for FvI.

Method	Comp-9		DEN-10		RBF-3		FvI		KDD99		Gas	
	Runs	Score	Runs	Score	Runs	Score	Runs	Score	Runs	Score	Runs	Score
STREAMKmeans	34568	1.09	8915.4	0.85	12488.8	1.24	25165	1.81	1265.6	1.79	2270.4	0.24
DenStream	5678	1.16	1874.0	1.16	2953.8	0.94	4526	1.66	2330.2	1.88	877.2	0.65
DBSTREAM	16548	1.18	1692.2	1.42	4537.2	1.25	11772	1.60	729.2	1.77	59.6	0.54
EMCStream	1161	1.48	272.6	1.52	31.4	0.92	579	1.87	51.8	1.18	32.2	0.85
MCMSTStream	1194	1.40	70.0	1.58	74.6	1.19	1727	1.88	7.8	1.74	1.0	0.00
GB-FuzzyStream	5620	0.84	1325.2	0.68	395.2	0.66	-	-	912	1.26	592.6	0.28
CluStream-O - var. k	9176	1.16	189.8	1.30	1806.8	0.98	6064	1.71	25.0	1.76	7.8	0.71
CluStream-O - fixed k	12578	1.06	2219.4	0.49	2768.2	0.98	9032	1.71	141.2	1.67	278.2	0.40
CluStream-C	1314	1.13	27.4	1.26	120.4	0.97	218	1.90	2.2	1.66	1.0	0.53

C.2 Expanded Offline Clustering

Aside from the methods introduced in the main paper, we also investigated the performance of the offline phase with SCAR [37] and MDBSCAN [63]. SCAR improves upon Spectral Clustering by increasing the robustness [49] by pruning noisy edges and by accelerating the eigendecomposition calculation. MDBSCAN uses a preprocessing scheme to extract low-density clusters before performing a DBSCAN clustering [26]. The implementation for SCAR stems from its repository[8]. MDBSCAN was self-implemented and can be found in our repository. We include the full ARI and NMI scores for all evaluated methods in Table 8. We also report the performance for default parameters in Table 9. Aside from this, we also perform a single-parameter optimization run using micro-clusters produced using the default parameters for the online phase. We then apply these parameters as an alternative for the online-offline CluStream variants when using default parameters in the online phase. Ultimately, we report the best performance according to the sum of ARI and AMI for runs, where the online phase used default parameters, but the parameters of the offline phase were optimized, in Table 10. The competitors do not allow for this procedure, but their default parameter scores are still included for comparison. Allowing for optimization in the offline phase while still maintaining the same default online phase leads to improvements over CluStream-O in most cases.

C.3 Expanded Metrics

Aside from ARI [38] and AMI [59] reported in the main paper, we also calculated several additional metrics. These were the normalized mutual information (NMI) [71], clustering accuracy [78, 43], precision [61], recall [61], F1 score [50],

[8] `https://github.com/SpectralClusteringAcceleratedRobust/SCAR`, last accessed: Feb 20th, 2025

Fowlkes–Mallows index (FMI) [29], Purity [51], Homogeneity [66] and Completeness [66]. Additionally, we tracked the average number of produced clusters per timestep for these runs. These can be found for the best-performing parameters based on ARI and AMI in Figures 1 to 12. Additionally, the numeric values for these can be found in Tables 11 to 22. Furthermore, we include these values for the default parameters as well in Tables 23 to 34. Finally, we also include all the metrics for experiments using the best parameters according to the sum of ARI and AMI for the offline phase, but with default parameters in the online phase in Tables 35 to 46. Here, the default parameters of the competitors are included for comparison.

Table 7: Summaries of offline clustering parameter optimization. The count is the average number of examined parameter settings per subset, score is the average score (ARI+AMI) achieved (the maximal possible score is 2). The online parameters are the ones obtained when optimizing CluStream. A score of -inf means that the optimization run failed. This was the case for Projected Dip-Means [21] for higher dimensions for CluStream-W and CluStream-S.

Method	Comp-9		DEN-10		RBF-3		FvI		KDD99		Gas	
	Runs	Score	Runs	Score	Runs	Score	Runs	Score	Runs	Score	Runs	Score
CluStream-C k-Means	2	1.00	2.0	0.57	2.0	0.95	2	1.79	2.0	1.70	2.0	0.38
CluStream-C SubKMeans	206	0.99	188.0	0.91	188.0	0.96	209	1.79	183.8	1.71	189.8	0.41
CluStream-C X-Means	3689	1.14	2715.0	1.06	2732.6	0.97	4121	0.79	2626.4	1.72	2391.2	0.78
CluStream-C P-DipM	10734	0.00	4057.6	0.00	5038.8	0.04	22116	1.00	5021.0	1.72	4776.6	0.40
CluStream-C SC	32057	1.21	4672.8	1.15	3885.2	0.98	25159	1.88	5657.4	1.75	1800.2	0.60
CluStream-C SCAR	9456	1.09	3631.2	1.21	3317.0	0.98	5174	1.75	3296.6	1.81	3286.6	0.64
CluStream-C SpectACl	34551	1.51	10123.2	1.45	10373.0	1.02	27457	1.98	9223.0	1.73	11215.2	0.66
CluStream-C DBSCAN	22791	1.60	6611.6	1.33	9045.2	0.83	15135	1.79	7695.6	1.71	7170.6	0.73
CluStream-C HDBSCAN	10486	1.58	4064.4	1.23	4353.2	0.88	8745	1.90	4812.6	1.73	4593.0	0.73
CluStream-C RNN-DBS	251	1.06	215.6	0.48	234.2	0.85	185	1.41	195.8	1.69	215.6	0.66
CluStream-C MDBSCAN	10749	1.58	4125.0	1.32	4408.8	0.87	9000	1.93	4905.8	1.71	4662.2	0.73
CluStream-C DPC	19551	1.21	6915.6	1.38	7030.8	1.00	12522	1.67	8649.6	1.79	8210.0	0.80
CluStream-C SNN-DPC	179	1.22	210.8	1.01	243.2	0.97	257	1.51	225.8	1.72	187.4	0.62
CluStream-C DBHD	18213	1.28	5386.2	1.36	6953.4	0.99	15825	1.93	8503.8	1.74	3831.8	0.83
CluStream-W k-Means	2	1.03	2.0	1.23	2.0	0.97	2	1.90	2.0	1.66	2.0	0.56
CluStream-W SubKMeans	194	1.02	194.0	1.34	189.2	0.97	218	1.90	197.0	1.66	198.8	0.58
CluStream-W X-Means	1743	0.64	820.8	1.29	217.0	0.74	1293	0.62	659.0	1.45	212.6	0.71
CluStream-W P-DipM	1877	0.67	3.0	-inf	357.8	0.61	3521	0.39	3.2	-inf	1.2	-inf
CluStream-W SC	3221	1.25	1845.8	1.31	846.2	0.98	9669	1.89	1618.8	1.68	1053.0	0.86
CluStream-W SCAR	114	1.11	1270.4	1.35	378.6	0.86	175	1.37	772.2	1.62	292.2	0.76
CluStream-W SpectACl	6940	1.68	3904.0	1.46	2373.6	1.03	7263	1.87	3763.2	1.77	1638.4	0.66
CluStream-W DBSCAN	17309	1.60	7398.6	1.46	7673.6	0.95	14583	1.79	7055.8	1.75	4984.0	0.75
CluStream-W HDBSCAN	9705	1.59	4026.8	1.42	3816.6	0.91	8436	1.93	3579.8	1.73	1740.2	0.82
CluStream-W RNN-DBS	209	0.89	228.8	1.27	199.6	0.64	158	1.21	92.8	1.54	91.6	0.75
CluStream-W MDBSCAN	16586	1.61	6380.4	1.33	5575.4	0.98	13878	1.93	5012.4	1.82	2350.8	0.80
CluStream-W DPC	629	1.22	1177.0	1.32	265.0	0.79	3687	1.80	241.4	1.71	80.8	0.72
CluStream-W SNN-DPC	221	1.27	240.8	0.96	106.2	0.78	275	1.90	41.0	1.46	27.6	0.42
CluStream-W DBHD	17293	1.28	5358.2	1.36	6263.0	0.99	14205	1.92	5763.8	1.74	1218.2	0.83
CluStream-S k-Means	2	1.07	2.0	1.22	2.0	0.96	2	1.90	2.0	1.67	2.0	0.53
CluStream-S SubKMeans	194	1.03	185.6	1.34	185.6	0.97	170	1.90	198.8	1.67	182.6	0.57
CluStream-S X-Means	1693	0.79	509.2	1.26	169.0	0.78	1207	0.63	520.2	1.45	211.4	0.72
CluStream-S P-DipM	1681	0.68	3.0	-inf	257.4	0.61	3254	0.38	3.0	-inf	1.0	-inf
CluStream-S SC	1418	1.40	1835.0	1.31	1506.0	1.00	10077	1.89	2399.6	1.69	1957.6	0.86
CluStream-S SCAR	703	1.28	926.2	1.34	421.0	0.95	151	1.22	537.8	1.61	396.6	0.78
CluStream-S SpectACl	7383	1.67	3034.6	1.45	2493.6	1.03	7020	1.95	3898.0	1.77	2388.0	0.65
CluStream-S DBSCAN	14943	1.60	7191.4	1.46	5755.8	0.93	14439	1.79	5199.0	1.76	3326.6	0.74
CluStream-S HDBSCAN	7857	1.59	3921.0	1.43	3101.6	0.92	8745	1.93	3012.2	1.74	1982.6	0.81
CluStream-S RNN-DBS	197	1.22	249.8	1.26	201.2	0.65	263	1.23	195.8	1.53	222.2	0.76
CluStream-S MDBSCAN	15501	1.61	5842.2	1.33	4518.6	0.98	17466	1.93	4206.0	1.83	2307.2	0.82
CluStream-S DPC	2503	1.18	753.2	1.34	286.0	0.94	2806	1.80	435.2	1.74	295.8	0.75
CluStream-S SNN-DPC	248	1.36	201.2	0.99	99.2	0.94	200	1.90	101.8	1.57	95.8	0.54
CluStream-S DBHD	13979	1.28	4994.4	1.36	4890.6	0.99	16075	1.93	4430.4	1.74	968.4	0.82
CluStream-G k-Means	2	1.02	2.0	1.25	2.0	0.94	2	1.89	2.0	1.67	2.0	0.54
CluStream-G SubKMeans	176	1.06	192.2	1.36	197.6	0.96	146	1.89	176.0	1.66	211.4	0.57
CluStream-G X-Means	1585	0.81	430.0	1.28	611.8	0.89	381	-inf	645.2	1.54	339.0	0.72
CluStream-G P-DipM	16107	1.12	838.8	1.29	6450.0	0.80	17219	0.90	1015.6	1.65	133.2	0.77
CluStream-G SC	3206	1.32	1621.4	1.29	1875.2	0.98	8690	1.89	868.4	1.66	2550.6	0.86
CluStream-G SCAR	3367	1.31	1093.0	1.30	760.8	0.96	742	1.89	1011.0	1.57	672.0	0.79
CluStream-G SpectACl	9335	1.58	2744.2	1.41	2412.2	1.00	7770	1.91	3757.8	1.78	2688.0	0.64
CluStream-G DBSCAN	20367	1.52	8873.8	1.41	8133.8	0.93	22287	1.84	8140.6	1.76	4099.6	0.75
CluStream-G HDBSCAN	9879	1.43	3894.0	1.39	4006.6	0.96	9657	1.84	3682.4	1.74	2215.6	0.81
CluStream-G RNN-DBS	233	1.35	214.4	1.12	220.4	0.81	233	1.42	217.4	1.54	196.4	0.77
CluStream-G MDBSCAN	20878	1.55	6961.2	1.34	6143.6	1.01	21909	1.93	5503.6	1.83	2860.8	0.85
CluStream-G DPC	4122	1.19	822.4	1.30	492.8	1.04	3201	1.65	703.4	1.60	397.6	0.77
CluStream-G SNN-DPC	209	1.30	220.2	1.33	148.8	1.00	248	1.48	178.0	1.78	120.2	0.69
CluStream-G DBHD	19790	1.66	1120.4	1.39	2454.0	1.12	17694	1.19	43.0	1.51	43.6	0.83

Table 8: Mean metric scores over 5 seeds for evaluated datasets for best-performing parameters according to the sum of ARI and AMI (×100). The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9		DEN-10		RBF-3		IvF		KDD99		Gas	
	ARI	AMI	ARI	AMI	ARI	AMI	ARI	AMI	ARI	AMI	ARI	AMI
STREAMKmeans	41.6	61.6	28.8	52.6	68.4	74.6	91.3	88.1	**94.0**	**87.0**	11.6	17.0
DenStream	50.0	70.5	60.0	73.2	63.3	69.9	86.1	87.4	79.2	75.9	35.3	53.0
DBSTREAM	56.9	69.3	67.8	74.9	69.6	76.1	74.2	74.9	92.5	85.2	26.3	50.1
EMCStream	57.3	80.4	60.3	73.9	53.6	66.3	92.6	90.8	81.6	76.8	35.1	41.7
MCMSTStream	65.3	74.5	**73.7**	**84.7**	74.8	78.1	95.3	92.5	90.3	82.7	16.4	38.4
GB-FuzzyStream	20.0	57.5	19.8	43.4	31.0	51.4	-	-	-	-	5.8	20.4
CluStream-O - var. k	48.7	66.9	53.2	70.7	65.2	73.2	86.2	84.6	89.5	83.5	27.4	50.1
CluStream-O - fixed k	41.6	64.7	16.0	34.3	60.2	71.2	86.2	84.6	87.1	80.6	25.5	37.8
CluStream-O - k=100	9.5	53.0	49.7	69.8	41.9	60.3	5.4	26.8	80.3	67.5	24.2	50.5
CluStream - Wk-Means	36.8	62.8	54.5	67.9	75.3	78.4	95.7	93.4	89.7	77.5	32.0	45.2
CluStream-C - k-Means	37.6	63.4	14.4	37.2	73.5	77.8	90.9	87.7	90.4	79.6	24.7	39.4
CluStream-W - k-Means	36.8	62.8	54.5	67.9	75.3	78.4	95.7	93.4	89.7	77.5	32.0	45.2
CluStream-S - k-Means	37.9	63.5	52.1	66.9	76.3	78.9	95.5	93.4	89.8	77.9	30.7	44.1
CluStream-G - k-Means	37.0	62.9	54.1	68.1	76.8	79.2	95.5	93.3	89.8	77.9	30.8	44.0
CluStream-C - SubKMeans	35.7	61.3	35.9	53.9	73.5	77.5	91.6	87.9	90.4	79.6	24.2	38.7
CluStream-W - SubKMeans	36.2	62.0	57.4	71.9	74.3	78.2	95.3	92.9	89.7	77.6	31.9	45.6
CluStream-S - SubKMeans	35.7	61.9	51.8	69.0	75.1	78.5	94.9	92.9	89.8	77.9	31.4	44.9
CluStream-G - SubKMeans	36.1	62.2	56.9	71.2	76.1	78.8	95.5	93.3	89.8	77.9	31.5	44.9
CluStream-C - X-Means	49.9	66.7	26.6	47.3	76.3	79.3	30.5	50.0	90.2	79.6	29.8	52.4
CluStream-W - X-Means	9.7	53.2	50.4	73.0	69.6	75.2	21.2	41.5	80.3	67.7	24.2	50.6
CluStream-S - X-Means	9.5	53.0	50.0	71.6	68.3	73.7	20.0	39.8	80.3	67.8	24.3	50.7
CluStream-G - X-Means	19.4	58.9	52.9	71.6	78.0	80.1	19.3	36.8	86.1	69.9	24.3	50.8
CluStream-C - P-Dip-M	0.0	0.0	0.0	0.0	18.3	24.4	24.9	24.9	89.6	79.0	12.7	20.3
CluStream-W - P-Dip-M	13.4	57.5	-	-	42.3	60.6	7.1	30.9	-	-	-	-
CluStream-S - P-Dip-M	13.2	57.7	-	-	44.8	61.9	6.8	30.2	-	-	-	-
CluStream-G - P-Dip-M	41.0	68.5	51.7	69.9	73.5	78.0	36.5	51.4	89.6	76.7	26.7	53.1
CluStream-C - SC	47.7	72.8	49.6	64.7	76.8	79.0	95.1	92.4	91.2	81.4	31.6	45.3
CluStream-W - SC	49.6	73.7	55.3	70.3	73.5	77.1	95.5	93.3	89.0	77.8	39.5	54.3
CluStream-S - SC	56.0	79.5	54.6	71.1	72.9	76.7	95.5	93.3	88.9	77.9	39.5	54.2
CluStream-G - SC	52.1	76.7	51.1	69.9	73.1	76.8	95.5	93.3	88.8	77.4	**39.7**	54.1
CluStream-C - SCAR	41.0	66.4	48.3	63.3	75.4	78.0	71.3	69.9	90.7	83.8	28.5	44.3
CluStream-W - SCAR	42.7	67.3	56.3	69.7	56.8	68.3	55.2	55.9	87.1	73.7	35.6	47.9
CluStream-S - SCAR	51.6	75.5	58.6	70.6	65.1	71.5	55.9	57.6	87.2	73.8	36.9	48.4
CluStream-G - SCAR	48.6	73.0	52.6	69.5	65.9	71.8	50.0	49.8	82.8	73.5	37.1	48.0
CluStream-C - SpectACl	60.8	79.0	55.9	74.5	66.5	76.4	84.9	86.5	89.6	80.0	26.4	39.0
CluStream-W - SpectACl	70.2	85.7	55.8	73.9	62.2	71.9	94.8	92.7	91.1	82.4	29.3	41.1
CluStream-S - SpectACl	65.9	83.3	60.1	75.2	69.6	77.4	**98.1**	**96.6**	91.2	82.4	30.2	41.8
CluStream-G - SpectACl	57.5	77.2	58.4	74.9	63.9	73.4	94.3	92.9	91.3	82.3	29.8	41.7
CluStream-C - DBSCAN	73.4	86.5	52.8	70.3	63.7	77.1	88.9	89.6	90.6	78.0	26.5	50.9
CluStream-W - DBSCAN	73.4	86.5	53.6	75.3	63.2	77.4	89.1	89.8	91.2	81.3	27.3	51.3
CluStream-S - DBSCAN	73.5	86.6	52.8	74.4	62.0	75.9	89.0	89.6	90.4	82.0	27.5	51.4
CluStream-G - DBSCAN	58.4	78.3	55.3	75.6	73.4	82.0	88.6	89.0	90.5	82.1	26.8	51.4
CluStream-C - HDBSCAN	71.9	85.7	58.3	73.2	72.0	79.6	96.0	94.1	90.7	80.5	34.7	51.4
CluStream-W - HDBSCAN	72.9	85.8	58.5	76.8	67.6	77.6	97.4	95.7	90.1	80.9	37.3	51.1
CluStream-S - HDBSCAN	72.9	85.8	57.5	77.3	69.8	77.3	97.4	95.7	90.2	81.2	39.1	54.6
CluStream-G - HDBSCAN	61.0	78.7	56.7	77.0	74.2	80.5	81.7	83.6	90.6	81.4	39.1	**54.7**
CluStream-C - RNN-DBS	37.0	69.2	9.5	22.1	65.1	71.9	72.9	72.1	87.6	79.8	32.4	49.0
CluStream-W - RNN-DBS	39.6	49.3	50.9	71.4	44.3	61.7	57.8	63.2	76.0	66.6	25.9	51.0
CluStream-S - RNN-DBS	48.5	73.2	49.5	70.8	44.4	60.4	58.7	63.9	76.8	66.7	27.9	51.0
CluStream-G - RNN-DBS	52.7	73.2	30.2	58.5	54.3	65.4	55.6	62.2	76.8	68.6	30.3	52.0
CluStream-C - MDBSCAN	71.6	86.2	51.1	69.4	62.8	73.1	97.2	95.9	90.6	78.0	26.4	51.0
CluStream-W - MDBSCAN	73.6	**87.0**	52.4	70.6	62.5	73.3	97.3	95.9	92.1	83.8	29.2	52.9
CluStream-S - MDBSCAN	**73.9**	**87.0**	51.4	70.4	62.4	73.0	97.3	95.9	92.1	83.9	31.3	54.5
CluStream-G - MDBSCAN	57.9	80.0	52.5	68.3	66.7	75.8	96.7	95.3	92.2	84.0	31.0	54.3
CluStream-C - DPC	45.0	75.7	56.5	70.2	69.3	76.7	83.2	83.3	92.1	83.7	31.5	52.2
CluStream-W - DPC	47.3	74.8	57.3	69.8	67.7	74.8	88.9	91.2	87.6	81.0	26.3	51.1
CluStream-S - DPC	42.7	75.6	59.7	71.3	67.5	73.4	88.9	91.2	93.0	86.5	28.6	48.4
CluStream-G - DPC	41.0	73.9	57.7	70.9	76.7	79.2	75.3	76.2	90.1	82.1	32.4	52.1
CluStream-C - SNN-DPC	46.3	68.0	25.6	49.4	59.0	69.2	55.8	61.4	86.1	77.6	29.6	47.0
CluStream-W - SNN-DPC	52.2	75.3	44.2	64.4	56.1	63.7	87.8	86.5	85.4	74.3	29.9	43.8
CluStream-S - SNN-DPC	58.0	78.5	38.9	60.2	54.6	62.9	96.1	94.2	83.8	73.3	27.4	40.7
CluStream-G - SNN-DPC	49.8	72.7	56.0	69.9	70.2	77.4	66.3	68.0	90.6	79.5	34.3	46.6
CluStream-C - DBHD	52.3	75.9	57.7	69.9	73.4	78.5	97.3	95.9	88.4	79.4	35.6	54.0
CluStream-W - DBHD	52.3	75.9	57.7	69.9	73.4	78.5	96.9	95.5	88.4	79.4	35.6	54.0
CluStream-S - DBHD	52.3	75.9	57.7	69.9	73.4	78.5	97.3	95.9	88.4	79.4	35.6	54.0
CluStream-G - DBHD	68.5	83.5	52.6	73.3	**81.4**	**84.2**	49.7	60.4	74.7	68.0	34.5	53.5

Table 9: Mean metric scores over 5 seeds for evaluated datasets for the default parameters (×100). The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9		DEN-10		RBF-3		IvF		KDD99		Gas	
	ARI	AMI	ARI	AMI	ARI	AMI	ARI	AMI	ARI	AMI	ARI	AMI
STREAMKmeans	36.5	56.6	0.3	2.3	54.9	66.5	13.3	14.4	0.0	0.0	0.0	0.0
DenStream	7.9	48.7	32.4	63.4	59.2	68.0	19.0	39.9	77.6	67.6	26.8	39.4
DBSTREAM	0.0	0.0	0.1	0.7	0.0	0.0	0.0	0.0	**92.7**	**84.4**	6.2	11.7
EMCStream	**48.9**	67.4	**58.4**	70.5	53.6	66.3	26.2	27.1	57.2	60.4	4.1	6.6
MCMSTStream	1.0	14.5	7.5	32.5	70.0	74.0	42.5	54.1	58.9	55.8	16.4	38.4
GB-FuzzyStream	2.9	9.9	13.3	36.2	25.4	49.0	-	-	-	-	4.6	16.7
CluStream-O - var. k	9.5	53.0	49.7	69.8	19.0	51.4	5.4	26.8	68.1	57.2	19.5	46.8
CluStream-O - fixed k	36.4	62.1	7.7	21.4	57.2	68.0	38.4	40.6	83.9	77.2	25.5	37.8
CluStream-O - k=100	9.5	53.0	49.7	69.8	19.0	51.4	5.4	26.8	68.1	57.2	19.5	46.8
CluStream - Wk-Means	36.8	62.8	50.2	66.4	75.2	78.4	**95.7**	**93.4**	86.7	74.9	32.0	45.2
CluStream-C - k-Means	37.1	62.8	14.4	37.2	70.2	76.2	90.9	87.7	89.9	78.3	24.7	39.4
CluStream-W - k-Means	36.8	62.8	50.2	66.4	75.2	78.4	**95.7**	**93.4**	86.7	74.9	32.0	45.2
CluStream-S - k-Means	35.4	61.8	48.8	65.0	76.3	78.9	94.9	92.4	86.9	75.3	30.7	44.1
CluStream-G - k-Means	36.1	62.0	50.0	66.0	**76.8**	**79.2**	95.4	93.1	87.0	75.3	30.8	44.0
CluStream-C - SubKMeans	35.7	61.3	15.3	40.2	70.6	76.1	91.2	87.8	89.8	78.3	24.2	38.7
CluStream-W - SubKMeans	35.4	61.5	49.9	66.3	73.7	77.3	95.3	92.9	86.6	75.0	31.9	45.6
CluStream-S - SubKMeans	35.5	61.6	49.8	65.9	74.8	77.9	94.9	92.4	87.0	75.4	31.4	44.9
CluStream-G - SubKMeans	36.1	61.9	51.2	66.9	76.1	78.8	95.4	93.0	87.0	75.4	31.5	44.9
CluStream-C - X-Means	46.0	64.4	5.7	18.6	49.7	62.7	30.5	50.0	84.6	72.9	28.1	48.5
CluStream-W - X-Means	9.7	53.2	50.2	72.9	66.5	73.4	21.2	41.5	68.2	57.6	19.5	47.0
CluStream-S - X-Means	9.5	53.0	50.0	71.5	64.2	72.0	20.0	39.8	68.2	57.3	19.5	46.9
CluStream-G - X-Means	19.4	58.9	51.4	71.0	68.7	75.0	19.3	36.8	73.6	58.6	19.5	46.9
CluStream-C - P-Dip-M	0.0	0.0	0.0	0.0	3.3	5.0	24.9	24.9	89.5	79.0	12.7	20.3
CluStream-W - P-Dip-M	13.4	57.5	-	-	24.5	56.1	6.5	29.6	-	-	-	-
CluStream-S - P-Dip-M	13.2	57.7	-	-	24.0	55.7	6.4	29.3	-	-	-	-
CluStream-G - P-Dip-M	39.6	66.7	50.9	70.2	70.8	77.3	32.1	49.8	81.4	67.5	22.4	50.2
CluStream-C - SC	30.3	52.6	10.2	31.1	57.5	68.2	90.9	87.0	90.4	79.6	23.0	36.3
CluStream-W - SC	25.7	53.3	37.2	55.2	73.5	77.1	94.9	92.4	51.7	51.3	22.0	35.1
CluStream-S - SC	25.7	53.7	29.9	50.4	72.9	76.7	94.9	92.4	48.8	50.0	22.8	35.6
CluStream-G - SC	24.8	51.9	31.8	51.9	73.1	76.8	95.4	93.2	48.9	50.0	22.8	35.6
CluStream-C - SCAR	30.0	50.2	2.2	15.1	45.8	57.9	32.9	35.5	89.7	76.2	22.1	33.5
CluStream-W - SCAR	13.5	44.5	33.4	58.3	17.2	41.7	5.3	13.4	63.3	58.4	11.6	31.3
CluStream-S - SCAR	11.1	42.9	24.9	52.6	16.9	41.7	6.9	14.3	61.3	56.3	9.9	30.4
CluStream-G - SCAR	15.7	45.6	47.8	65.8	30.7	52.2	8.1	14.7	66.3	60.8	11.1	32.1
CluStream-C - SpectACl	10.8	29.4	19.9	42.3	21.5	32.8	28.0	24.4	86.7	72.4	22.3	32.7
CluStream-W - SpectACl	5.9	28.6	37.4	59.3	28.6	41.7	27.8	33.2	87.8	74.2	22.6	32.1
CluStream-S - SpectACl	5.8	28.6	37.5	58.8	26.0	39.2	30.4	34.2	88.4	74.7	23.8	33.3
CluStream-G - SpectACl	5.1	24.4	36.5	58.2	20.3	34.1	29.7	33.6	88.2	74.6	22.9	32.5
CluStream-C - DBSCAN	0.0	0.0	6.2	25.2	0.0	0.0	0.0	0.0	66.6	64.1	10.6	19.3
CluStream-W - DBSCAN	0.0	0.0	6.2	25.2	0.0	0.0	0.0	0.0	91.2	81.3	9.0	20.0
CluStream-S - DBSCAN	0.0	0.0	6.1	25.0	0.0	0.0	0.0	0.0	91.2	80.7	9.0	20.0
CluStream-G - DBSCAN	0.0	0.0	6.0	24.3	0.0	0.0	0.0	0.0	91.2	80.8	9.1	20.1
CluStream-C - HDBSCAN	25.2	47.5	3.2	8.0	61.8	74.4	88.7	87.4	83.7	77.2	28.7	40.6
CluStream-W - HDBSCAN	11.2	54.4	56.2	76.3	21.9	54.9	6.1	29.0	78.0	65.9	20.5	49.4
CluStream-S - HDBSCAN	11.4	54.9	56.4	76.8	21.3	54.5	6.0	28.7	76.9	64.2	20.4	49.2
CluStream-G - HDBSCAN	22.2	54.9	56.7	**77.0**	70.4	78.1	13.9	33.9	76.9	64.3	20.4	49.2
CluStream-C - RNN-DBS	15.2	30.3	0.1	1.0	11.9	19.6	72.9	72.1	78.6	75.6	17.1	26.6
CluStream-W - RNN-DBS	8.5	48.7	28.9	56.7	19.6	51.7	6.1	27.8	63.6	58.4	19.7	47.9
CluStream-S - RNN-DBS	8.2	49.0	42.0	67.0	19.6	51.9	5.7	27.7	63.1	56.2	19.7	47.8
CluStream-G - RNN-DBS	36.2	66.1	19.5	42.3	48.1	60.8	18.8	38.0	63.9	57.4	19.9	48.2
CluStream-C - MDBSCAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	62.3	63.0	5.5	10.7
CluStream-W - MDBSCAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	91.7	81.9	8.8	19.3
CluStream-S - MDBSCAN	0.0	0.0	0.1	0.9	0.0	0.0	0.0	0.0	91.5	81.5	8.8	19.3
CluStream-G - MDBSCAN	0.0	0.0	0.2	1.3	0.0	0.0	0.0	0.0	91.5	81.5	8.9	19.4
CluStream-C - DPC	14.4	32.8	7.3	14.3	48.3	62.5	71.1	73.8	32.1	37.8	8.6	14.2
CluStream-W - DPC	25.6	49.2	7.5	20.6	17.9	25.4	38.4	40.5	55.1	52.1	16.5	24.8
CluStream-S - DPC	25.3	48.5	3.3	9.2	9.4	13.6	38.4	40.5	11.5	10.9	9.0	11.9
CluStream-G - DPC	16.1	37.1	0.0	0.0	44.1	59.7	9.4	16.1	4.5	4.8	8.8	12.3
CluStream-C - SNN-DPC	45.6	66.8	15.5	34.3	57.1	68.0	31.9	35.7	82.7	71.0	29.6	47.0
CluStream-W - SNN-DPC	33.0	56.3	25.8	50.8	40.3	55.2	57.1	56.0	81.8	72.8	29.9	43.8
CluStream-S - SNN-DPC	30.9	56.7	26.0	50.5	42.8	58.0	68.0	66.5	79.8	71.1	27.4	40.7
CluStream-G - SNN-DPC	43.5	69.0	15.0	35.1	69.1	76.7	46.4	52.0	89.7	78.4	31.5	47.3
CluStream-C - DBHD	43.6	**72.7**	37.7	60.2	66.6	74.7	29.2	46.1	88.2	75.4	**35.6**	**54.0**
CluStream-W - DBHD	43.6	**72.7**	37.7	60.2	66.6	74.7	29.2	46.1	88.2	75.4	**35.6**	**54.0**
CluStream-S - DBHD	43.6	**72.7**	37.7	60.2	66.6	74.7	29.2	46.1	88.2	75.4	**35.6**	**54.0**
CluStream-G - DBHD	5.6	43.5	22.6	59.1	5.9	39.5	2.5	22.9	61.6	51.7	5.5	37.4

Table 10: Mean metric scores over 5 seeds for evaluated datasets using the default parameters for the online phase, but the best-performing parameters according to the sum of ARI and AMI for the offline phase (×100). Competitors are included with default parameters. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9		DEN-10		RBF-3		IvF		KDD99		Gas	
	ARI	AMI	ARI	AMI	ARI	AMI	ARI	AMI	ARI	AMI	ARI	AMI
STREAMKmeans	36.5	56.6	0.3	2.3	54.9	66.5	13.3	14.4	0.0	0.0	0.0	0.0
DenStream	7.9	48.7	32.4	63.4	59.2	68.0	19.0	39.9	77.6	67.6	26.8	39.4
DBSTREAM	0.0	0.0	0.1	0.7	0.0	0.0	0.0	0.0	**92.7**	84.4	6.2	11.7
EMCStream	48.9	67.4	58.4	70.5	53.6	66.3	26.2	27.1	57.2	60.4	4.1	6.6
MCMSTStream	1.0	14.5	7.5	32.5	70.0	74.0	42.5	54.1	58.9	55.8	16.4	38.4
GB-FuzzyStream	2.9	9.9	13.3	36.2	25.4	49.0	-	-	-	-	4.6	16.7
CluStream-O - var. k	9.5	53.0	49.7	69.8	19.0	51.4	5.4	26.8	68.1	57.2	19.5	46.8
CluStream-O - fixed k	36.4	62.1	7.7	21.4	57.2	68.0	38.4	40.6	83.9	77.2	25.5	37.8
CluStream-O - k=100	9.5	53.0	49.7	69.8	19.0	51.4	5.4	26.8	68.1	57.2	19.5	46.8
CluStream - Wk-Means	36.8	62.8	50.2	66.4	75.2	78.4	95.7	93.4	86.7	74.9	32.0	45.2
CluStream-C - k-Means	37.1	62.8	14.4	37.2	70.2	76.2	90.9	87.7	89.9	78.3	24.7	39.4
CluStream-W - k-Means	36.8	62.8	50.2	66.4	75.2	78.4	95.7	93.4	86.7	74.9	32.0	45.2
CluStream-S - k-Means	35.4	61.8	48.8	65.0	76.3	78.9	94.9	92.4	86.9	75.3	30.7	44.1
CluStream-G - k-Means	36.1	62.0	50.0	66.0	76.8	79.2	95.4	93.1	87.0	75.3	30.8	44.0
CluStream-C - SubKMeans	35.7	61.3	34.8	53.9	70.6	76.1	91.4	88.1	89.8	78.3	24.5	39.1
CluStream-W - SubKMeans	35.4	61.5	52.0	69.1	74.5	78.2	95.3	92.9	86.6	75.0	31.9	45.6
CluStream-S - SubKMeans	35.5	61.6	52.6	69.2	75.4	78.5	94.9	92.4	87.0	75.4	31.6	45.3
CluStream-G - SubKMeans	36.1	61.9	53.2	69.0	76.1	78.8	95.4	93.0	87.0	75.4	31.6	45.2
CluStream-C - X-Means	46.0	64.4	19.2	41.1	73.5	78.1	32.7	51.2	86.1	75.3	28.1	48.5
CluStream-W - X-Means	10.0	53.4	50.2	72.9	67.8	74.5	21.2	41.5	68.2	57.9	19.5	47.1
CluStream-S - X-Means	9.7	53.1	50.0	71.8	68.7	74.7	20.5	40.5	68.2	57.3	19.5	46.9
CluStream-G - X-Means	21.5	60.9	51.9	71.5	73.4	77.2	19.3	36.8	73.8	58.7	19.5	46.9
CluStream-C - P-Dip-M	0.0	0.0	0.0	0.0	3.3	5.0	29.9	29.9	89.3	79.3	20.9	33.0
CluStream-W - P-Dip-M	14.4	58.5	-	-	25.4	56.7	12.2	33.5	-	-	-	-
CluStream-S - P-Dip-M	13.9	58.2	-	-	24.9	56.3	13.5	34.1	-	-	-	-
CluStream-G - P-Dip-M	40.4	66.0	50.9	70.2	73.0	78.4	40.9	54.8	82.2	68.6	22.7	50.7
CluStream-C - SC	44.4	64.6	44.2	61.6	76.3	79.6	94.9	92.4	90.3	79.7	29.9	45.0
CluStream-W - SC	48.5	73.6	50.3	68.7	73.5	77.1	94.9	92.4	85.5	75.1	42.3	56.8
CluStream-S - SC	47.3	72.5	53.6	70.7	72.9	76.7	94.9	92.4	85.2	73.7	**44.5**	**58.2**
CluStream-G - SC	44.9	71.8	52.0	70.2	73.1	76.8	95.4	93.2	85.5	74.0	37.0	50.9
CluStream-C - SCAR	41.8	66.4	44.9	61.7	73.3	77.1	83.5	80.8	87.5	79.1	31.5	46.1
CluStream-W - SCAR	41.9	66.0	53.8	69.8	57.8	69.1	51.3	54.6	74.7	71.0	36.5	48.7
CluStream-S - SCAR	45.1	69.7	52.4	69.5	58.3	69.2	37.2	39.8	71.0	65.5	35.0	48.5
CluStream-G - SCAR	45.8	71.2	52.0	69.6	58.4	69.5	53.7	54.2	74.8	65.2	37.6	49.8
CluStream-C - SpectACl	44.6	69.1	54.3	73.3	66.8	76.3	84.7	84.4	86.7	72.4	29.9	43.3
CluStream-W - SpectACl	49.8	71.6	**59.4**	75.7	28.6	41.7	97.7	96.4	90.7	80.7	34.6	46.8
CluStream-S - SpectACl	48.7	71.1	57.3	74.5	68.4	76.9	97.7	96.4	90.3	81.7	34.4	47.1
CluStream-G - SpectACl	48.2	70.8	53.6	73.2	20.3	34.1	94.2	93.3	90.5	81.9	33.1	45.7
CluStream-C - DBSCAN	46.3	72.8	46.2	66.1	63.5	76.0	93.2	93.8	91.2	79.5	28.3	49.7
CluStream-W - DBSCAN	47.1	71.3	49.3	73.6	64.5	77.3	93.1	93.4	91.4	83.6	28.4	49.9
CluStream-S - DBSCAN	46.5	73.1	48.6	72.8	66.4	78.4	93.0	93.2	91.5	83.8	28.6	50.0
CluStream-G - DBSCAN	44.5	71.2	53.7	75.6	73.6	81.5	75.5	75.9	91.5	83.8	28.8	50.2
CluStream-C - HDBSCAN	48.5	72.3	46.6	67.5	65.5	76.6	98.2	96.9	84.4	77.0	33.9	53.1
CluStream-W - HDBSCAN	47.9	71.7	57.9	**77.4**	62.9	75.3	98.2	96.9	88.4	81.6	35.0	55.9
CluStream-S - HDBSCAN	48.0	71.9	56.8	77.1	62.4	72.3	98.2	96.9	89.4	81.4	34.8	57.0
CluStream-G - HDBSCAN	47.7	70.6	56.8	77.0	74.0	80.2	89.1	89.8	89.4	81.4	35.5	53.4
CluStream-C - RNN-DBS	34.9	67.0	12.5	23.8	63.2	71.4	74.7	74.7	86.2	76.7	31.8	49.0
CluStream-W - RNN-DBS	40.8	66.4	50.1	71.8	26.8	51.4	53.5	62.2	60.9	61.1	30.4	51.3
CluStream-S - RNN-DBS	40.8	65.4	49.7	71.1	19.6	51.9	59.6	67.4	61.3	61.6	33.3	52.4
CluStream-G - RNN-DBS	40.9	68.0	28.8	47.0	53.5	63.9	40.3	49.9	64.5	63.7	30.7	53.0
CluStream-C - MDBSCAN	47.1	71.3	52.3	70.4	67.5	74.9	98.0	96.2	91.2	81.0	29.6	51.9
CluStream-W - MDBSCAN	49.4	75.8	53.7	70.6	63.2	73.4	**99.5**	**99.0**	90.4	84.1	31.5	52.5
CluStream-S - MDBSCAN	48.6	74.6	53.5	70.5	63.6	73.8	**99.5**	**99.0**	91.8	85.2	30.7	52.3
CluStream-G - MDBSCAN	44.8	72.3	49.2	68.6	66.0	75.3	93.9	93.1	91.9	**85.3**	27.9	52.2
CluStream-C - DPC	42.2	70.0	46.1	67.6	70.7	76.9	88.4	88.5	88.8	84.2	21.5	37.9
CluStream-W - DPC	45.6	65.3	58.9	70.8	67.0	74.2	74.0	77.6	89.6	75.8	29.3	51.0
CluStream-S - DPC	47.3	65.7	59.1	71.9	67.2	74.6	75.1	78.1	89.6	75.9	28.9	51.4
CluStream-G - DPC	38.1	70.2	54.8	70.7	76.4	79.4	71.9	73.8	82.3	76.3	29.1	51.6
CluStream-C - SNN-DPC	45.6	66.8	22.9	45.0	58.3	69.2	31.9	35.7	82.7	71.0	29.6	47.0
CluStream-W - SNN-DPC	47.8	64.7	34.6	58.6	40.3	55.2	87.1	87.0	81.8	72.8	33.6	45.8
CluStream-S - SNN-DPC	47.9	67.7	32.6	55.7	42.8	58.0	81.7	82.7	81.9	71.2	28.5	40.0
CluStream-G - SNN-DPC	43.5	69.4	42.7	63.1	69.1	76.7	62.1	65.7	90.1	78.6	31.5	47.3
CluStream-C - DBHD	**52.9**	**76.6**	52.1	75.0	71.4	77.6	95.6	93.2	88.2	75.4	43.7	58.1
CluStream-W - DBHD	**52.9**	**76.6**	52.1	75.0	71.4	77.6	95.6	93.2	88.2	75.4	43.7	58.1
CluStream-S - DBHD	**52.9**	**76.6**	52.1	75.0	71.4	77.6	95.6	93.2	88.2	75.4	43.7	58.1
CluStream-G - DBHD	44.8	73.0	49.8	72.4	**77.8**	**81.7**	31.7	47.5	68.2	64.6	33.5	55.3

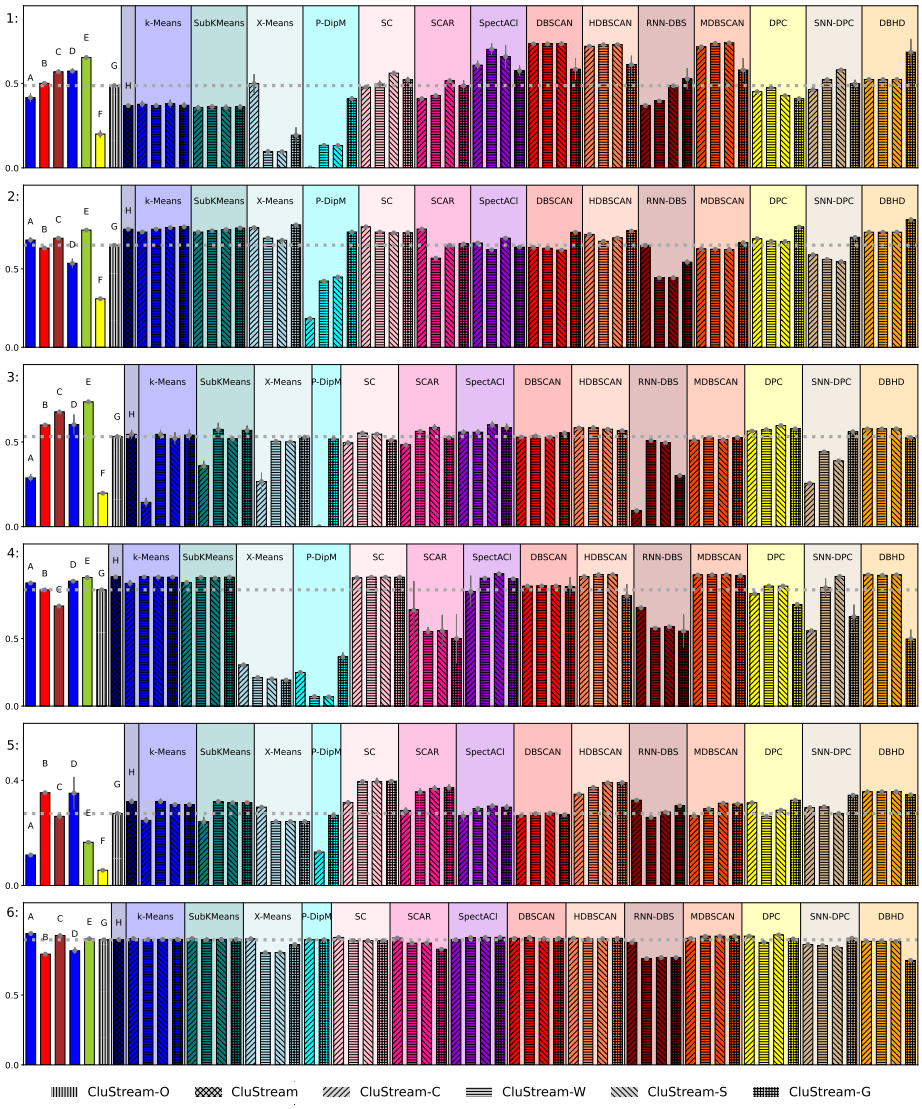

Fig. 1: ARI results for the datasets Complex-9 (1), RBF-3 40000 (2), DENSIRED-10 (3), Fertility-vs-Income (4), Gas Sensor Array (5), and KDD-CUP99 (6) for the best-performing runs of STREAMKmeans (A), DenStream (B), DBSTREAM (C), EMCStream (D), MCMSTStream (E), GB-FuzzyStream (F), CluStream-O (G) (also marked by the horizontal line), as well as the CluStream variants (denoted by hatch) for the respective offline clustering algorithms, including the default case of Wk-Means (H). The color indicates the offline clustering. The standard deviation for different seeds is denoted by gray bars at the top.

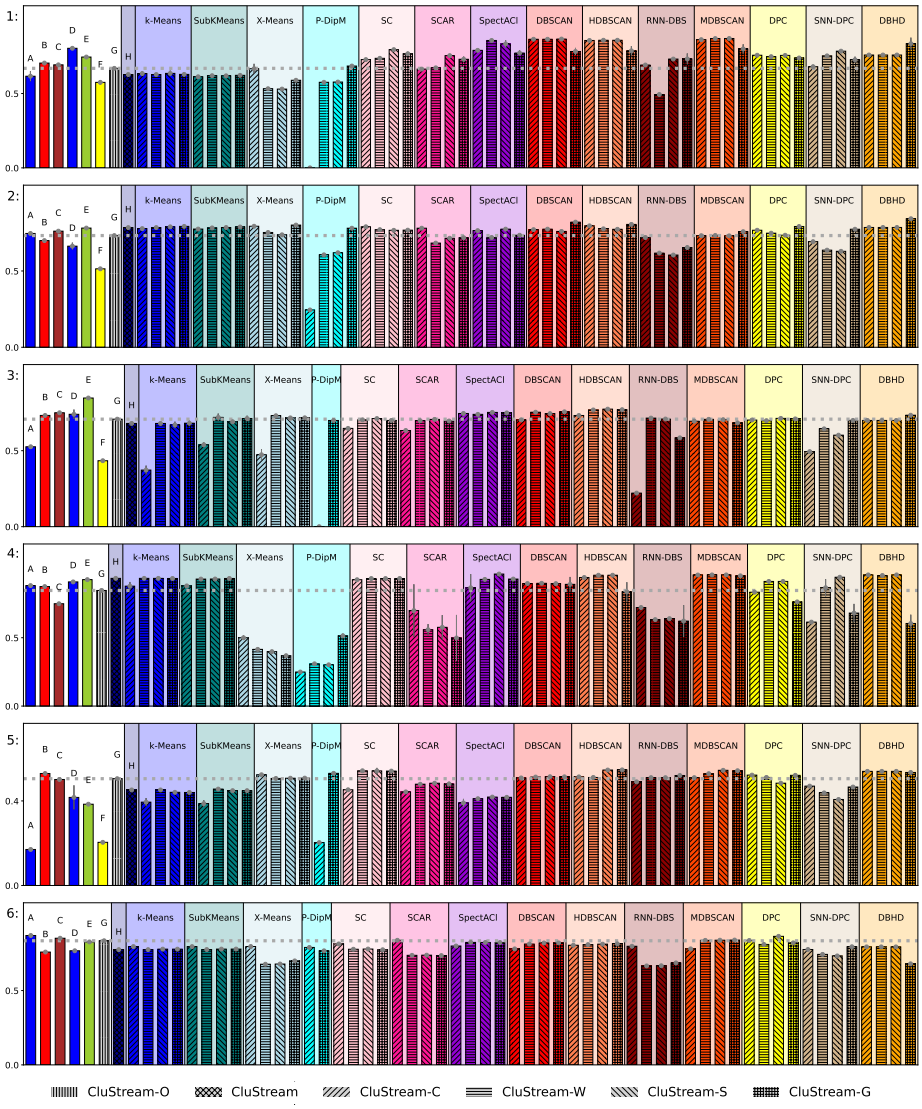

Fig. 2: AMI results for the datasets Complex-9 (1), RBF-3 40000 (2), DENSIRED-10 (3), Fertility-vs-Income (4), Gas Sensor Array (5), and KDD-CUP99 (6) for the best-performing runs of STREAMKmeans (A), DenStream (B), DBSTREAM (C), EMCStream (D), MCMSTStream (E), GB-FuzzyStream (F), CluStream-O (G) (also marked by the horizontal line), as well as the CluStream variants (denoted by hatch) for the respective offline clustering algorithms, including the default case of Wk-Means (H). The color indicates the offline clustering. The standard deviation for different seeds is denoted by gray bars at the top.

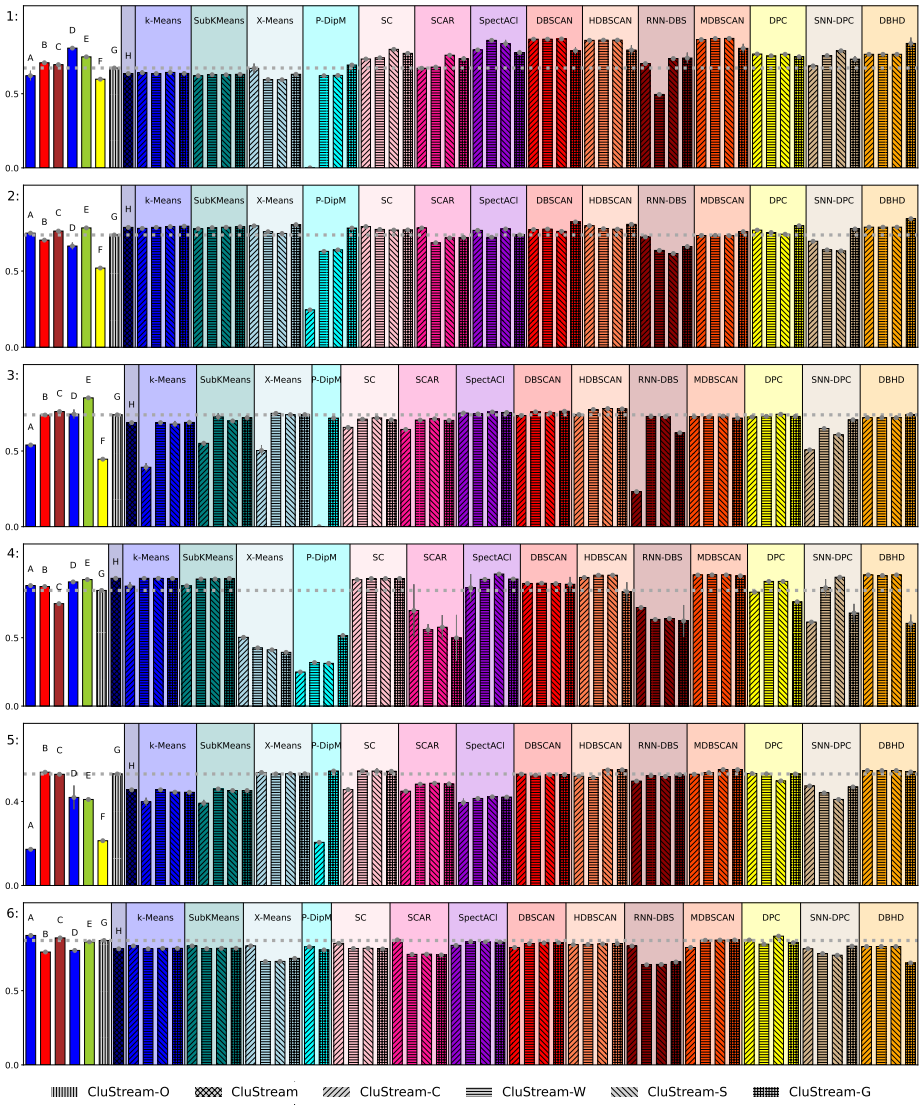

Fig. 3: NMI results for the datasets Complex-9 (1), RBF-3 40000 (2), DENSIRED-10 (3), Fertility-vs-Income (4), Gas Sensor Array (5), and KDD-CUP99 (6) for the best-performing runs of STREAMKmeans (A), DenStream (B), DBSTREAM (C), EMCStream (D), MCMSTStream (E), GB-FuzzyStream (F), CluStream-O (G) (also marked by the horizontal line), as well as the CluStream variants (denoted by hatch) for the respective offline clustering algorithms, including the default case of Wk-Means (H). The color indicates the offline clustering. The standard deviation for different seeds is denoted by gray bars at the top.

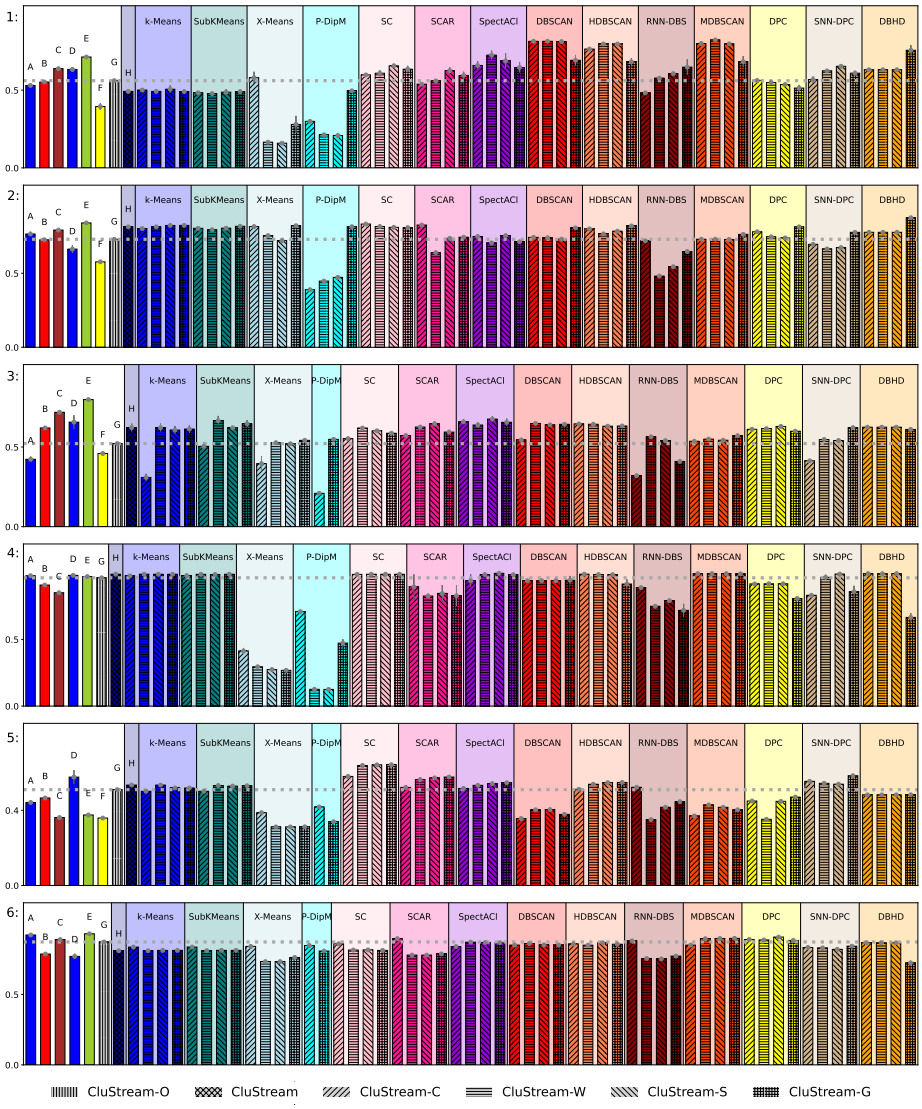

Fig. 4: Accuracy results for the datasets Complex-9 (1), RBF-3 40000 (2), DENSIRED-10 (3), Fertility-vs-Income (4), Gas Sensor Array (5), and KDD-CUP99 (6) for the best-performing runs of STREAMKmeans (A), DenStream (B), DBSTREAM (C), EMCStream (D), MCMSTStream (E), GB-FuzzyStream (F), CluStream-O (G) (also marked by the horizontal line), as well as the CluStream variants (denoted by hatch) for the respective offline clustering algorithms, including the default case of Wk-Means (H). The color indicates the offline clustering. The standard deviation for different seeds is denoted by gray bars at the top.

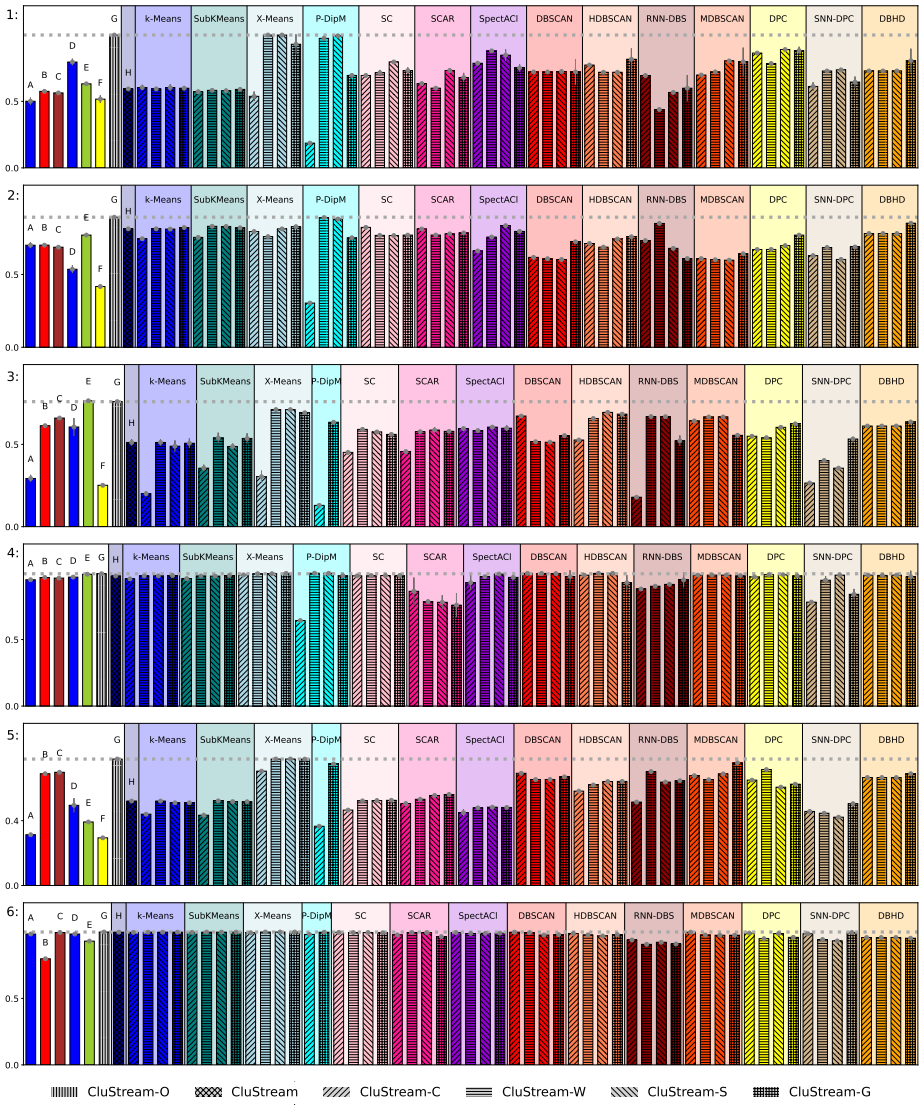

Fig. 5: Precision results for the datasets Complex-9 (1), RBF-3 40000 (2), DENSIRED-10 (3), Fertility-vs-Income (4), Gas Sensor Array (5), and KDD-CUP99 (6) for the best-performing runs of STREAMKmeans (A), DenStream (B), DBSTREAM (C), EMCStream (D), MCMSTStream (E), GB-FuzzyStream (F), CluStream-O (G) (also marked by the horizontal line), as well as the CluStream variants (denoted by hatch) for the respective offline clustering algorithms, including the default case of Wk-Means (H). The color indicates the offline clustering. The standard deviation for different seeds is denoted by gray bars at the top.

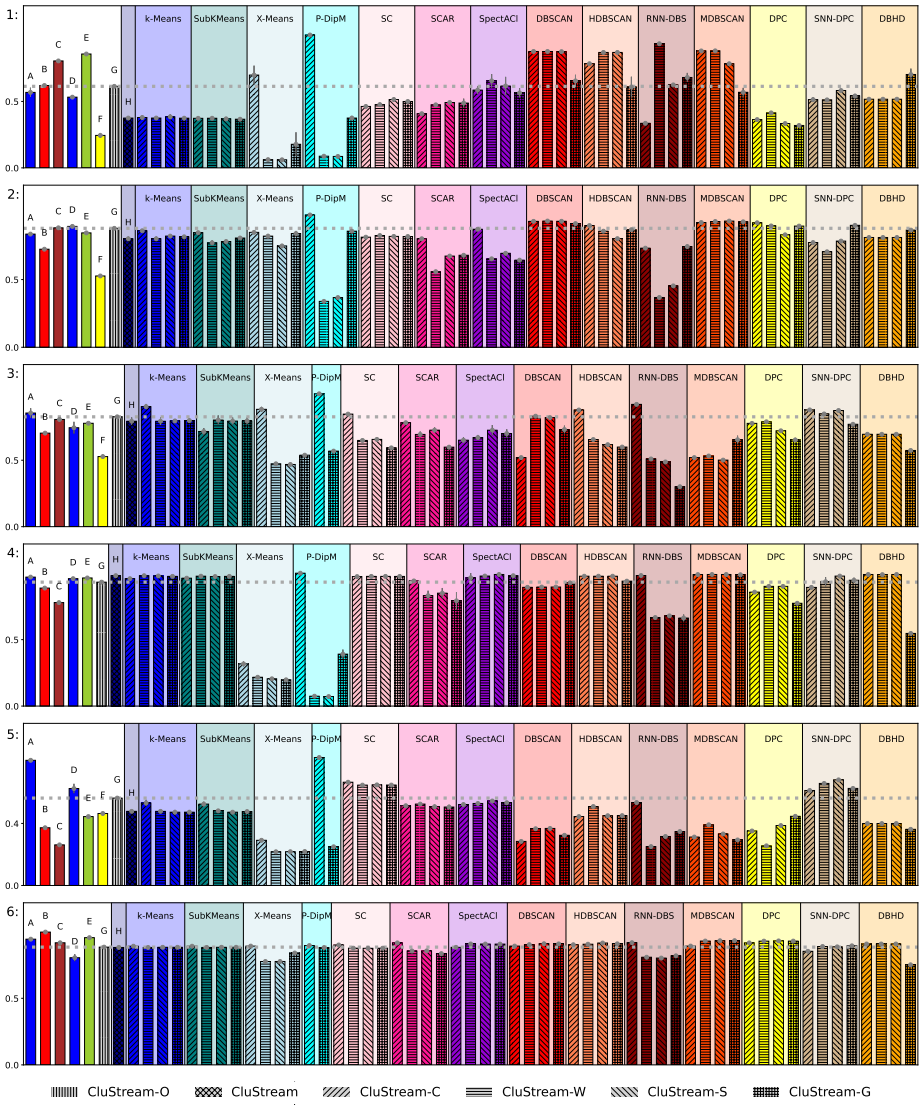

Fig. 6: Recall results for the datasets Complex-9 (1), RBF-3 40000 (2), DENSIRED-10 (3), Fertility-vs-Income (4), Gas Sensor Array (5), and KDD-CUP99 (6) for the best-performing runs of STREAMKmeans (A), DenStream (B), DBSTREAM (C), EMCStream (D), MCMSTStream (E), GB-FuzzyStream (F), CluStream-O (G) (also marked by the horizontal line), as well as the CluStream variants (denoted by hatch) for the respective offline clustering algorithms, including the default case of Wk-Means (H). The color indicates the offline clustering. The standard deviation for different seeds is denoted by gray bars at the top.

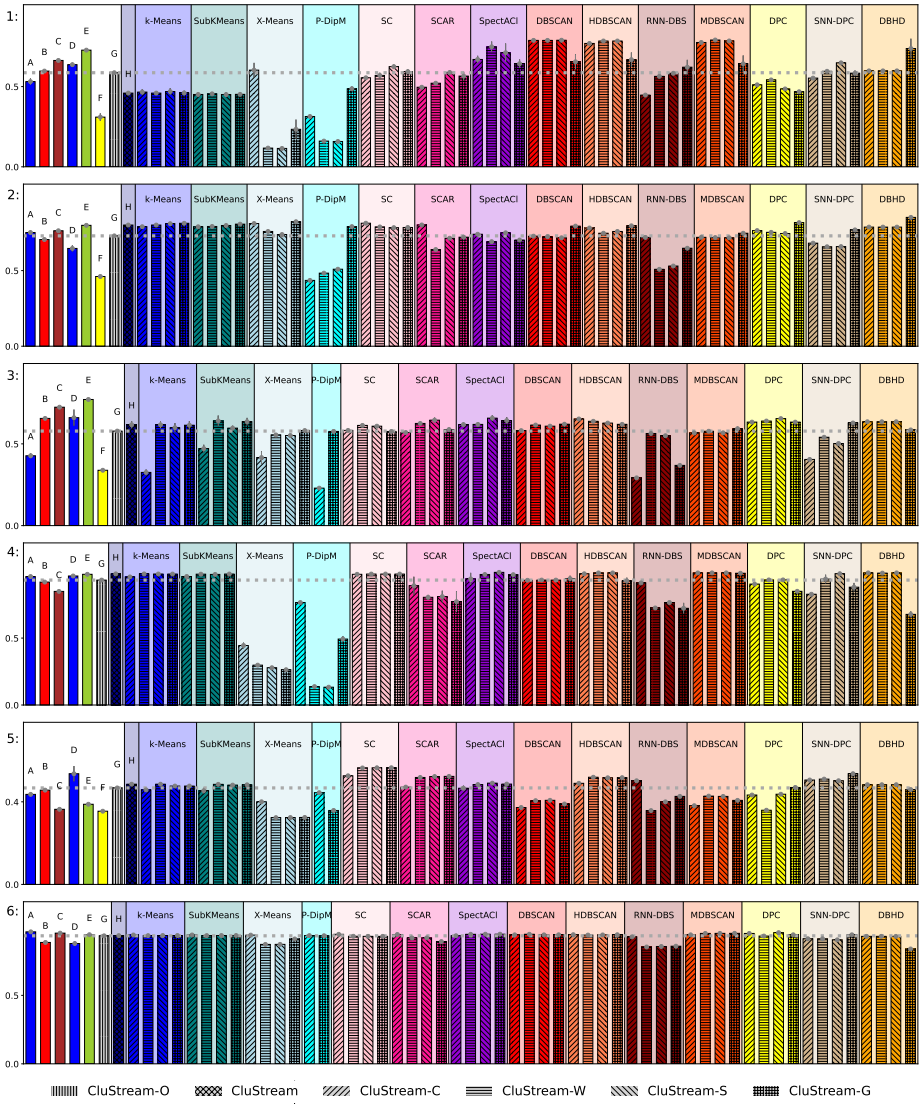

Fig. 7: F1 results for the datasets Complex-9 (1), RBF-3 40000 (2), DENSIRED-10 (3), Fertility-vs-Income (4), Gas Sensor Array (5), and KDDCUP99 (6) for the best-performing runs of STREAMKmeans (A), DenStream (B), DBSTREAM (C), EMCStream (D), MCMSTStream (E), GB-FuzzyStream (F), CluStream-O (G) (also marked by the horizontal line), as well as the CluStream variants (denoted by hatch) for the respective offline clustering algorithms, including the default case of Wk-Means (H). The color indicates the offline clustering. The standard deviation for different seeds is denoted by gray bars at the top.

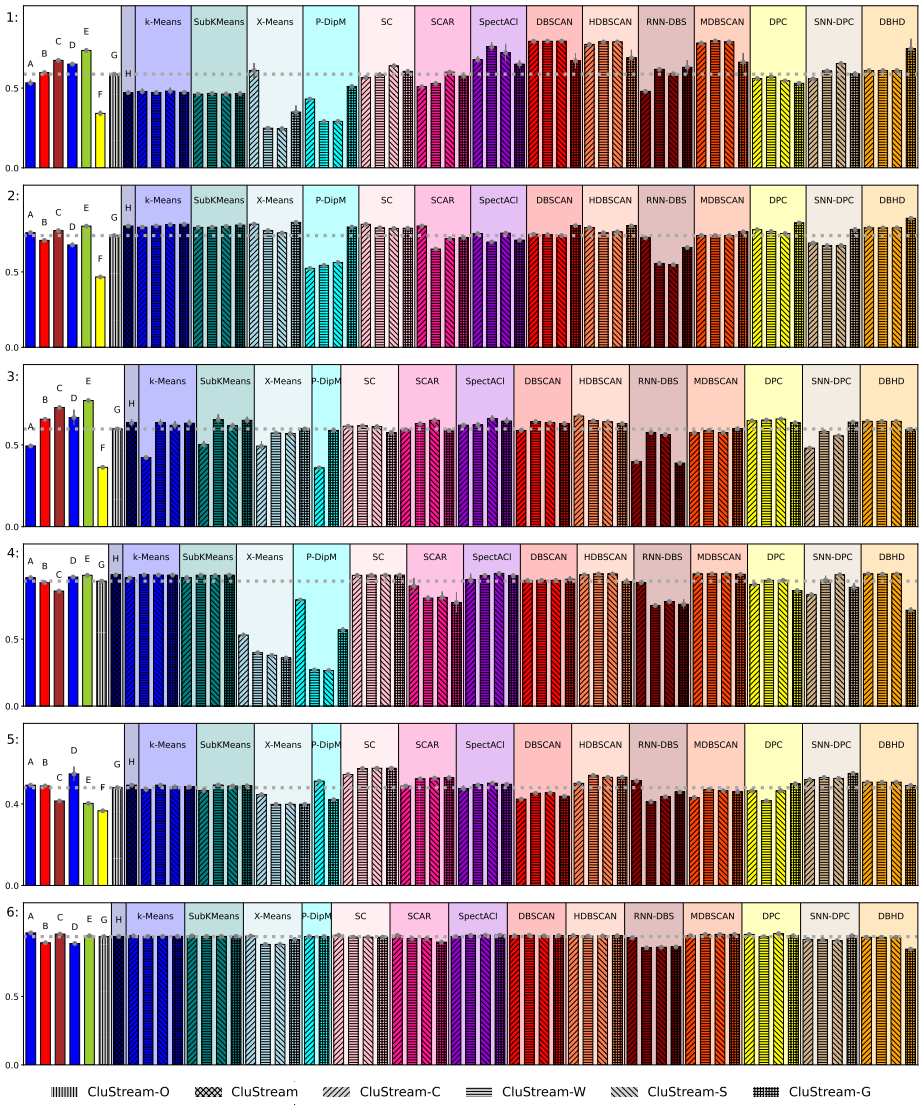

Fig. 8: FMI results for the datasets Complex-9 (1), RBF-3 40000 (2), DENSIRED-10 (3), Fertility-vs-Income (4), Gas Sensor Array (5), and KDD-CUP99 (6) for the best-performing runs of STREAMKmeans (A), DenStream (B), DBSTREAM (C), EMCStream (D), MCMSTStream (E), GB-FuzzyStream (F), CluStream-O (G) (also marked by the horizontal line), as well as the CluStream variants (denoted by hatch) for the respective offline clustering algorithms, including the default case of Wk-Means (H). The color indicates the offline clustering. The standard deviation for different seeds is denoted by gray bars at the top.

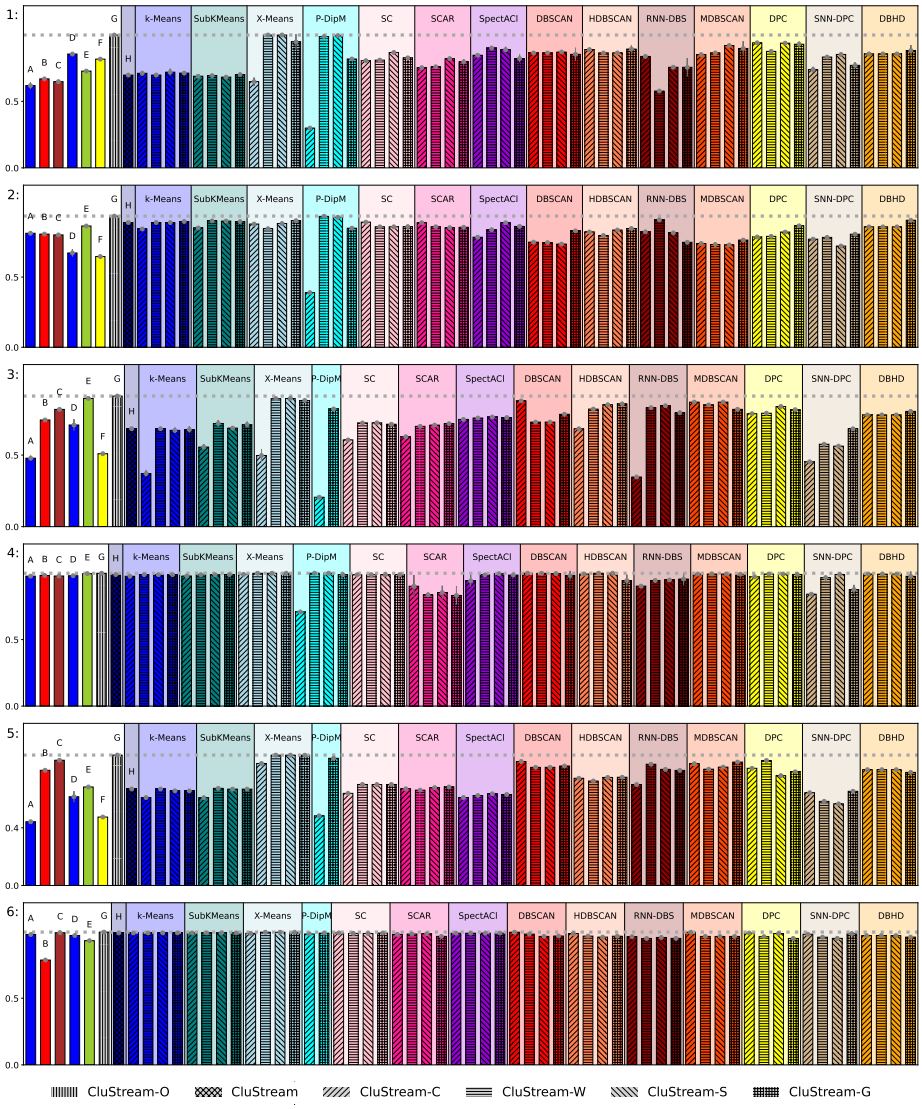

Fig. 9: Purity results for the datasets Complex-9 (1), RBF-3 40000 (2), DENSIRED-10 (3), Fertility-vs-Income (4), Gas Sensor Array (5), and KDD-CUP99 (6) for the best-performing runs of STREAMKmeans (A), DenStream (B), DBSTREAM (C), EMCStream (D), MCMSTStream (E), GB-FuzzyStream (F), CluStream-O (G) (also marked by the horizontal line), as well as the CluStream variants (denoted by hatch) for the respective offline clustering algorithms, including the default case of Wk-Means (H). The color indicates the offline clustering. The standard deviation for different seeds is denoted by gray bars at the top.

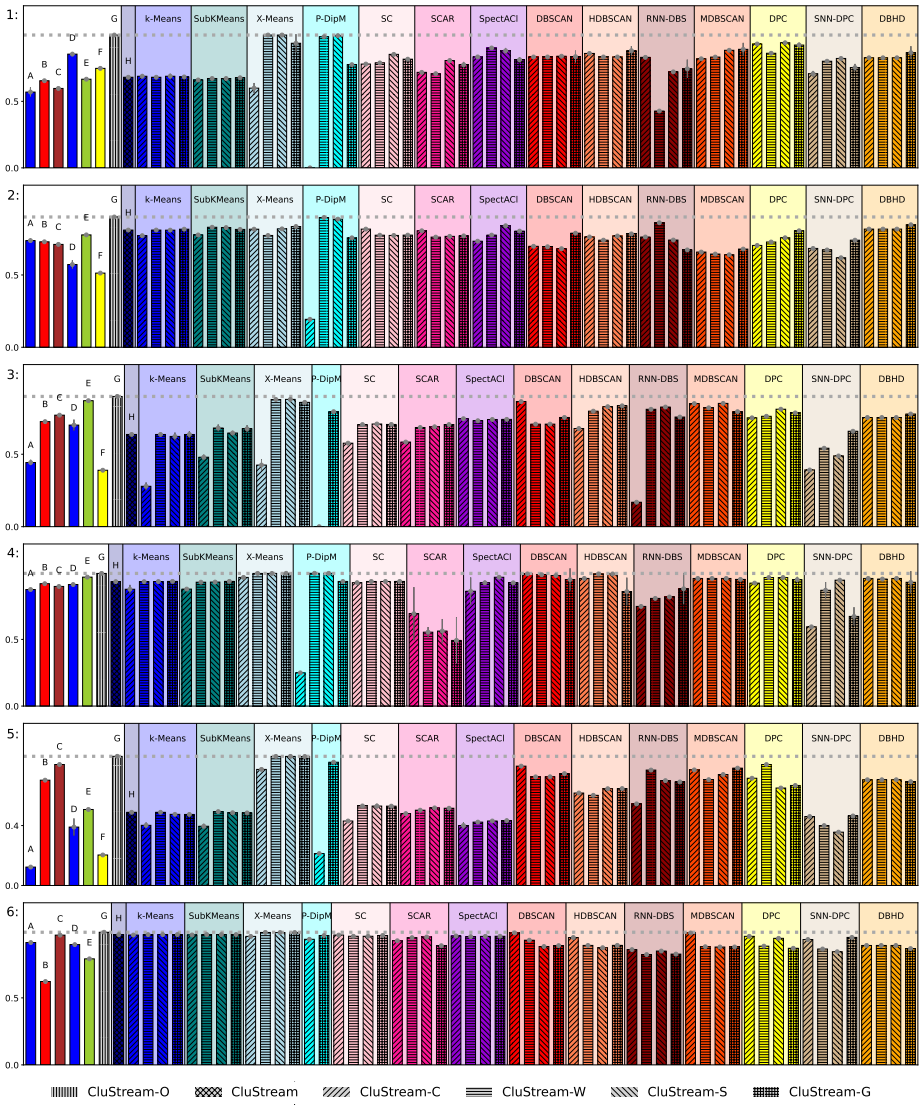

Fig. 10: Homogeneity results for the datasets Complex-9 (1), RBF-3 40000 (2), DENSIRED-10 (3), Fertility-vs-Income (4), Gas Sensor Array (5), and KDD-CUP99 (6) for the best-performing runs of STREAMKmeans (A), DenStream (B), DBSTREAM (C), EMCStream (D), MCMSTStream (E), GB-FuzzyStream (F), CluStream-O (G) (also marked by the horizontal line), as well as the CluStream variants (denoted by hatch) for the respective offline clustering algorithms, including the default case of Wk-Means (H). The color indicates the offline clustering. The standard deviation for different seeds is denoted by gray bars at the top.

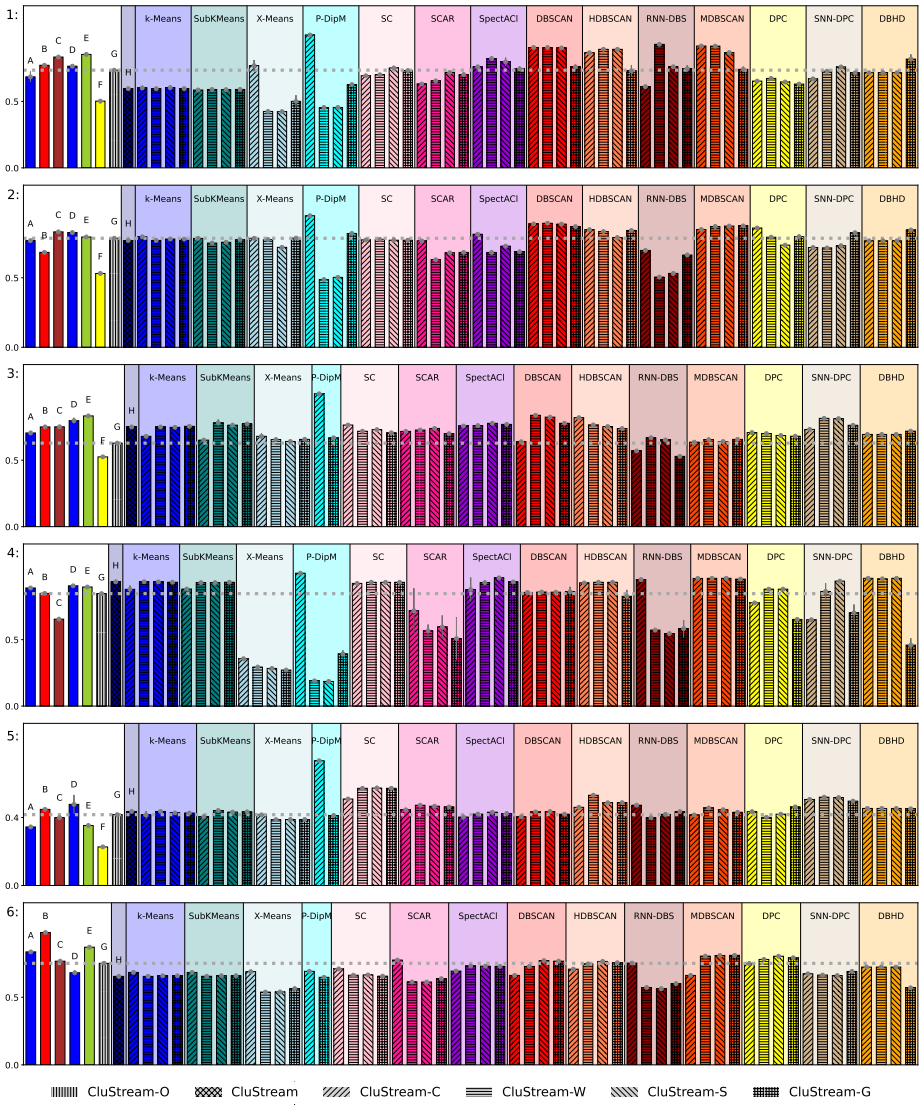

Fig. 11: Completeness results for the datasets Complex-9 (1), RBF-3 40000 (2), DENSIRED-10 (3), Fertility-vs-Income (4), Gas Sensor Array (5), and KDD-CUP99 (6) for the best-performing runs of STREAMKmeans (A), DenStream (B), DBSTREAM (C), EMCStream (D), MCMSTStream (E), GB-FuzzyStream (F), CluStream-O (G) (also marked by the horizontal line), as well as the CluStream variants (denoted by hatch) for the respective offline clustering algorithms, including the default case of Wk-Means (H). The color indicates the offline clustering. The standard deviation for different seeds is denoted by gray bars at the top.

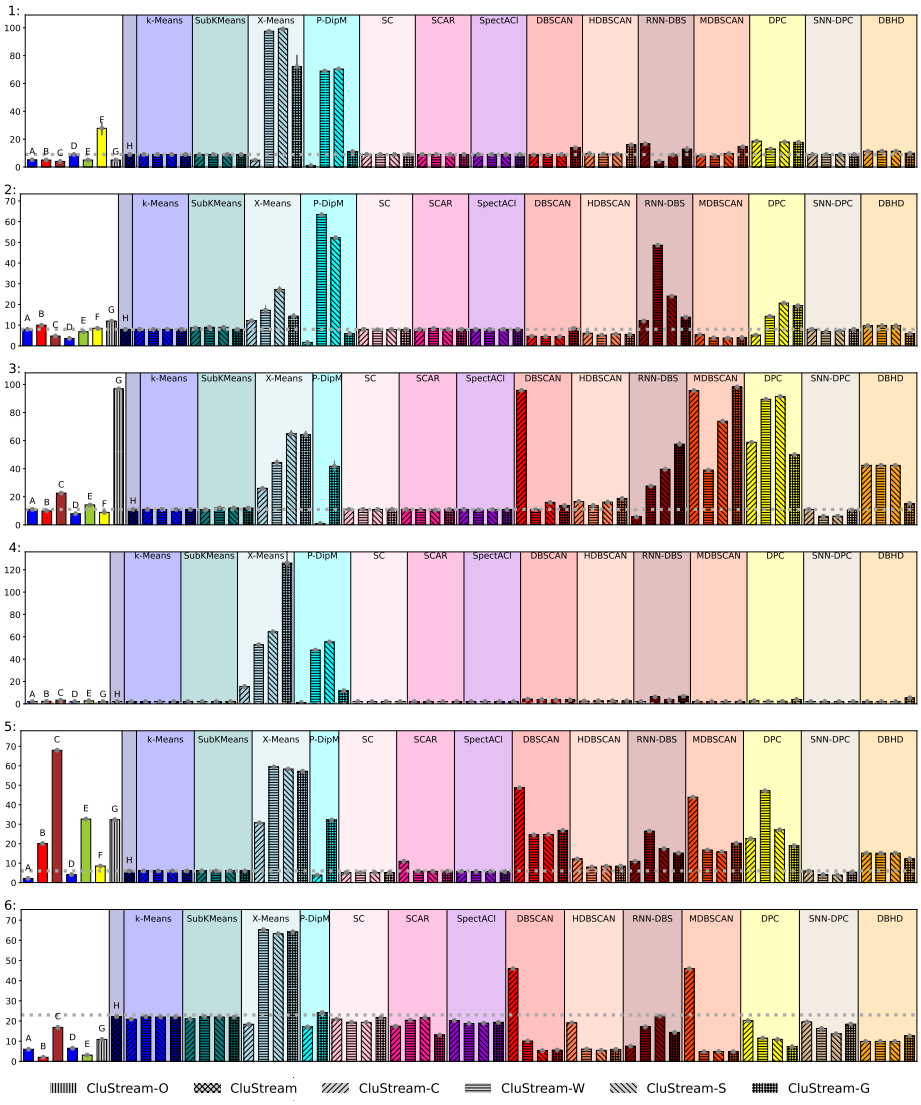

Fig. 12: Average number of clusters per evaluation batch for the datasets Complex-9 (1), RBF-3 40000 (2), DENSIRED-10 (3), Fertility-vs-Income (4), Gas Sensor Array (5), and KDDCUP99 (6) for the best-performing runs of STREAMKmeans (A), DenStream (B), DBSTREAM (C), EMCStream (D), MCMSTStream (E), GB-FuzzyStream (F), CluStream-O (G), as well as the CluStream variants (denoted by hatch) for the respective offline clustering algorithms, including the default case of Wk-Means (H). The color indicates the offline clustering. The standard deviation for different seeds is denoted by gray bars at the top. The horizontal line notes the ground truth cluster number.

Table 11: ARI Scores for evaluated datasets for the best parameters according to the sum of ARI and AMI (×100). The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	ARI	ARI	ARI	ARI	ARI	ARI
STREAMKmeans	41.6±2.6	28.8±2.3	68.4±1.8	91.3±0.0	**94.0**±0.0	11.6±0.0
DenStream	50.0±0.0	60.0±0.0	63.3±0.0	86.1±0.0	79.2±0.0	35.3±0.0
DBSTREAM	56.9±0.0	67.8±0.0	69.6±0.0	74.2±0.0	92.5±0.0	26.3±0.0
EMCStream	57.3±1.5	60.3±5.9	53.6±3.0	92.6±1.2	81.6±2.4	35.1±6.2
MCMSTStream	65.3±0.0	**73.7**±0.0	74.8±0.0	95.3±0.0	90.3±0.0	16.4±0.0
GB-FuzzyStream	20.0±2.2	19.8±0.9	31.0±0.6	-	-	5.8±0.2
CluStream-O - var. k	48.7±0.0	53.2±0.0	65.2±0.0	86.2±0.0	89.5±0.0	27.4±0.0
CluStream-O - fixed k	41.6±0.0	16.0±0.0	60.2±0.0	86.2±0.0	87.1±0.0	25.5±0.0
CluStream-O - k=100	9.5±0.0	49.7±0.0	41.9±0.0	5.4±0.0	80.3±0.0	24.2±0.0
CluStream - Wk-Means	36.8±1.0	54.5±2.6	75.3±0.7	95.7±0.4	89.7±0.0	32.0±1.1
CluStream-C - k-Means	37.6±2.0	14.4±2.7	73.5±0.9	90.9±2.5	90.4±0.0	24.7±1.2
CluStream-W - k-Means	36.8±1.0	54.5±2.6	75.3±0.7	95.7±0.4	89.7±0.0	32.0±1.1
CluStream-S - k-Means	37.9±2.5	52.1±3.6	76.3±0.6	95.5±1.2	89.8±0.0	30.7±0.7
CluStream-G - k-Means	37.0±1.6	54.1±3.2	76.8±0.8	95.5±0.1	89.8±0.0	30.8±0.8
CluStream-C - SubKMeans	35.7±1.4	35.9±3.0	73.5±0.5	91.6±0.0	90.4±0.0	24.2±1.9
CluStream-W - SubKMeans	36.2±1.1	57.4±3.9	74.3±1.1	95.3±0.5	89.7±0.0	31.9±0.5
CluStream-S - SubKMeans	35.7±1.7	51.8±1.7	75.1±0.8	94.9±1.5	89.8±0.0	31.4±0.4
CluStream-G - SubKMeans	36.1±1.5	56.9±2.9	76.1±0.9	95.5±0.1	89.8±0.0	31.5±0.6
CluStream-C - X-Means	49.9±5.5	26.6±5.2	76.3±0.6	30.5±1.8	90.2±0.1	29.8±0.3
CluStream-W - X-Means	9.7±0.1	50.4±0.2	69.6±0.4	21.2±0.0	80.3±0.0	24.2±0.0
CluStream-S - X-Means	9.5±0.0	50.0±0.1	68.3±1.1	20.0±0.0	80.3±0.0	24.3±0.0
CluStream-G - X-Means	19.4±4.7	52.9±1.0	78.0±1.0	19.3±0.1	86.1±0.0	24.3±0.0
CluStream-C - P-Dip-M	0.0±0.0	0.0±0.0	18.3±0.9	24.9±0.0	89.6±0.0	12.7±0.4
CluStream-W - P-Dip-M	13.4±0.2	-	42.3±0.0	7.1±0.1	-	-
CluStream-S - P-Dip-M	13.2±0.1	-	44.8±0.1	6.8±0.1	-	-
CluStream-G - P-Dip-M	41.0±1.4	51.7±1.0	73.5±0.6	36.5±3.3	89.6±0.0	26.7±0.1
CluStream-C - SC	47.7±0.2	49.6±0.8	76.8±0.1	95.1±0.0	91.2±0.0	31.6±0.7
CluStream-W - SC	49.6±2.1	55.3±0.5	73.5±0.5	95.5±0.0	89.0±0.1	39.5±0.7
CluStream-S - SC	56.0±1.4	54.6±1.0	72.9±0.5	95.5±0.0	88.9±0.1	39.5±1.4
CluStream-G - SC	52.1±1.8	51.1±0.7	73.1±0.3	95.5±0.1	88.8±0.1	**39.7**±0.8
CluStream-C - SCAR	41.0±0.3	48.3±0.9	75.4±0.1	71.3±21.4	90.7±0.2	28.5±1.2
CluStream-W - SCAR	42.7±0.5	56.3±0.7	56.8±0.5	55.2±3.3	87.1±0.1	35.6±1.3
CluStream-S - SCAR	51.6±1.4	58.6±1.9	65.1±0.3	55.9±11.8	87.2±0.1	36.9±1.2
CluStream-G - SCAR	48.6±3.1	52.6±1.2	65.9±0.5	50.0±18.2	82.8±0.5	37.1±1.3
CluStream-C - SpectACl	60.8±2.7	55.9±1.5	66.5±0.8	84.9±11.8	89.6±0.1	26.4±1.8
CluStream-W - SpectACl	70.2±3.7	55.8±1.6	62.2±0.8	94.8±1.6	91.1±0.2	29.3±0.9
CluStream-S - SpectACl	65.9±6.7	60.1±2.0	69.6±1.2	**98.1**±0.0	91.2±0.2	30.2±1.1
CluStream-G - SpectACl	57.5±3.0	58.4±2.4	63.9±0.8	94.3±0.5	91.3±0.1	29.8±1.1
CluStream-C - DBSCAN	73.4±0.0	52.8±0.0	63.7±0.0	88.9±0.0	90.6±0.0	26.5±0.0
CluStream-W - DBSCAN	73.4±0.0	53.6±0.0	63.2±0.0	89.1±0.0	91.2±0.0	27.3±0.0
CluStream-S - DBSCAN	73.5±0.0	52.8±0.0	62.0±0.0	89.0±0.0	90.4±0.0	27.5±0.0
CluStream-G - DBSCAN	58.4±6.3	55.3±1.2	73.4±0.3	88.6±7.1	90.5±0.0	26.8±0.0
CluStream-C - HDBSCAN	71.9±0.0	58.3±0.0	72.0±0.0	96.0±0.0	90.7±0.0	34.7±0.0
CluStream-W - HDBSCAN	72.9±0.0	58.5±0.0	67.6±0.0	97.4±0.0	90.1±0.0	37.3±0.0
CluStream-S - HDBSCAN	72.9±0.0	57.5±0.0	69.8±0.0	97.4±0.0	90.2±0.0	39.1±0.0
CluStream-G - HDBSCAN	61.0±5.4	56.7±0.2	74.2±0.6	81.7±8.7	90.6±0.0	39.1±0.0
CluStream-C - RNN-DBS	37.0±0.0	9.5±0.0	65.1±0.0	72.9±0.0	87.6±0.0	32.4±0.0
CluStream-W - RNN-DBS	39.6±0.0	50.9±0.0	44.3±0.0	57.8±0.0	76.0±0.0	25.9±0.0
CluStream-S - RNN-DBS	48.5±0.0	49.5±0.0	44.4±0.0	58.7±0.0	76.8±0.0	27.9±0.0
CluStream-G - RNN-DBS	52.7±6.3	30.2±1.4	54.3±1.6	55.6±12.2	76.8±0.1	30.3±0.2
CluStream-C - MDBSCAN	71.6±0.0	51.1±0.0	62.8±0.0	97.2±0.0	90.6±0.0	26.4±0.0
CluStream-W - MDBSCAN	73.6±0.0	52.4±0.0	62.5±0.0	97.3±0.0	92.1±0.0	29.2±0.0
CluStream-S - MDBSCAN	**73.9**±0.0	51.4±0.0	62.4±0.0	97.3±0.0	92.1±0.0	31.3±0.0
CluStream-G - MDBSCAN	57.9±7.0	52.5±1.3	66.7±0.4	96.7±0.3	92.2±0.0	31.0±0.1
CluStream-C - DPC	45.0±0.0	56.5±0.0	69.3±0.0	83.2±0.0	92.1±0.0	31.5±0.0
CluStream-W - DPC	47.3±0.0	57.3±0.0	67.7±0.0	88.9±0.0	87.6±0.0	26.3±0.0
CluStream-S - DPC	42.7±0.0	59.7±0.0	67.5±0.0	88.9±0.0	93.0±0.0	28.6±0.0
CluStream-G - DPC	41.0±0.9	57.7±1.2	76.7±0.3	75.3±1.5	90.1±0.1	32.4±0.0
CluStream-C - SNN-DPC	46.3±0.7	25.6±0.0	59.0±0.0	55.8±0.0	86.1±0.0	29.6±0.5
CluStream-W - SNN-DPC	52.2±0.0	44.2±0.1	56.1±0.0	87.8±6.8	85.4±0.0	29.9±0.0
CluStream-S - SNN-DPC	58.0±0.0	38.9±0.0	54.6±0.0	96.1±0.0	83.8±0.0	27.4±0.0
CluStream-G - SNN-DPC	49.8±2.4	56.0±1.2	70.2±0.4	66.3±8.8	90.6±0.0	34.3±0.5
CluStream-C - DBHD	52.3±0.0	57.7±0.0	73.4±0.0	97.3±0.0	88.4±0.0	35.6±0.0
CluStream-W - DBHD	52.3±0.0	57.7±0.0	73.4±0.0	96.9±0.0	88.4±0.0	35.6±0.0
CluStream-S - DBHD	52.3±0.0	57.7±0.0	73.4±0.0	97.3±0.0	88.4±0.0	35.6±0.0
CluStream-G - DBHD	68.5±7.9	52.6±0.7	**81.4**±0.4	49.7±7.1	74.7±0.2	34.5±0.4

Table 12: AMI Scores for evaluated datasets for the best parameters according to the sum of ARI and AMI (×100). The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	AMI	AMI	AMI	AMI	AMI	AMI
STREAMKmeans	61.6±3.4	52.6±1.0	74.6±1.1	88.1±0.0	**87.0**±0.3	17.0±0.0
DenStream	70.5±0.0	73.2±0.0	69.9±0.0	87.4±0.0	75.9±0.0	53.0±0.0
DBSTREAM	69.3±0.0	74.9±0.0	76.1±0.0	74.9±0.0	85.2±0.0	50.1±0.0
EMCStream	80.4±1.2	73.9±3.1	66.3±2.3	90.8±1.1	76.8±1.1	41.7±5.7
MCMSTStream	74.5±0.0	**84.7**±0.0	78.1±0.0	92.5±0.0	82.7±0.0	38.4±0.0
GB-FuzzyStream	57.5±1.6	43.4±0.5	51.4±0.3	-	-	20.4±0.5
CluStream-O - var. k	66.9±0.0	70.7±0.0	73.2±0.0	84.6±0.0	83.5±0.0	50.1±0.0
CluStream-O - fixed k	64.7±0.0	34.3±0.0	71.2±0.0	84.6±0.0	80.6±0.0	37.8±0.0
CluStream-O - k=100	53.0±0.0	69.8±0.0	60.3±0.0	26.8±0.0	67.5±0.0	50.5±0.0
CluStream - Wk-Means	62.8±0.8	67.9±1.1	78.4±0.5	93.4±0.5	77.5±0.1	45.2±0.6
CluStream-C - k-Means	63.4±1.7	37.2±2.9	77.8±0.5	87.7±3.1	79.6±0.0	39.4±2.0
CluStream-W - k-Means	62.8±0.8	67.9±1.1	78.4±0.5	93.4±0.5	77.5±0.1	45.2±0.6
CluStream-S - k-Means	63.5±1.9	66.9±2.2	78.9±0.3	93.4±0.9	77.9±0.1	44.1±0.5
CluStream-G - k-Means	62.9±1.2	68.1±1.7	79.2±0.4	93.3±0.1	77.9±0.1	44.0±0.7
CluStream-C - SubKMeans	61.3±1.0	53.9±1.6	77.5±0.1	87.9±0.0	79.6±0.1	38.7±1.6
CluStream-W - SubKMeans	62.0±0.7	71.9±2.5	78.2±0.6	92.9±0.6	77.6±0.1	45.6±0.6
CluStream-S - SubKMeans	61.9±1.1	69.0±1.4	78.5±0.4	92.9±1.2	77.9±0.1	44.9±0.6
CluStream-G - SubKMeans	62.2±1.4	71.2±1.9	78.8±0.5	93.3±0.1	77.9±0.1	44.9±0.5
CluStream-C - X-Means	66.7±3.3	47.3±3.7	79.3±0.5	50.0±1.6	79.6±0.1	52.4±0.1
CluStream-W - X-Means	53.2±0.0	73.0±0.3	75.2±0.4	41.5±0.1	67.7±0.0	50.6±0.0
CluStream-S - X-Means	53.0±0.0	71.6±0.2	73.7±0.6	39.8±0.1	67.8±0.0	50.7±0.0
CluStream-G - X-Means	58.9±0.7	71.6±0.7	80.1±0.6	36.8±0.6	69.9±0.0	50.8±0.0
CluStream-C - P-Dip-M	0.0±0.0	0.0±0.0	24.4±0.9	24.9±0.0	79.0±0.0	20.3±0.5
CluStream-W - P-Dip-M	57.5±0.4	-	60.6±0.0	30.9±0.1	-	-
CluStream-S - P-Dip-M	57.7±0.0	-	61.9±0.1	30.2±0.2	-	-
CluStream-G - P-Dip-M	68.5±0.9	69.9±0.5	78.0±0.3	51.4±1.7	76.7±0.0	53.1±0.1
CluStream-C - SC	72.8±0.1	64.7±0.6	79.0±0.1	92.4±0.0	81.4±0.0	45.3±0.8
CluStream-W - SC	73.7±1.1	70.3±0.3	77.1±0.4	93.3±0.0	77.8±0.1	54.3±0.4
CluStream-S - SC	79.5±0.6	71.1±0.5	76.7±0.3	93.3±0.0	77.9±0.1	54.2±1.4
CluStream-G - SC	76.7±1.4	69.9±0.3	76.8±0.2	93.3±0.1	77.4±0.0	54.1±0.8
CluStream-C - SCAR	66.4±0.3	63.3±0.6	78.0±0.1	69.9±19.2	83.8±0.1	44.3±0.8
CluStream-W - SCAR	67.3±0.5	69.7±0.4	68.3±0.2	55.9±4.1	73.7±0.0	47.9±0.8
CluStream-S - SCAR	75.5±1.2	70.6±1.0	71.5±0.2	57.6±8.9	73.8±0.1	48.4±0.7
CluStream-G - SCAR	73.0±1.8	69.5±0.6	71.8±0.2	49.8±16.8	73.5±0.4	48.0±1.1
CluStream-C - SpectACl	79.0±0.7	74.5±0.5	76.4±0.4	86.5±10.0	80.0±0.1	39.0±1.9
CluStream-W - SpectACl	85.7±0.9	73.9±0.9	71.9±0.4	92.7±1.6	82.4±0.1	41.1±0.5
CluStream-S - SpectACl	83.3±2.6	75.2±1.1	77.4±0.6	**96.6**±0.0	82.4±0.1	41.8±0.4
CluStream-G - SpectACl	77.2±1.8	74.9±1.2	73.4±0.3	92.9±0.4	82.3±0.1	41.7±0.9
CluStream-C - DBSCAN	86.5±0.0	70.3±0.0	77.1±0.0	89.6±0.0	78.0±0.0	50.9±0.0
CluStream-W - DBSCAN	86.5±0.0	75.3±0.0	77.4±0.0	89.8±0.0	81.3±0.0	51.3±0.0
CluStream-S - DBSCAN	86.6±0.0	74.4±0.0	75.9±0.0	89.6±0.0	82.0±0.0	51.4±0.0
CluStream-G - DBSCAN	78.3±2.4	75.6±0.4	82.0±0.1	89.0±5.4	82.1±0.0	51.4±0.1
CluStream-C - HDBSCAN	85.7±0.0	73.2±0.0	79.6±0.0	94.1±0.0	80.5±0.0	51.4±0.0
CluStream-W - HDBSCAN	85.8±0.0	76.8±0.0	77.6±0.0	95.7±0.0	80.9±0.0	51.1±0.0
CluStream-S - HDBSCAN	85.8±0.0	77.3±0.0	77.3±0.0	95.7±0.0	81.2±0.0	54.6±0.0
CluStream-G - HDBSCAN	78.7±3.2	77.0±0.2	80.5±0.2	83.6±7.0	81.4±0.0	**54.7**±0.0
CluStream-C - RNN-DBS	69.2±0.0	22.1±0.0	71.9±0.0	72.1±0.0	79.8±0.0	49.0±0.0
CluStream-W - RNN-DBS	49.3±0.0	71.4±0.0	61.7±0.0	63.2±0.0	66.6±0.0	51.0±0.0
CluStream-S - RNN-DBS	73.2±0.0	70.8±0.0	60.4±0.0	63.9±0.0	66.7±0.0	51.0±0.0
CluStream-G - RNN-DBS	73.2±3.7	58.5±0.8	65.4±1.4	62.2±11.7	68.6±0.1	52.0±0.2
CluStream-C - MDBSCAN	86.2±0.0	69.4±0.0	73.1±0.0	95.9±0.0	78.0±0.0	51.0±0.0
CluStream-W - MDBSCAN	**87.0**±0.0	70.6±0.0	73.3±0.0	95.9±0.0	83.8±0.0	52.9±0.0
CluStream-S - MDBSCAN	**87.0**±0.0	70.4±0.0	73.0±0.0	95.9±0.0	83.9±0.0	54.5±0.0
CluStream-G - MDBSCAN	80.0±3.1	68.3±0.4	75.8±0.3	95.3±0.3	84.0±0.0	54.3±0.0
CluStream-C - DPC	75.7±0.0	70.2±0.0	76.7±0.0	83.3±0.0	83.7±0.0	52.2±0.0
CluStream-W - DPC	74.8±0.0	69.8±0.0	74.8±0.0	91.2±0.0	81.0±0.0	51.1±0.0
CluStream-S - DPC	75.6±0.0	71.3±0.0	73.4±0.0	91.2±0.0	86.5±0.0	48.4±0.0
CluStream-G - DPC	73.9±0.8	70.9±0.4	79.2±0.1	76.2±1.4	82.1±0.0	52.1±0.0
CluStream-C - SNN-DPC	68.0±1.3	49.4±0.0	69.2±0.0	61.4±0.0	77.6±0.0	47.0±0.5
CluStream-W - SNN-DPC	75.3±0.0	64.4±0.2	63.7±0.0	86.5±6.3	74.3±0.0	43.8±0.0
CluStream-S - SNN-DPC	78.5±0.0	60.2±0.0	62.9±0.0	94.2±0.0	73.3±0.0	40.7±0.0
CluStream-G - SNN-DPC	72.7±2.1	69.9±0.5	77.4±0.2	68.0±6.7	79.5±0.0	46.6±0.2
CluStream-C - DBHD	75.9±0.0	69.9±0.0	78.5±0.0	95.9±0.0	79.4±0.0	54.0±0.0
CluStream-W - DBHD	75.9±0.0	69.9±0.0	78.5±0.0	95.5±0.0	79.4±0.0	54.0±0.0
CluStream-S - DBHD	75.9±0.0	69.9±0.0	78.5±0.0	95.9±0.0	79.4±0.0	54.0±0.0
CluStream-G - DBHD	83.5±4.1	73.3±0.5	**84.2**±0.2	60.4±6.4	68.0±0.2	53.5±0.4

Table 13: NMI Scores for evaluated datasets for the best parameters according to the sum of ARI and AMI (×100). The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	NMI	NMI	NMI	NMI	NMI	NMI
STREAMKmeans	62.1±3.3	54.0±1.0	74.9±1.0	88.1±0.0	**87.2**±0.3	17.2±0.0
DenStream	70.9±0.0	73.8±0.0	70.3±0.0	87.4±0.0	76.0±0.0	53.9±0.0
DBSTREAM	69.6±0.0	76.1±0.0	76.2±0.0	74.9±0.0	85.6±0.0	53.0±0.0
EMCStream	80.7±1.2	74.4±3.1	66.4±2.3	90.8±1.1	77.1±1.1	41.9±5.7
MCMSTStream	74.9±0.0	**85.1**±0.0	78.3±0.0	92.5±0.0	82.9±0.0	41.0±0.0
GB-FuzzyStream	59.8±1.2	44.6±0.5	52.0±0.3	-	-	21.3±0.6
CluStream-O - var. k	67.3±0.0	73.9±0.0	73.7±0.0	84.6±0.0	83.8±0.0	51.7±0.0
CluStream-O - fixed k	65.5±0.0	36.2±0.0	71.6±0.0	84.6±0.0	81.1±0.0	38.3±0.0
CluStream-O - k=100	59.4±0.0	73.2±0.0	62.8±0.0	28.8±0.0	69.5±0.0	53.1±0.0
CluStream - Wk-Means	63.6±0.8	68.7±1.1	78.7±0.5	93.4±0.5	78.2±0.1	45.6±0.6
CluStream-C - k-Means	64.2±1.6	39.3±2.8	78.0±0.5	87.7±3.1	80.2±0.0	39.9±1.9
CluStream-W - k-Means	63.6±0.8	68.7±1.1	78.7±0.5	93.4±0.5	78.2±0.1	45.6±0.6
CluStream-S - k-Means	64.4±1.8	67.8±2.1	79.2±0.3	93.4±0.9	78.5±0.1	44.5±0.5
CluStream-G - k-Means	63.7±1.2	68.9±1.6	79.4±0.4	93.4±0.1	78.5±0.1	44.4±0.7
CluStream-C - SubKMeans	62.1±1.0	55.1±1.6	77.7±0.1	87.9±0.0	80.2±0.1	39.2±1.6
CluStream-W - SubKMeans	62.8±0.6	72.7±2.4	78.5±0.6	92.9±0.6	78.3±0.1	46.0±0.6
CluStream-S - SubKMeans	62.8±1.1	69.9±1.4	78.7±0.4	92.9±1.2	78.6±0.1	45.2±0.6
CluStream-G - SubKMeans	63.1±1.3	72.0±1.8	79.0±0.5	93.4±0.1	78.6±0.1	45.2±0.5
CluStream-C - X-Means	67.1±3.3	50.3±3.5	79.7±0.5	50.3±1.6	80.2±0.1	53.8±0.1
CluStream-W - X-Means	59.6±0.0	74.9±0.2	75.8±0.3	42.6±0.0	69.6±0.0	53.1±0.0
CluStream-S - X-Means	59.4±0.0	74.0±0.1	74.7±0.6	41.1±0.0	69.7±0.0	53.2±0.0
CluStream-G - X-Means	63.1±0.4	74.1±0.7	80.5±0.6	39.3±0.4	71.8±0.0	53.2±0.0
CluStream-C - P-Dip-M	0.0±0.0	0.0±0.0	24.5±0.9	24.9±0.0	79.5±0.0	20.5±0.5
CluStream-W - P-Dip-M	62.1±0.4	-	62.9±0.0	31.8±0.1	-	-
CluStream-S - P-Dip-M	62.4±0.0	-	63.9±0.1	31.2±0.1	-	-
CluStream-G - P-Dip-M	69.3±0.9	71.7±0.4	78.2±0.3	51.6±1.6	77.5±0.0	54.5±0.1
CluStream-C - SC	73.4±0.1	65.6±0.5	79.2±0.1	92.4±0.0	81.9±0.0	45.7±0.8
CluStream-W - SC	74.2±1.1	71.0±0.3	77.3±0.4	93.3±0.0	78.4±0.1	54.5±0.4
CluStream-S - SC	79.9±0.6	71.8±0.5	76.9±0.3	93.3±0.0	78.5±0.1	54.5±1.4
CluStream-G - SC	77.2±1.4	70.6±0.3	77.0±0.2	93.3±0.1	78.1±0.0	54.4±0.8
CluStream-C - SCAR	67.2±0.3	64.2±0.5	78.3±0.1	69.9±19.2	84.2±0.1	44.9±0.8
CluStream-W - SCAR	68.0±0.5	70.4±0.4	68.6±0.2	55.9±4.1	74.5±0.0	48.3±0.8
CluStream-S - SCAR	76.0±1.2	71.3±1.0	71.7±0.2	57.7±8.9	74.6±0.1	48.7±0.7
CluStream-G - SCAR	73.6±1.8	70.2±0.6	72.0±0.2	49.9±16.8	74.1±0.4	48.3±1.1
CluStream-C - SpectACl	79.5±0.7	75.1±0.5	76.7±0.4	86.5±10.0	80.5±0.1	39.5±1.9
CluStream-W - SpectACl	86.0±0.9	74.5±0.9	72.2±0.4	92.7±1.6	82.9±0.1	41.4±0.5
CluStream-S - SpectACl	83.7±2.6	75.8±1.0	77.6±0.6	**96.6**±0.0	82.8±0.1	42.2±0.4
CluStream-G - SpectACl	77.7±1.8	75.5±1.2	73.7±0.3	92.9±0.4	82.8±0.1	42.1±0.9
CluStream-C - DBSCAN	86.8±0.0	73.4±0.0	77.2±0.0	89.7±0.0	79.1±0.0	53.0±0.0
CluStream-W - DBSCAN	86.8±0.0	75.9±0.0	77.5±0.0	89.8±0.0	81.7±0.0	52.6±0.0
CluStream-S - DBSCAN	86.9±0.0	75.1±0.0	76.0±0.0	89.6±0.0	82.3±0.0	52.7±0.0
CluStream-G - DBSCAN	79.0±2.4	76.3±0.4	82.2±0.1	89.1±5.4	82.3±0.0	52.8±0.1
CluStream-C - HDBSCAN	86.0±0.0	74.1±0.0	79.7±0.0	94.1±0.0	81.0±0.0	52.1±0.0
CluStream-W - HDBSCAN	86.1±0.0	77.4±0.0	77.8±0.0	95.7±0.0	81.2±0.0	51.5±0.0
CluStream-S - HDBSCAN	86.1±0.0	78.1±0.0	77.5±0.0	95.7±0.0	81.5±0.0	55.0±0.0
CluStream-G - HDBSCAN	79.5±3.2	77.8±0.2	80.7±0.2	83.6±7.0	81.7±0.0	55.1±0.0
CluStream-C - RNN-DBS	70.3±0.0	23.1±0.0	72.4±0.0	72.1±0.0	80.1±0.0	49.7±0.0
CluStream-W - RNN-DBS	49.5±0.0	72.8±0.0	63.6±0.0	63.4±0.0	67.4±0.0	52.3±0.0
CluStream-S - RNN-DBS	73.7±0.0	72.7±0.0	61.5±0.0	64.0±0.0	67.7±0.0	51.9±0.0
CluStream-G - RNN-DBS	74.1±3.7	62.1±0.7	66.0±1.3	62.3±11.7	69.3±0.1	52.8±0.2
CluStream-C - MDBSCAN	86.5±0.0	72.7±0.0	73.3±0.0	95.9±0.0	79.1±0.0	53.0±0.0
CluStream-W - MDBSCAN	87.2±0.0	72.6±0.0	73.4±0.0	95.9±0.0	84.0±0.0	53.7±0.0
CluStream-S - MDBSCAN	**87.3**±0.0	73.1±0.0	73.1±0.0	95.9±0.0	84.1±0.0	**55.2**±0.0
CluStream-G - MDBSCAN	80.6±3.1	71.8±0.4	75.9±0.3	95.3±0.3	84.2±0.0	**55.2**±0.0
CluStream-C - DPC	76.8±0.0	72.5±0.0	76.8±0.0	83.3±0.0	84.1±0.0	53.3±0.0
CluStream-W - DPC	75.6±0.0	73.0±0.0	75.3±0.0	91.2±0.0	81.3±0.0	53.2±0.0
CluStream-S - DPC	76.6±0.0	74.3±0.0	74.2±0.0	91.2±0.0	86.7±0.0	49.8±0.0
CluStream-G - DPC	74.9±0.8	72.9±0.4	79.7±0.1	76.3±1.4	82.4±0.0	53.1±0.0
CluStream-C - SNN-DPC	68.8±1.3	50.7±0.0	69.5±0.0	61.5±0.0	78.2±0.0	47.4±0.5
CluStream-W - SNN-DPC	75.7±0.0	64.9±0.2	63.9±0.0	86.6±6.3	75.0±0.0	44.1±0.0
CluStream-S - SNN-DPC	79.0±0.0	60.8±0.0	63.2±0.0	94.2±0.0	73.9±0.0	41.0±0.0
CluStream-G - SNN-DPC	73.3±2.0	70.6±0.5	77.6±0.2	68.1±6.7	80.0±0.0	46.9±0.2
CluStream-C - DBHD	76.6±0.0	72.1±0.0	78.8±0.0	95.9±0.0	79.8±0.0	54.8±0.0
CluStream-W - DBHD	76.6±0.0	72.1±0.0	78.8±0.0	95.5±0.0	79.8±0.0	54.8±0.0
CluStream-S - DBHD	76.6±0.0	72.1±0.0	78.8±0.0	95.9±0.0	79.8±0.0	54.8±0.0
CluStream-G - DBHD	83.9±4.0	74.1±0.5	**84.3**±0.2	60.5±6.4	68.7±0.2	54.1±0.4

Table 14: Accuracy Scores for evaluated datasets for the best parameters according to the sum of ARI and AMI (×100). The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	Accuracy	Accuracy	Accuracy	Accuracy	Accuracy	Accuracy
STREAMKmeans	53.1±0.7	42.3±1.8	76.6±1.5	97.7±0.0	92.2±0.1	44.2±0.0
DenStream	55.2±0.0	62.0±0.0	72.6±0.0	90.7±0.0	78.7±0.0	46.6±0.0
DBSTREAM	63.8±0.0	71.8±0.0	79.2±0.0	85.0±0.0	88.9±0.0	36.1±0.0
EMCStream	63.3±1.5	65.6±4.3	66.3±2.6	98.0±0.3	77.0±1.9	57.7±3.7
MCMSTStream	71.3±0.0	**79.8**±0.0	84.0±0.0	97.1±0.0	**93.0**±0.0	37.5±0.0
GB-FuzzyStream	39.4±2.0	45.9±1.0	57.7±0.6	-	-	35.9±0.5
CluStream-O - var. k	56.1±0.0	52.2±0.0	73.0±0.0	96.2±0.0	87.2±0.0	38.8±0.0
CluStream-O - fixed k	50.6±0.0	37.1±0.0	69.8±0.0	96.2±0.0	84.6±0.0	51.0±0.0
CluStream-O - k=100	15.8±0.0	50.8±0.0	44.3±0.0	11.4±0.0	73.2±0.0	31.2±0.0
CluStream - Wk-Means	49.2±1.5	62.2±2.5	81.4±0.7	98.9±0.1	81.0±0.1	53.4±0.6
CluStream-C - k-Means	50.1±1.3	30.9±2.3	80.2±0.9	97.6±0.7	83.6±0.1	50.1±0.6
CluStream-W - k-Means	49.2±1.5	62.2±2.5	81.4±0.7	98.9±0.1	81.0±0.1	53.4±0.6
CluStream-S - k-Means	50.6±2.5	60.7±2.6	82.3±0.6	98.8±0.3	81.3±0.1	51.9±0.4
CluStream-G - k-Means	49.1±1.3	61.3±2.5	82.4±0.7	98.8±0.0	81.3±0.1	51.9±0.5
CluStream-C - SubKMeans	48.3±0.6	50.5±2.5	80.4±0.3	97.8±0.0	83.6±0.2	50.1±1.2
CluStream-W - SubKMeans	47.7±0.7	66.6±3.0	79.4±1.0	98.8±0.1	81.1±0.1	53.2±0.9
CluStream-S - SubKMeans	48.7±1.8	62.1±1.1	80.5±0.7	98.7±0.4	81.3±0.1	52.9±0.5
CluStream-G - SubKMeans	49.0±1.4	64.6±2.3	81.8±0.9	98.8±0.0	81.3±0.1	53.1±0.5
CluStream-C - X-Means	58.0±3.8	39.6±4.7	81.6±0.7	41.3±2.3	84.1±0.1	38.7±0.4
CluStream-W - X-Means	16.5±0.2	52.7±0.5	75.5±0.8	29.5±0.0	73.3±0.0	31.2±0.0
CluStream-S - X-Means	15.9±0.1	52.0±0.4	72.1±1.0	27.4±0.0	73.3±0.0	31.2±0.0
CluStream-G - X-Means	28.0±5.5	54.2±0.6	82.1±1.1	26.8±0.4	76.2±0.0	31.2±0.0
CluStream-C - P-Dip-M	29.9±0.0	20.9±0.0	38.9±0.7	70.8±0.0	84.7±0.0	41.8±0.4
CluStream-W - P-Dip-M	21.3±0.2	-	44.7±0.1	12.6±0.0	-	-
CluStream-S - P-Dip-M	20.9±0.1	-	47.2±0.1	12.5±0.1	-	-
CluStream-G - P-Dip-M	49.6±1.2	54.9±0.6	81.5±0.6	47.2±3.0	80.8±0.0	33.9±0.2
CluStream-C - SC	59.8±0.4	55.3±0.7	83.3±0.1	98.7±0.0	86.0±0.1	58.0±0.6
CluStream-W - SC	60.9±1.9	62.0±0.3	81.6±0.4	98.8±0.0	81.5±0.1	63.9±0.7
CluStream-S - SC	65.6±1.4	60.2±0.5	81.0±0.5	98.8±0.0	81.6±0.1	64.2±0.8
CluStream-G - SC	63.5±2.2	58.7±0.5	80.9±0.3	98.8±0.0	81.2±0.0	**64.3**±0.6
CluStream-C - SCAR	53.8±0.3	57.2±0.6	82.6±0.0	89.4±9.4	89.6±0.2	52.2±1.2
CluStream-W - SCAR	55.9±0.9	62.6±0.5	63.9±0.5	82.5±1.8	77.9±0.1	56.4±1.2
CluStream-S - SCAR	62.5±2.2	64.6±1.6	73.6±0.4	84.5±6.3	77.9±0.0	57.2±1.0
CluStream-G - SCAR	59.5±2.4	59.4±1.4	74.4±0.5	82.7±7.6	78.7±0.1	57.7±1.1
CluStream-C - SpectACl	65.9±2.8	65.8±1.5	74.9±0.4	94.0±4.8	84.0±0.1	51.6±1.0
CluStream-W - SpectACl	72.5±2.9	63.8±1.7	70.5±1.0	98.6±0.5	87.1±0.1	53.3±0.6
CluStream-S - SpectACl	68.8±4.8	67.5±1.8	75.4±1.2	**99.5**±0.0	86.9±0.1	54.2±0.5
CluStream-G - SpectACl	64.6±3.3	65.5±2.3	71.3±0.8	98.5±0.1	86.7±0.2	54.6±0.9
CluStream-C - DBSCAN	81.4±0.0	54.5±0.0	74.3±0.0	94.0±0.0	85.0±0.0	35.6±0.0
CluStream-W - DBSCAN	81.4±0.0	64.8±0.0	74.0±0.0	94.0±0.0	86.1±0.0	40.3±0.0
CluStream-S - DBSCAN	81.2±0.0	63.9±0.0	73.1±0.0	94.0±0.0	85.2±0.0	40.4±0.0
CluStream-G - DBSCAN	69.2±3.4	64.3±1.0	80.7±0.1	94.4±3.2	85.1±0.0	37.8±0.0
CluStream-C - HDBSCAN	76.4±0.0	64.5±0.0	80.0±0.0	98.9±0.0	85.8±0.0	51.2±0.0
CluStream-W - HDBSCAN	79.7±0.0	64.3±0.0	76.6±0.0	98.6±0.0	85.0±0.0	53.9±0.0
CluStream-S - HDBSCAN	79.7±0.0	63.1±0.0	78.5±0.0	98.6±0.0	86.6±0.0	54.7±0.0
CluStream-G - HDBSCAN	68.2±2.3	63.2±0.5	82.0±0.5	91.5±3.7	85.6±0.0	54.8±0.0
CluStream-C - RNN-DBS	48.2±0.0	32.0±0.0	71.9±0.0	88.8±0.0	88.0±0.0	52.2±0.0
CluStream-W - RNN-DBS	57.8±0.0	56.4±0.0	48.1±0.0	74.8±0.0	75.5±0.0	35.0±0.0
CluStream-S - RNN-DBS	60.6±0.0	54.0±0.0	54.4±0.0	79.1±0.0	75.2±0.0	41.6±0.0
CluStream-G - RNN-DBS	64.8±5.0	41.0±0.7	64.7±1.2	71.8±4.9	77.2±0.1	44.6±0.2
CluStream-C - MDBSCAN	80.0±0.0	53.6±0.0	73.0±0.0	99.3±0.0	85.0±0.0	37.0±0.0
CluStream-W - MDBSCAN	**82.3**±0.0	55.0±0.0	73.0±0.0	99.3±0.0	89.5±0.0	42.9±0.0
CluStream-S - MDBSCAN	79.8±0.0	54.3±0.0	72.9±0.0	99.3±0.0	89.7±0.0	41.6±0.0
CluStream-G - MDBSCAN	68.3±3.5	57.1±1.2	76.3±0.4	99.1±0.1	89.8±0.0	40.3±0.1
CluStream-C - DPC	56.2±0.0	61.1±0.0	78.0±0.0	91.6±0.0	89.0±0.0	44.9±0.0
CluStream-W - DPC	54.9±0.0	61.5±0.0	74.6±0.0	91.7±0.0	88.7±0.0	35.2±0.0
CluStream-S - DPC	53.6±0.0	62.9±0.0	73.9±0.0	91.7±0.0	90.7±0.0	44.8±0.0
CluStream-G - DPC	51.4±2.0	59.9±0.9	81.4±0.2	80.7±0.6	88.3±0.0	47.0±0.0
CluStream-C - SNN-DPC	56.8±2.0	41.4±0.2	69.6±0.0	83.1±0.0	83.3±0.0	55.4±1.2
CluStream-W - SNN-DPC	62.4±0.0	54.7±0.4	66.4±0.0	96.5±2.0	83.0±0.0	54.4±0.0
CluStream-S - SNN-DPC	65.4±0.0	54.1±0.0	67.3±0.0	99.0±0.0	82.0±0.0	53.9±0.0
CluStream-G - SNN-DPC	60.9±1.6	62.2±0.5	77.7±0.4	85.8±4.4	84.2±0.0	58.4±0.3
CluStream-C - DBHD	63.1±0.0	62.5±0.0	77.7±0.0	99.3±0.0	86.6±0.0	48.2±0.0
CluStream-W - DBHD	63.1±0.0	62.5±0.0	77.7±0.0	99.2±0.0	86.6±0.0	48.2±0.0
CluStream-S - DBHD	63.1±0.0	62.5±0.0	77.7±0.0	99.3±0.0	86.6±0.0	48.2±0.0
CluStream-G - DBHD	75.6±3.4	61.1±0.7	**87.5**±0.5	66.5±3.2	72.4±0.1	48.3±0.4

Table 15: Precision Scores for evaluated datasets for the best parameters according to the sum of ARI and AMI (×100). The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	Precision	Precision	Precision	Precision	Precision	Precision
STREAMKmeans	50.1±2.8	29.3±2.2	70.1±2.1	94.9±0.0	98.5±0.1	31.3±0.0
DenStream	57.5±0.0	61.4±0.0	70.1±0.0	96.6±0.0	79.8±0.0	69.0±0.0
DBSTREAM	56.4±0.0	66.0±0.0	68.7±0.0	96.2±0.0	99.5±0.0	69.9±0.0
EMCStream	79.6±2.5	60.6±5.5	53.6±2.6	96.9±0.5	98.4±0.2	49.5±4.4
MCMSTStream	63.2±0.0	**76.5**±0.0	77.0±0.0	99.1±0.0	93.1±0.0	39.2±0.0
GB-FuzzyStream	51.7±2.9	25.1±0.6	41.7±0.3	-	-	29.4±0.1
CluStream-O - var. k	56.2±0.0	76.0±0.0	66.2±0.0	93.4±0.0	99.3±0.0	65.2±0.0
CluStream-O - fixed k	58.8±0.0	20.9±0.0	59.5±0.0	93.4±0.0	99.6±0.0	42.4±0.0
CluStream-O - k=100	**99.9**±0.0	73.2±0.0	**89.3**±0.0	99.5±0.0	**99.9**±0.0	78.0±0.0
CluStream - Wk-Means	59.4±1.3	51.2±2.0	81.3±0.7	97.8±0.0	99.8±0.0	52.1±1.0
CluStream-C - k-Means	60.4±2.0	20.0±1.5	74.5±1.0	95.6±1.5	99.7±0.0	44.0±1.2
CluStream-W - k-Means	59.4±1.3	51.2±2.0	81.3±0.7	97.8±0.0	99.8±0.0	52.1±1.0
CluStream-S - k-Means	60.3±2.5	48.9±3.5	81.2±0.6	97.8±0.4	99.8±0.0	51.0±0.7
CluStream-G - k-Means	59.9±1.7	50.7±2.9	82.2±0.6	98.1±0.0	99.8±0.0	51.1±0.8
CluStream-C - SubKMeans	57.2±1.5	35.6±2.1	75.5±0.8	95.8±0.0	99.7±0.0	43.4±1.4
CluStream-W - SubKMeans	58.3±1.2	53.9±3.2	83.1±1.0	97.8±0.0	99.8±0.0	52.2±0.8
CluStream-S - SubKMeans	57.9±1.6	48.7±1.8	82.9±0.6	97.7±0.4	99.8±0.0	51.8±0.5
CluStream-G - SubKMeans	59.0±1.5	53.6±3.1	82.0±0.5	98.1±0.0	99.8±0.0	51.7±0.6
CluStream-C - X-Means	53.8±3.6	30.4±3.6	79.5±0.5	98.6±0.5	99.4±0.1	70.6±0.3
CluStream-W - X-Means	**99.9**±0.0	71.2±0.2	76.0±1.1	99.5±0.0	**99.9**±0.0	78.0±0.0
CluStream-S - X-Means	**99.9**±0.0	71.1±0.1	81.3±1.3	99.5±0.0	**99.9**±0.0	**78.1**±0.0
CluStream-G - X-Means	92.9±7.5	69.2±0.9	82.8±0.9	99.7±0.2	**99.9**±0.0	78.0±0.0
CluStream-C - P-Dip-M	18.6±0.0	12.9±0.0	30.4±0.7	64.3±0.0	98.1±0.0	36.6±0.7
CluStream-W - P-Dip-M	97.4±1.9	-	89.0±0.0	**99.8**±0.0	-	-
CluStream-S - P-Dip-M	99.3±0.2	-	88.1±0.1	**99.8**±0.0	-	-
CluStream-G - P-Dip-M	69.5±0.7	63.5±1.1	75.2±0.9	98.0±0.1	99.8±0.0	75.0±0.3
CluStream-C - SC	69.5±0.2	45.2±0.5	82.3±0.1	97.9±0.0	99.6±0.0	46.5±0.4
CluStream-W - SC	71.5±2.2	59.1±0.2	76.8±0.4	98.1±0.0	99.5±0.0	52.2±0.8
CluStream-S - SC	79.6±0.6	57.6±1.1	76.7±0.6	98.1±0.0	99.5±0.0	52.4±1.1
CluStream-G - SC	73.1±2.4	56.1±0.4	77.0±0.3	98.1±0.0	99.3±0.0	52.6±0.6
CluStream-C - SCAR	63.4±0.1	45.6±0.6	81.2±0.1	86.3±10.3	97.8±0.2	50.6±1.0
CluStream-W - SCAR	59.9±0.6	57.7±0.8	77.1±0.4	78.5±1.6	99.5±0.0	53.2±1.2
CluStream-S - SCAR	73.2±1.8	58.7±1.7	77.9±0.3	78.0±5.3	99.5±0.0	55.5±0.7
CluStream-G - SCAR	67.9±3.5	57.9±0.8	78.5±0.3	75.8±9.1	96.5±0.5	56.2±1.2
CluStream-C - SpectACl	78.6±1.7	59.6±1.0	66.2±1.0	92.7±5.6	99.6±0.0	45.0±2.1
CluStream-W - SpectACl	88.0±1.4	58.4±1.0	75.7±0.6	97.2±0.8	98.8±0.2	47.9±1.2
CluStream-S - SpectACl	84.7±4.4	60.5±0.8	83.5±0.9	99.2±0.0	99.0±0.2	48.3±0.4
CluStream-G - SpectACl	75.1±2.9	59.8±1.8	79.6±0.7	96.7±0.3	99.1±0.1	48.2±1.2
CluStream-C - DBSCAN	72.1±0.0	67.2±0.0	61.7±0.0	99.7±0.0	99.8±0.0	69.2±0.0
CluStream-W - DBSCAN	72.1±0.0	51.6±0.0	60.8±0.0	99.7±0.0	99.4±0.0	65.4±0.0
CluStream-S - DBSCAN	72.4±0.0	51.3±0.0	60.3±0.0	99.6±0.0	97.7±0.0	65.4±0.0
CluStream-G - DBSCAN	72.1±9.7	55.3±0.9	72.4±0.4	97.4±4.7	98.0±0.0	67.0±0.1
CluStream-C - HDBSCAN	77.3±0.0	52.7±0.0	71.3±0.0	98.4±0.0	98.9±0.0	58.2±0.0
CluStream-W - HDBSCAN	71.9±0.0	65.8±0.0	68.8±0.0	**99.8**±0.0	97.8±0.0	62.0±0.0
CluStream-S - HDBSCAN	71.9±0.0	69.5±0.0	74.4±0.0	**99.8**±0.0	97.0±0.0	64.1±0.0
CluStream-G - HDBSCAN	81.6±8.1	68.4±0.3	75.9±0.8	92.7±5.7	98.0±0.0	64.2±0.0
CluStream-C - RNN-DBS	69.4±0.0	17.9±0.0	73.2±0.0	88.0±0.0	94.0±0.0	51.5±0.0
CluStream-W - RNN-DBS	43.9±0.0	66.9±0.0	85.0±0.0	90.1±0.0	90.7±0.0	70.3±0.0
CluStream-S - RNN-DBS	56.7±0.0	66.8±0.0	67.9±0.0	91.4±0.0	92.2±0.0	63.8±0.0
CluStream-G - RNN-DBS	59.9±9.9	52.2±3.2	60.9±0.9	94.8±5.7	90.9±0.0	64.7±0.5
CluStream-C - MDBSCAN	69.8±0.0	64.2±0.0	60.9±0.0	98.4±0.0	99.8±0.0	67.8±0.0
CluStream-W - MDBSCAN	72.1±0.0	66.7±0.0	60.1±0.0	98.4±0.0	97.7±0.0	65.2±0.0
CluStream-S - MDBSCAN	80.4±0.0	66.7±0.0	59.8±0.0	98.4±0.0	97.5±0.0	68.9±0.0
CluStream-G - MDBSCAN	79.7±10.7	55.5±1.0	64.2±0.4	98.1±0.2	97.5±0.0	75.6±0.1
CluStream-C - DPC	86.3±0.0	55.0±0.0	67.1±0.0	97.0±0.0	99.1±0.0	65.0±0.0
CluStream-W - DPC	78.4±0.0	54.1±0.0	67.2±0.0	98.7±0.0	94.9±0.0	71.5±0.0
CluStream-S - DPC	88.9±0.0	60.4±0.0	69.8±0.0	98.7±0.0	98.7±0.0	60.7±0.0
CluStream-G - DPC	88.2±2.9	62.5±1.2	77.0±0.4	97.9±0.9	95.9±0.1	62.5±0.0
CluStream-C - SNN-DPC	61.2±3.2	26.5±0.1	62.9±0.1	78.1±0.0	98.6±0.0	45.7±0.5
CluStream-W - SNN-DPC	72.8±0.0	40.2±0.2	68.5±0.0	94.6±3.1	94.3±0.0	44.6±0.0
CluStream-S - SNN-DPC	73.7±0.0	35.6±0.0	60.3±0.0	98.4±0.0	93.3±0.0	42.2±0.0
CluStream-G - SNN-DPC	64.5±4.1	53.3±1.4	68.9±0.6	84.0±4.1	99.6±0.0	50.5±0.7
CluStream-C - DBHD	72.8±0.0	61.2±0.0	78.1±0.0	98.4±0.0	95.8±0.0	66.6±0.0
CluStream-W - DBHD	72.8±0.0	61.2±0.0	78.1±0.0	98.2±0.0	95.8±0.0	66.6±0.0
CluStream-S - DBHD	72.8±0.0	61.2±0.0	78.1±0.0	98.4±0.0	95.8±0.0	66.6±0.0
CluStream-G - DBHD	80.6±9.0	63.6±0.6	85.2±0.6	97.2±4.6	95.3±0.3	69.0±0.6

Table 16: Recall Scores for evaluated datasets for the best parameters according to the sum of ARI and AMI (×100). The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	Recall	Recall	Recall	Recall	Recall	Recall
STREAMKmeans	56.8±3.5	85.5±3.6	83.6±0.8	97.1±0.0	94.4±0.1	80.7±0.0
DenStream	62.0±0.0	70.4±0.0	72.4±0.0	88.8±0.0	**99.7**±0.0	37.2±0.0
DBSTREAM	80.5±0.0	80.7±0.0	88.2±0.0	77.9±0.0	91.7±0.0	26.2±0.0
EMCStream	53.2±1.1	74.5±4.5	89.3±0.5	95.9±0.6	80.5±2.6	62.5±3.0
MCMSTStream	85.7±0.0	77.8±0.0	84.5±0.0	96.4±0.0	95.5±0.0	44.4±0.0
GB-FuzzyStream	24.4±1.8	52.8±1.5	52.7±0.7	-	-	46.4±0.5
CluStream-O - var. k	61.4±0.0	47.6±0.0	84.3±0.0	93.3±0.0	88.4±0.0	29.3±0.0
CluStream-O - fixed k	45.1±0.0	82.7±0.0	87.8±0.0	93.3±0.0	85.4±0.0	56.3±0.0
CluStream-O - k=100	6.1±0.0	46.2±0.0	33.5±0.0	5.6±0.0	77.6±0.0	21.7±0.0
CluStream - Wk-Means	37.5±0.7	79.3±2.9	80.1±1.6	98.1±0.4	88.2±0.0	47.8±1.0
CluStream-C - k-Means	37.9±1.7	90.3±2.0	86.0±0.5	95.9±0.9	89.1±0.0	53.2±2.0
CluStream-W - k-Means	37.5±0.7	79.3±2.9	80.1±1.6	98.1±0.4	88.2±0.0	47.8±1.0
CluStream-S - k-Means	38.4±1.9	79.6±1.4	82.1±0.9	97.9±0.8	88.3±0.0	47.2±1.5
CluStream-G - k-Means	37.4±1.3	79.8±1.6	81.6±1.0	97.6±0.0	88.3±0.0	47.3±1.4
CluStream-C - SubKMeans	37.3±1.5	71.6±2.6	84.6±0.5	96.3±0.0	89.1±0.0	52.5±1.5
CluStream-W - SubKMeans	37.3±1.2	80.2±3.5	77.1±1.8	97.8±0.5	88.2±0.0	48.1±0.7
CluStream-S - SubKMeans	36.9±1.5	79.5±2.8	78.1±0.8	97.5±1.0	88.3±0.0	47.2±0.8
CluStream-G - SubKMeans	36.6±1.3	79.5±2.6	80.7±1.3	97.6±0.0	88.3±0.0	47.6±1.0
CluStream-C - X-Means	69.8±7.1	88.3±1.9	84.9±1.0	31.7±1.8	89.2±0.0	29.1±0.3
CluStream-W - X-Means	6.2±0.0	47.3±0.2	82.1±1.6	21.7±0.0	77.6±0.0	21.7±0.0
CluStream-S - X-Means	6.1±0.0	46.8±0.2	74.8±1.5	20.5±0.0	77.7±0.0	21.8±0.0
CluStream-G - X-Means	17.7±9.0	53.8±0.6	84.0±1.9	19.8±0.1	84.0±0.0	21.9±0.0
CluStream-C - P-Dip-M	**100.0**±0.0	**100.0**±0.0	**97.7**±0.2	**100.0**±0.0	89.6±0.0	**82.5**±0.3
CluStream-W - P-Dip-M	8.8±0.1	-	33.9±0.0	7.4±0.1	-	-
CluStream-S - P-Dip-M	8.6±0.1	-	36.7±0.1	7.2±0.1	-	-
CluStream-G - P-Dip-M	37.5±1.6	56.9±1.2	85.7±0.8	39.1±3.4	88.1±0.0	24.9±0.1
CluStream-C - SC	46.2±0.2	84.7±1.0	81.3±0.1	97.5±0.0	90.0±0.0	66.6±1.2
CluStream-W - SC	47.6±1.3	64.9±0.8	82.5±0.6	97.6±0.0	87.6±0.2	64.7±0.3
CluStream-S - SC	51.5±1.6	65.7±0.3	81.9±0.4	97.6±0.0	87.6±0.1	64.9±0.8
CluStream-G - SC	50.0±1.3	59.3±1.2	81.8±0.4	97.6±0.1	87.6±0.1	64.7±0.6
CluStream-C - SCAR	40.8±0.5	78.2±1.0	80.1±0.1	94.2±0.6	91.6±0.1	51.4±1.0
CluStream-W - SCAR	47.4±1.0	69.4±2.2	55.8±0.5	83.1±3.7	85.5±0.1	52.5±0.7
CluStream-S - SCAR	49.2±1.0	72.6±2.0	67.3±0.3	85.0±3.9	85.6±0.1	50.8±1.3
CluStream-G - SCAR	48.8±3.3	59.8±1.5	67.9±0.5	79.2±6.7	83.5±0.2	50.6±1.4
CluStream-C - SpectACl	58.5±3.1	65.1±2.1	87.2±0.9	96.5±3.6	88.3±0.1	52.2±1.6
CluStream-W - SpectACl	65.5±5.1	67.1±2.0	65.3±1.0	97.9±1.0	90.8±0.1	52.9±1.1
CluStream-S - SpectACl	61.6±6.9	72.6±3.9	69.4±1.5	99.0±0.0	90.8±0.1	54.5±0.9
CluStream-G - SpectACl	56.4±3.5	70.1±3.2	64.3±0.6	98.1±0.1	90.7±0.1	53.4±1.0
CluStream-C - DBSCAN	87.6±0.0	52.0±0.0	93.0±0.0	89.4±0.0	89.2±0.0	28.4±0.0
CluStream-W - DBSCAN	87.6±0.0	83.2±0.0	93.2±0.0	89.6±0.0	90.3±0.0	36.6±0.0
CluStream-S - DBSCAN	87.5±0.0	82.1±0.0	93.0±0.0	89.6±0.0	91.0±0.0	36.8±0.0
CluStream-G - DBSCAN	65.5±4.6	73.1±2.9	91.3±0.2	92.7±0.5	90.9±0.0	32.4±0.0
CluStream-C - HDBSCAN	78.4±0.0	87.8±0.0	89.9±0.0	97.7±0.0	90.2±0.0	44.4±0.0
CluStream-W - HDBSCAN	86.9±0.0	65.6±0.0	85.7±0.0	97.7±0.0	90.6±0.0	50.9±0.0
CluStream-S - HDBSCAN	86.9±0.0	61.7±0.0	80.2±0.0	97.7±0.0	91.5±0.0	45.0±0.0
CluStream-G - HDBSCAN	60.9±7.7	59.9±0.1	86.8±0.9	94.0±1.5	90.9±0.0	45.0±0.0
CluStream-C - RNN-DBS	33.5±0.0	92.0±0.0	73.2±0.0	98.3±0.0	91.8±0.0	53.4±0.0
CluStream-W - RNN-DBS	93.4±0.0	51.0±0.0	36.8±0.0	66.6±0.0	80.8±0.0	25.1±0.0
CluStream-S - RNN-DBS	62.4±0.0	48.7±0.0	45.3±0.0	67.9±0.0	80.2±0.0	31.6±0.0
CluStream-G - RNN-DBS	68.0±3.4	30.1±1.2	74.4±1.6	66.3±2.6	81.9±0.0	34.8±0.1
CluStream-C - MDBSCAN	88.0±0.0	52.0±0.0	92.1±0.0	99.0±0.0	89.2±0.0	31.2±0.0
CluStream-W - MDBSCAN	88.1±0.0	53.2±0.0	92.9±0.0	99.0±0.0	93.0±0.0	39.1±0.0
CluStream-S - MDBSCAN	78.4±0.0	50.1±0.0	93.2±0.0	99.0±0.0	93.2±0.0	33.2±0.0
CluStream-G - MDBSCAN	56.9±3.3	65.4±3.1	92.7±0.2	98.8±0.1	93.3±0.0	29.4±0.2
CluStream-C - DPC	36.3±0.0	77.7±0.0	92.0±0.0	85.8±0.0	91.6±0.0	35.1±0.0
CluStream-W - DPC	41.4±0.0	78.9±0.0	89.6±0.0	90.1±0.0	92.9±0.0	25.6±0.0
CluStream-S - DPC	33.4±0.0	72.1±0.0	83.0±0.0	90.1±0.0	93.1±0.0	38.6±0.0
CluStream-G - DPC	31.9±0.8	65.3±1.6	89.5±0.3	77.4±0.6	93.0±0.0	44.6±0.0
CluStream-C - SNN-DPC	51.4±1.8	87.9±0.3	77.4±0.3	89.3±0.0	85.3±0.0	61.2±1.1
CluStream-W - SNN-DPC	51.2±0.0	84.8±0.4	70.5±0.0	93.6±3.4	88.9±0.0	65.8±0.0
CluStream-S - SNN-DPC	58.2±0.0	87.4±0.0	78.4±0.0	97.8±0.0	88.6±0.0	68.1±0.0
CluStream-G - SNN-DPC	54.1±1.6	77.1±1.0	90.1±0.2	94.7±1.9	89.4±0.0	62.6±0.3
CluStream-C - DBHD	51.7±0.0	69.5±0.0	81.1±0.0	99.0±0.0	90.8±0.0	39.9±0.0
CluStream-W - DBHD	51.7±0.0	69.5±0.0	81.1±0.0	98.9±0.0	90.8±0.0	39.9±0.0
CluStream-S - DBHD	51.7±0.0	69.5±0.0	81.1±0.0	99.0±0.0	90.8±0.0	39.9±0.0
CluStream-G - DBHD	70.3±4.4	57.4±0.7	86.5±0.5	54.7±0.2	75.2±0.1	36.2±0.4

Table 17: F1 Scores for evaluated datasets for the best parameters according to the sum of ARI and AMI (×100). The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	F1	F1	F1	F1	F1	F1
STREAMKmeans	53.1±2.0	42.7±1.5	75.2±1.4	96.0±0.0	**96.4**±0.0	43.6±0.0
DenStream	59.7±0.0	65.6±0.0	70.6±0.0	91.9±0.0	88.7±0.0	45.7±0.0
DBSTREAM	66.3±0.0	72.4±0.0	76.3±0.0	84.9±0.0	95.4±0.0	36.4±0.0
EMCStream	63.7±1.2	66.0±5.0	64.7±2.1	96.4±0.6	87.9±1.7	53.6±3.7
MCMSTStream	72.7±0.0	**77.1**±0.0	79.9±0.0	97.7±0.0	94.3±0.0	38.8±0.0
GB-FuzzyStream	31.0±2.3	33.9±0.8	46.1±0.5	-	-	35.4±0.2
CluStream-O - var. k	58.6±0.0	57.8±0.0	73.0±0.0	93.3±0.0	93.5±0.0	39.0±0.0
CluStream-O - fixed k	51.0±0.0	33.3±0.0	69.8±0.0	93.3±0.0	91.9±0.0	46.7±0.0
CluStream-O - k=100	11.4±0.0	54.7±0.0	47.9±0.0	10.6±0.0	87.2±0.0	32.3±0.0
CluStream - Wk-Means	45.9±0.9	61.7±2.2	80.1±0.6	98.0±0.2	93.6±0.0	48.5±0.7
CluStream-C - k-Means	46.6±1.8	32.5±1.8	79.0±0.6	95.7±1.2	94.1±0.0	45.8±0.9
CluStream-W - k-Means	45.9±0.9	61.7±2.2	80.1±0.6	98.0±0.2	93.6±0.0	48.5±0.7
CluStream-S - k-Means	46.9±2.1	59.9±2.9	81.0±0.4	97.9±0.6	93.7±0.0	47.6±0.7
CluStream-G - k-Means	46.0±1.4	61.4±2.5	81.3±0.6	97.9±0.0	93.7±0.0	47.6±0.7
CluStream-C - SubKMeans	45.1±1.3	47.1±2.4	79.0±0.4	96.0±0.0	94.1±0.0	45.4±1.4
CluStream-W - SubKMeans	45.5±1.0	64.0±3.3	79.2±0.9	97.8±0.3	93.7±0.0	48.5±0.3
CluStream-S - SubKMeans	45.0±1.5	59.6±1.5	79.8±0.6	97.6±0.7	93.7±0.0	48.1±0.3
CluStream-G - SubKMeans	45.2±1.3	63.6±2.3	80.7±0.8	97.9±0.0	93.7±0.0	48.2±0.5
CluStream-C - X-Means	60.3±4.5	41.6±3.8	81.1±0.5	44.5±2.2	94.0±0.0	40.0±0.4
CluStream-W - X-Means	11.7±0.1	55.5±0.2	75.9±0.4	29.8±0.0	87.2±0.0	32.3±0.0
CluStream-S - X-Means	11.5±0.0	55.1±0.1	73.9±1.0	27.9±0.0	87.2±0.0	32.4±0.0
CluStream-G - X-Means	23.4±6.1	58.1±0.9	82.3±0.9	26.4±0.2	91.2±0.0	32.4±0.0
CluStream-C - P-Dip-M	31.4±0.0	22.9±0.0	43.5±0.5	76.6±0.0	93.6±0.0	44.4±0.3
CluStream-W - P-Dip-M	16.0±0.1	-	48.3±0.0	13.8±0.2	-	-
CluStream-S - P-Dip-M	15.8±0.1	-	50.9±0.1	13.3±0.1	-	-
CluStream-G - P-Dip-M	48.6±1.4	57.6±1.0	79.1±0.5	49.3±2.3	93.6±0.0	35.8±0.1
CluStream-C - SC	55.5±0.2	58.2±0.7	81.3±0.1	97.7±0.0	94.6±0.0	52.6±0.5
CluStream-W - SC	57.0±1.7	61.3±0.4	78.9±0.4	97.8±0.0	93.2±0.1	56.4±0.5
CluStream-S - SC	62.4±1.3	60.8±0.8	78.4±0.4	97.8±0.0	93.1±0.1	**56.5**±0.9
CluStream-G - SC	59.3±1.5	57.6±0.7	78.5±0.2	97.8±0.1	93.1±0.0	**56.5**±0.6
CluStream-C - SCAR	49.6±0.3	56.9±0.7	80.2±0.1	89.2±6.7	94.5±0.1	47.1±0.8
CluStream-W - SCAR	52.1±0.6	62.5±0.7	63.9±0.5	80.5±1.8	91.9±0.0	51.8±0.9
CluStream-S - SCAR	58.8±1.2	64.5±1.6	71.4±0.2	81.0±4.4	92.0±0.0	52.2±1.0
CluStream-G - SCAR	56.5±2.7	58.8±1.1	72.1±0.4	77.2±7.8	89.3±0.3	52.3±1.0
CluStream-C - SpectACl	66.9±2.3	61.8±1.3	74.0±0.5	94.2±4.5	93.5±0.0	46.6±1.2
CluStream-W - SpectACl	74.8±3.3	61.9±1.4	69.1±0.7	97.5±0.8	94.6±0.1	48.4±0.4
CluStream-S - SpectACl	71.1±5.8	65.7±1.8	75.0±1.1	**99.1**±0.0	94.7±0.1	49.0±0.7
CluStream-G - SpectACl	64.3±2.6	64.3±2.1	70.2±0.6	97.4±0.2	94.7±0.1	48.6±0.6
CluStream-C - DBSCAN	78.8±0.0	58.1±0.0	72.8±0.0	93.2±0.0	94.2±0.0	37.2±0.0
CluStream-W - DBSCAN	78.8±0.0	61.5±0.0	72.4±0.0	93.3±0.0	94.6±0.0	40.6±0.0
CluStream-S - DBSCAN	78.9±0.0	60.8±0.0	71.7±0.0	93.3±0.0	94.2±0.0	40.7±0.0
CluStream-G - DBSCAN	65.4±4.8	62.0±1.1	79.4±0.2	94.5±2.1	94.2±0.0	39.0±0.0
CluStream-C - HDBSCAN	76.9±0.0	65.2±0.0	78.2±0.0	98.0±0.0	94.3±0.0	49.0±0.0
CluStream-W - HDBSCAN	78.4±0.0	63.8±0.0	74.7±0.0	98.7±0.0	94.0±0.0	51.9±0.0
CluStream-S - HDBSCAN	78.4±0.0	62.7±0.0	75.9±0.0	98.7±0.0	94.1±0.0	51.6±0.0
CluStream-G - HDBSCAN	66.8±4.5	61.9±0.1	79.6±0.4	92.7±2.5	94.3±0.0	51.7±0.0
CluStream-C - RNN-DBS	44.7±0.0	29.2±0.0	71.9±0.0	91.2±0.0	92.7±0.0	50.2±0.0
CluStream-W - RNN-DBS	56.4±0.0	56.3±0.0	50.9±0.0	72.5±0.0	85.3±0.0	35.8±0.0
CluStream-S - RNN-DBS	58.3±0.0	55.0±0.0	53.0±0.0	76.6±0.0	85.7±0.0	40.0±0.0
CluStream-G - RNN-DBS	62.1±4.6	36.8±1.2	64.8±1.0	72.3±4.0	85.9±0.0	42.6±0.1
CluStream-C - MDBSCAN	77.5±0.0	56.7±0.0	72.0±0.0	98.7±0.0	94.2±0.0	38.1±0.0
CluStream-W - MDBSCAN	**79.0**±0.0	57.7±0.0	71.8±0.0	98.7±0.0	95.3±0.0	42.8±0.0
CluStream-S - MDBSCAN	78.4±0.0	56.8±0.0	71.7±0.0	98.7±0.0	95.3±0.0	42.6±0.0
CluStream-G - MDBSCAN	64.2±5.2	59.3±1.2	74.7±0.2	98.4±0.1	95.3±0.0	40.7±0.1
CluStream-C - DPC	51.1±0.0	63.3±0.0	76.4±0.0	90.4±0.0	95.2±0.0	43.3±0.0
CluStream-W - DPC	54.1±0.0	64.0±0.0	75.3±0.0	93.5±0.0	93.3±0.0	35.9±0.0
CluStream-S - DPC	48.5±0.0	65.4±0.0	74.5±0.0	93.5±0.0	95.8±0.0	43.7±0.0
CluStream-G - DPC	46.8±0.9	63.3±1.0	81.7±0.3	85.0±1.1	94.2±0.0	46.9±0.0
CluStream-C - SNN-DPC	55.3±0.4	40.5±0.0	68.1±0.0	82.8±0.0	91.3±0.0	50.6±0.3
CluStream-W - SNN-DPC	59.5±0.0	54.0±0.1	65.8±0.0	94.1±3.3	91.3±0.0	51.0±0.0
CluStream-S - SNN-DPC	64.8±0.0	50.2±0.0	65.9±0.0	98.1±0.0	90.5±0.0	50.2±0.0
CluStream-G - SNN-DPC	58.4±1.7	62.8±0.9	76.9±0.3	88.0±3.2	94.2±0.0	53.6±0.4
CluStream-C - DBHD	59.8±0.0	63.5±0.0	78.8±0.0	98.7±0.0	93.1±0.0	48.3±0.0
CluStream-W - DBHD	59.8±0.0	63.5±0.0	78.8±0.0	98.5±0.0	93.1±0.0	48.3±0.0
CluStream-S - DBHD	59.8±0.0	63.5±0.0	78.8±0.0	98.7±0.0	93.1±0.0	48.3±0.0
CluStream-G - DBHD	73.7±6.1	58.5±0.6	**85.2**±0.3	67.7±2.3	83.9±0.1	45.9±0.3

Table 18: FMI Scores for evaluated datasets for the best parameters according to the sum of ARI and AMI (×100). The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	FMI	FMI	FMI	FMI	FMI	FMI
STREAMKmeans	53.3±2.0	49.4±0.9	76.0±1.3	96.0±0.0	**96.4**±0.0	49.2±0.0
DenStream	59.7±0.0	65.7±0.0	70.9±0.0	92.3±0.0	89.2±0.0	48.9±0.0
DBSTREAM	67.3±0.0	72.9±0.0	77.4±0.0	85.9±0.0	95.5±0.0	41.5±0.0
EMCStream	65.0±1.3	66.8±4.8	67.9±1.6	96.4±0.6	88.6±1.5	54.8±3.6
MCMSTStream	73.6±0.0	**77.2**±0.0	80.3±0.0	97.7±0.0	94.3±0.0	40.3±0.0
GB-FuzzyStream	34.1±1.7	36.3±0.9	46.6±0.5	-	-	36.6±0.2
CluStream-O - var. k	58.7±0.0	59.8±0.0	74.1±0.0	93.3±0.0	93.7±0.0	42.8±0.0
CluStream-O - fixed k	51.5±0.0	41.5±0.0	71.7±0.0	93.3±0.0	92.2±0.0	48.0±0.0
CluStream-O - k=100	24.6±0.0	57.1±0.0	54.1±0.0	23.4±0.0	88.0±0.0	39.8±0.0
CluStream - Wk-Means	47.2±0.9	63.4±2.2	80.4±0.6	98.0±0.2	93.8±0.0	49.2±0.7
CluStream-C - k-Means	47.8±1.8	42.3±1.1	79.6±0.6	95.7±1.2	94.3±0.0	47.1±1.0
CluStream-W - k-Means	47.2±0.9	63.4±2.2	80.4±0.6	98.0±0.2	93.8±0.0	49.2±0.7
CluStream-S - k-Means	48.1±2.2	62.0±2.5	81.3±0.4	97.9±0.6	93.9±0.0	48.4±0.7
CluStream-G - k-Means	47.3±1.4	63.3±2.1	81.6±0.6	97.9±0.0	93.9±0.0	48.4±0.8
CluStream-C - SubKMeans	46.2±1.3	50.2±2.2	79.5±0.4	96.0±0.0	94.3±0.0	46.6±1.4
CluStream-W - SubKMeans	46.6±1.0	65.5±3.2	79.6±0.8	97.8±0.3	93.8±0.0	49.3±0.4
CluStream-S - SubKMeans	46.2±1.5	61.8±1.7	80.2±0.6	97.6±0.7	93.9±0.0	48.8±0.3
CluStream-G - SubKMeans	46.5±1.3	65.1±2.1	81.0±0.7	97.9±0.0	93.9±0.0	48.9±0.5
CluStream-C - X-Means	61.0±4.6	49.3±2.8	81.6±0.5	53.0±1.8	94.1±0.0	44.6±0.3
CluStream-W - X-Means	24.9±0.1	57.3±0.2	77.4±0.4	39.8±0.0	88.0±0.0	39.8±0.0
CluStream-S - X-Means	24.6±0.0	57.0±0.1	75.8±0.8	37.9±0.0	88.0±0.0	39.8±0.0
CluStream-G - X-Means	35.0±4.1	59.8±0.8	82.8±0.8	35.9±0.3	91.6±0.0	39.9±0.0
CluStream-C - P-Dip-M	43.1±0.0	36.0±0.0	52.3±0.4	79.3±0.0	93.8±0.0	51.2±0.3
CluStream-W - P-Dip-M	29.0±0.4	-	54.3±0.0	27.0±0.2	-	-
CluStream-S - P-Dip-M	29.1±0.1	-	56.2±0.1	26.5±0.1	-	-
CluStream-G - P-Dip-M	51.0±1.2	58.9±0.9	79.8±0.4	56.9±2.1	93.7±0.0	42.1±0.1
CluStream-C - SC	56.7±0.2	61.4±0.7	81.6±0.1	97.7±0.0	94.7±0.0	54.5±0.6
CluStream-W - SC	58.2±1.7	61.6±0.5	79.3±0.4	97.8±0.0	93.4±0.1	57.4±0.5
CluStream-S - SC	64.0±1.2	61.2±0.7	78.8±0.4	97.8±0.0	93.3±0.1	57.5±0.9
CluStream-G - SC	60.4±1.6	57.6±0.7	79.0±0.2	97.8±0.1	93.3±0.0	**57.6**±0.6
CluStream-C - SCAR	50.8±0.3	59.3±0.7	80.4±0.1	89.7±6.1	94.6±0.1	48.8±0.7
CluStream-W - SCAR	52.9±0.5	63.0±0.8	65.1±0.4	80.6±1.9	92.2±0.0	52.3±0.9
CluStream-S - SCAR	60.0±1.2	65.1±1.5	72.0±0.2	81.2±4.3	92.3±0.0	52.7±1.0
CluStream-G - SCAR	57.4±2.7	58.8±1.1	72.7±0.4	77.4±7.7	89.7±0.3	52.8±1.0
CluStream-C - SpectACl	67.7±2.2	62.1±1.3	75.3±0.5	94.4±4.4	93.7±0.0	47.5±1.4
CluStream-W - SpectACl	75.8±2.9	62.3±1.4	69.8±0.7	97.5±0.8	94.7±0.1	49.3±0.4
CluStream-S - SpectACl	72.1±5.5	66.1±2.0	75.7±1.0	**99.1**±0.0	94.8±0.1	50.2±0.6
CluStream-G - SpectACl	65.0±2.6	64.6±2.1	71.1±0.6	97.4±0.2	94.8±0.1	49.6±0.6
CluStream-C - DBSCAN	79.3±0.0	58.8±0.0	75.0±0.0	93.9±0.0	94.4±0.0	42.4±0.0
CluStream-W - DBSCAN	79.3±0.0	64.3±0.0	74.7±0.0	94.0±0.0	94.7±0.0	45.2±0.0
CluStream-S - DBSCAN	79.4±0.0	63.6±0.0	74.1±0.0	93.9±0.0	94.3±0.0	45.4±0.0
CluStream-G - DBSCAN	67.1±4.9	63.1±1.3	80.6±0.2	94.8±2.2	94.3±0.0	43.8±0.0
CluStream-C - HDBSCAN	77.4±0.0	67.7±0.0	79.3±0.0	98.1±0.0	94.4±0.0	50.1±0.0
CluStream-W - HDBSCAN	78.9±0.0	64.7±0.0	76.0±0.0	98.7±0.0	94.1±0.0	54.0±0.0
CluStream-S - HDBSCAN	78.9±0.0	64.1±0.0	76.6±0.0	98.7±0.0	94.2±0.0	53.1±0.0
CluStream-G - HDBSCAN	68.9±5.0	63.0±0.2	80.5±0.4	93.0±2.4	94.4±0.0	53.1±0.0
CluStream-C - RNN-DBS	47.9±0.0	39.7±0.0	72.6±0.0	92.1±0.0	92.8±0.0	51.3±0.0
CluStream-W - RNN-DBS	61.7±0.0	57.6±0.0	55.6±0.0	75.1±0.0	85.5±0.0	41.1±0.0
CluStream-S - RNN-DBS	58.9±0.0	56.3±0.0	54.8±0.0	78.1±0.0	86.0±0.0	43.5±0.0
CluStream-G - RNN-DBS	63.0±4.5	38.9±1.3	66.2±1.0	76.1±3.6	86.2±0.0	45.9±0.2
CluStream-C - MDBSCAN	78.2±0.0	57.4±0.0	74.2±0.0	98.7±0.0	94.4±0.0	43.2±0.0
CluStream-W - MDBSCAN	**79.6**±0.0	58.8±0.0	74.1±0.0	98.7±0.0	95.3±0.0	47.1±0.0
CluStream-S - MDBSCAN	78.9±0.0	57.6±0.0	74.0±0.0	98.7±0.0	95.3±0.0	46.5±0.0
CluStream-G - MDBSCAN	66.2±5.7	59.9±1.4	76.5±0.2	98.4±0.1	95.4±0.0	46.1±0.1
CluStream-C - DPC	56.0±0.0	64.8±0.0	78.0±0.0	90.9±0.0	95.3±0.0	46.4±0.0
CluStream-W - DPC	57.0±0.0	65.2±0.0	76.8±0.0	93.9±0.0	93.6±0.0	41.5±0.0
CluStream-S - DPC	54.5±0.0	65.8±0.0	75.5±0.0	93.9±0.0	95.9±0.0	46.5±0.0
CluStream-G - DPC	53.0±0.9	63.6±1.0	82.5±0.2	86.2±0.9	94.3±0.0	50.0±0.0
CluStream-C - SNN-DPC	55.8±0.5	48.0±0.0	69.1±0.1	83.2±0.0	91.6±0.0	52.0±0.3
CluStream-W - SNN-DPC	60.7±0.0	58.1±0.0	67.4±0.0	94.1±3.3	91.5±0.0	53.0±0.0
CluStream-S - SNN-DPC	65.4±0.0	55.5±0.0	67.5±0.0	98.1±0.0	90.7±0.0	52.5±0.0
CluStream-G - SNN-DPC	58.8±1.7	64.0±0.8	78.2±0.3	88.7±3.1	94.4±0.0	55.0±0.3
CluStream-C - DBHD	61.0±0.0	64.4±0.0	79.2±0.0	98.7±0.0	93.2±0.0	50.7±0.0
CluStream-W - DBHD	61.0±0.0	64.4±0.0	79.2±0.0	98.6±0.0	93.2±0.0	50.7±0.0
CluStream-S - DBHD	61.0±0.0	64.4±0.0	79.2±0.0	98.7±0.0	93.2±0.0	50.7±0.0
CluStream-G - DBHD	74.6±6.3	59.5±0.6	**85.5**±0.3	71.6±2.3	84.5±0.1	49.1±0.4

Table 19: Purity Scores for evaluated datasets for the best parameters according to the sum of ARI and AMI (×100). The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	Purity	Purity	Purity	Purity	Purity	Purity
STREAMKmeans	61.9±2.6	47.8±1.8	81.2±1.5	97.7±0.0	97.8±0.3	44.2±0.0
DenStream	66.9±0.0	74.5±0.0	80.6±0.0	98.2±0.0	78.7±0.0	79.9±0.0
DBSTREAM	64.8±0.0	81.9±0.0	80.0±0.0	97.8±0.0	99.1±0.0	86.9±0.0
EMCStream	85.6±1.5	71.0±4.1	67.1±2.7	98.0±0.3	97.1±0.0	61.5±3.9
MCMSTStream	72.8±0.0	89.6±0.0	86.3±0.0	99.6±0.0	93.2±0.0	68.3±0.0
GB-FuzzyStream	81.8±1.1	51.0±0.2	64.6±0.3	-	-	47.5±0.4
CluStream-O - var. k	66.7±0.0	**91.2**±0.0	79.0±0.0	96.2±0.0	98.6±0.0	82.3±0.0
CluStream-O - fixed k	70.2±0.0	41.7±0.0	73.6±0.0	96.2±0.0	99.0±0.0	59.8±0.0
CluStream-O - k=100	**99.9**±0.0	90.7±0.0	**93.4**±0.0	**99.9**±0.0	**99.6**±0.0	**90.4**±0.0
CluStream - Wk-Means	69.8±1.6	68.4±1.1	88.9±0.4	98.9±0.1	99.0±0.0	66.9±0.4
CluStream-C - k-Means	71.1±1.8	37.1±2.3	84.2±0.6	97.6±0.7	99.0±0.0	61.0±1.0
CluStream-W - k-Means	69.8±1.6	68.4±1.1	88.9±0.4	98.9±0.1	99.0±0.0	66.9±0.4
CluStream-S - k-Means	72.0±2.6	67.3±1.9	88.8±0.4	98.8±0.3	99.0±0.0	65.6±0.5
CluStream-G - k-Means	71.3±1.5	67.8±2.3	89.6±0.4	98.8±0.0	99.0±0.0	65.6±0.7
CluStream-C - SubKMeans	68.9±1.4	55.6±2.1	85.0±0.5	97.8±0.0	99.0±0.0	60.9±1.0
CluStream-W - SubKMeans	69.4±0.7	72.1±2.3	90.0±0.6	98.8±0.1	99.0±0.0	67.4±0.6
CluStream-S - SubKMeans	68.2±1.1	68.8±1.3	89.9±0.3	98.7±0.4	99.0±0.0	66.8±0.5
CluStream-G - SubKMeans	70.1±1.4	71.2±2.2	89.5±0.3	98.8±0.0	99.0±0.0	66.8±0.5
CluStream-C - X-Means	64.8±3.1	49.7±4.5	87.7±0.3	99.0±0.4	98.7±0.0	84.6±0.1
CluStream-W - X-Means	**99.9**±0.0	89.4±0.4	84.4±0.8	**99.9**±0.0	99.5±0.0	**90.4**±0.0
CluStream-S - X-Means	**99.9**±0.0	89.5±0.2	88.1±1.0	**99.9**±0.0	99.5±0.0	**90.4**±0.0
CluStream-G - X-Means	94.7±5.8	88.1±0.9	90.1±0.7	**99.9**±0.0	99.5±0.0	**90.4**±0.0
CluStream-C - P-Dip-M	29.9±0.0	20.6±0.0	38.9±0.7	70.8±0.0	98.2±0.0	48.3±0.5
CluStream-W - P-Dip-M	98.7±0.8	-	93.2±0.0	**99.9**±0.0	-	-
CluStream-S - P-Dip-M	99.5±0.2	-	92.6±0.1	**99.9**±0.0	-	-
CluStream-G - P-Dip-M	81.9±0.6	82.2±0.6	84.8±0.6	98.8±0.1	98.8±0.0	88.2±0.2
CluStream-C - SC	80.6±0.0	60.6±0.5	89.1±0.1	98.7±0.0	99.0±0.0	63.9±0.6
CluStream-W - SC	81.0±0.9	72.4±0.3	85.7±0.4	98.8±0.0	98.6±0.0	70.1±0.5
CluStream-S - SC	86.8±0.8	72.5±0.7	85.8±0.4	98.8±0.0	98.6±0.0	70.0±0.9
CluStream-G - SC	82.7±1.2	71.5±0.5	85.9±0.2	98.8±0.0	98.9±0.0	70.1±0.6
CluStream-C - SCAR	75.3±0.2	62.8±0.6	88.7±0.1	90.1±8.4	97.9±0.1	67.1±0.9
CluStream-W - SCAR	76.0±1.0	70.1±0.6	85.8±0.2	83.6±1.7	98.2±0.0	66.1±1.0
CluStream-S - SCAR	82.1±1.4	70.9±1.4	85.2±0.2	85.4±5.1	98.3±0.0	67.9±0.7
CluStream-G - SCAR	79.7±2.1	71.9±0.6	85.5±0.2	83.2±7.0	96.4±0.3	68.3±1.0
CluStream-C - SpectACl	84.7±0.6	74.9±0.8	78.4±0.6	94.2±4.6	98.8±0.0	61.0±1.2
CluStream-W - SpectACl	90.1±0.8	75.9±0.8	83.7±0.5	98.6±0.5	98.8±0.1	62.4±0.6
CluStream-S - SpectACl	88.9±2.1	76.6±0.9	88.7±0.5	99.5±0.0	98.9±0.1	63.6±0.8
CluStream-G - SpectACl	82.2±2.9	76.2±1.3	86.1±0.5	98.5±0.1	98.9±0.0	63.1±1.0
CluStream-C - DBSCAN	86.4±0.0	87.8±0.0	74.9±0.0	**99.9**±0.0	99.5±0.0	86.0±0.0
CluStream-W - DBSCAN	86.4±0.0	73.0±0.0	74.5±0.0	99.8±0.0	98.1±0.0	81.9±0.0
CluStream-S - DBSCAN	87.1±0.0	73.0±0.0	73.5±0.0	99.7±0.0	96.4±0.0	82.0±0.0
CluStream-G - DBSCAN	85.4±4.9	78.5±0.6	82.8±0.3	98.1±3.6	96.7±0.0	82.9±0.1
CluStream-C - HDBSCAN	88.9±0.0	68.4±0.0	82.1±0.0	99.3±0.0	98.5±0.0	74.4±0.0
CluStream-W - HDBSCAN	86.4±0.0	82.1±0.0	79.6±0.0	**99.9**±0.0	96.6±0.0	72.5±0.0
CluStream-S - HDBSCAN	86.4±0.0	85.2±0.0	83.5±0.0	**99.9**±0.0	95.9±0.0	74.9±0.0
CluStream-G - HDBSCAN	89.3±2.7	85.8±0.3	84.5±0.4	94.4±4.4	96.5±0.0	75.1±0.0
CluStream-C - RNN-DBS	83.8±0.0	34.7±0.0	82.2±0.0	90.2±0.0	96.2±0.0	70.0±0.0
CluStream-W - RNN-DBS	57.8±0.0	83.1±0.0	90.7±0.0	94.5±0.0	94.9±0.0	84.1±0.0
CluStream-S - RNN-DBS	75.7±0.0	84.5±0.0	81.4±0.0	94.8±0.0	95.6±0.0	80.5±0.0
CluStream-G - RNN-DBS	75.6±7.0	79.5±1.6	74.7±0.9	95.5±4.6	94.9±0.0	79.8±0.2
CluStream-C - MDBSCAN	85.2±0.0	87.0±0.0	73.9±0.0	99.3±0.0	99.5±0.0	84.5±0.0
CluStream-W - MDBSCAN	86.4±0.0	85.0±0.0	73.2±0.0	99.3±0.0	96.4±0.0	80.7±0.0
CluStream-S - MDBSCAN	92.0±0.0	87.0±0.0	72.9±0.0	99.3±0.0	96.4±0.0	82.1±0.0
CluStream-G - MDBSCAN	89.8±5.5	82.0±0.6	76.3±0.4	99.1±0.1	96.4±0.0	85.6±0.1
CluStream-C - DPC	94.0±0.0	78.9±0.0	78.5±0.0	97.2±0.0	98.9±0.0	81.3±0.0
CluStream-W - DPC	87.6±0.0	79.2±0.0	79.0±0.0	99.3±0.0	96.2±0.0	86.7±0.0
CluStream-S - DPC	93.8±0.0	83.9±0.0	82.0±0.0	99.3±0.0	98.5±0.0	76.2±0.0
CluStream-G - DPC	93.0±2.0	81.7±0.4	86.5±0.2	99.0±0.4	94.9±0.0	78.8±0.0
CluStream-C - SNN-DPC	73.9±2.1	45.3±0.1	77.0±0.1	84.2±0.0	98.0±0.0	64.3±0.7
CluStream-W - SNN-DPC	83.3±0.0	57.6±0.8	78.2±0.0	96.5±2.0	95.8±0.0	58.4±0.0
CluStream-S - SNN-DPC	85.3±0.0	56.3±0.0	72.1±0.0	99.0±0.0	94.9±0.0	56.6±0.0
CluStream-G - SNN-DPC	77.1±2.3	68.3±0.7	80.5±0.4	87.6±3.5	98.5±0.0	65.3±0.2
CluStream-C - DBHD	85.7±0.0	78.0±0.0	85.7±0.0	99.3±0.0	97.0±0.0	80.3±0.0
CluStream-W - DBHD	85.7±0.0	78.0±0.0	85.7±0.0	99.2±0.0	97.0±0.0	80.3±0.0
CluStream-S - DBHD	85.7±0.0	78.0±0.0	85.7±0.0	99.3±0.0	97.0±0.0	80.3±0.0
CluStream-G - DBHD	88.3±4.1	80.5±0.4	90.4±0.3	97.6±3.6	95.9±0.1	78.4±0.5

Table 20: Homogeneity Scores for evaluated datasets for the best parameters according to the sum of ARI and AMI (×100). The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	Homogeneity	Homogeneity	Homogeneity	Homogeneity	Homogeneity	Homogeneity
STREAMKmeans	57.0±3.5	44.3±1.9	73.8±1.6	87.4±0.0	91.3±0.7	12.3±0.0
DenStream	65.5±0.0	72.5±0.0	72.9±0.0	91.8±0.0	62.2±0.0	70.3±0.0
DBSTREAM	59.7±0.0	77.0±0.0	71.1±0.0	89.7±0.0	96.8±0.0	80.8±0.0
EMCStream	85.5±1.6	70.1±3.8	57.2±3.0	91.2±1.0	89.7±0.1	39.0±5.8
MCMSTStream	66.6±0.0	87.0±0.0	77.7±0.0	96.7±0.0	79.1±0.0	50.7±0.0
GB-FuzzyStream	74.8±1.1	39.0±0.6	51.3±0.2	-	-	20.4±0.7
CluStream-O - var. k	62.1±0.0	**89.9**±0.0	72.7±0.0	84.6±0.0	94.9±0.0	73.5±0.0
CluStream-O - fixed k	68.1±0.0	25.7±0.0	66.5±0.0	84.6±0.0	96.9±0.0	36.8±0.0
CluStream-O - k=100	**99.8**±0.0	89.1±0.0	**90.1**±0.0	99.5±0.0	**98.9**±0.0	**86.2**±0.0
CluStream - Wk-Means	68.1±0.9	63.7±1.1	81.1±0.2	93.3±0.4	97.2±0.0	48.8±0.8
CluStream-C - k-Means	68.9±1.7	27.9±2.6	77.2±0.7	87.6±3.3	96.9±0.0	40.2±1.9
CluStream-W - k-Means	68.1±0.9	63.7±1.1	81.1±0.2	93.3±0.4	97.2±0.0	48.8±0.8
CluStream-S - k-Means	68.9±1.9	62.3±2.7	81.0±0.2	93.4±0.8	97.2±0.0	47.5±0.6
CluStream-G - k-Means	68.4±1.3	63.7±2.2	81.7±0.3	93.5±0.1	97.2±0.0	47.4±0.9
CluStream-C - SubKMeans	66.1±1.2	48.0±1.8	77.7±0.3	87.7±0.0	96.9±0.0	39.5±1.6
CluStream-W - SubKMeans	67.2±0.7	68.1±2.4	83.0±0.5	92.9±0.5	97.2±0.0	49.3±0.8
CluStream-S - SubKMeans	67.2±1.2	64.7±1.5	82.8±0.2	93.0±1.0	97.2±0.0	48.6±0.7
CluStream-G - SubKMeans	67.7±1.4	67.6±2.5	81.5±0.2	93.5±0.1	97.2±0.0	48.4±0.7
CluStream-C - X-Means	59.9±3.9	42.5±4.0	81.7±0.4	96.5±1.0	95.9±0.1	77.5±0.3
CluStream-W - X-Means	**99.8**±0.0	87.8±0.3	77.3±1.0	99.5±0.0	98.8±0.0	**86.2**±0.0
CluStream-S - X-Means	**99.8**±0.0	87.9±0.3	81.9±1.0	99.5±0.0	98.7±0.0	**86.2**±0.0
CluStream-G - X-Means	93.7±6.8	85.8±1.0	83.5±0.6	**99.6**±0.2	98.8±0.0	86.1±0.0
CluStream-C - P-Dip-M	0.0±0.0	0.0±0.0	19.3±0.9	24.9±0.0	93.7±0.0	21.3±0.8
CluStream-W - P-Dip-M	98.5±0.8	-	89.7±0.0	**99.6**±0.0	-	-
CluStream-S - P-Dip-M	99.4±0.2	-	88.6±0.1	**99.6**±0.0	-	-
CluStream-G - P-Dip-M	77.6±0.8	79.4±0.6	75.7±0.6	93.5±0.4	96.5±0.0	82.3±0.3
CluStream-C - SC	78.0±0.1	57.6±0.5	81.7±0.1	92.5±0.0	96.9±0.0	43.0±0.7
CluStream-W - SC	78.9±1.2	70.5±0.2	77.5±0.4	93.4±0.0	96.0±0.0	53.1±0.6
CluStream-S - SC	85.3±0.4	70.9±0.6	77.3±0.3	93.4±0.0	96.0±0.1	53.0±1.6
CluStream-G - SC	81.7±1.5	70.6±0.3	77.6±0.2	93.5±0.1	96.6±0.1	53.0±0.9
CluStream-C - SCAR	71.8±0.4	58.4±0.5	80.6±0.1	69.3±19.9	92.6±0.3	48.0±0.8
CluStream-W - SCAR	70.8±0.5	68.5±0.7	76.2±0.3	55.4±3.9	94.9±0.1	50.2±1.0
CluStream-S - SCAR	80.7±1.3	68.9±1.3	76.7±0.2	56.3±9.0	95.4±0.1	51.8±0.7
CluStream-G - SCAR	77.5±2.1	70.5±0.6	77.1±0.1	49.2±17.4	88.9±0.8	51.6±1.2
CluStream-C - SpectACl	83.4±0.6	74.5±0.6	73.4±0.7	86.1±10.3	96.2±0.0	40.0±2.2
CluStream-W - SpectACl	90.1±0.4	73.1±0.8	77.6±0.4	92.4±1.6	95.7±0.2	42.3±1.1
CluStream-S - SpectACl	88.0±2.2	74.0±0.8	84.0±0.5	96.6±0.0	95.9±0.2	43.0±0.5
CluStream-G - SpectACl	81.3±2.0	74.1±1.1	80.3±0.4	92.4±0.5	96.0±0.1	43.3±1.2
CluStream-C - DBSCAN	83.4±0.0	86.3±0.0	69.8±0.0	99.2±0.0	98.4±0.0	79.7±0.0
CluStream-W - DBSCAN	83.4±0.0	70.8±0.0	69.5±0.0	98.5±0.0	93.0±0.0	72.5±0.0
CluStream-S - DBSCAN	83.9±0.0	70.8±0.0	68.2±0.0	97.9±0.0	88.3±0.0	72.6±0.0
CluStream-G - DBSCAN	83.6±4.5	75.4±0.7	78.9±0.3	94.9±8.4	89.0±0.0	74.7±0.1
CluStream-C - HDBSCAN	86.0±0.0	67.8±0.0	76.3±0.0	95.7±0.0	95.0±0.0	61.7±0.0
CluStream-W - HDBSCAN	83.4±0.0	79.7±0.0	74.1±0.0	99.1±0.0	89.1±0.0	60.2±0.0
CluStream-S - HDBSCAN	83.4±0.0	82.8±0.0	77.0±0.0	99.1±0.0	87.4±0.0	64.6±0.0
CluStream-G - HDBSCAN	88.1±3.5	83.4±0.2	78.4±0.3	85.9±10.4	89.2±0.0	64.7±0.0
CluStream-C - RNN-DBS	83.1±0.0	16.9±0.0	76.3±0.0	74.7±0.0	86.0±0.0	54.5±0.0
CluStream-W - RNN-DBS	42.7±0.0	81.0±0.0	86.1±0.0	80.8±0.0	82.3±0.0	77.0±0.0
CluStream-S - RNN-DBS	72.2±0.0	82.6±0.0	74.2±0.0	81.8±0.0	84.9±0.0	70.0±0.0
CluStream-G - RNN-DBS	74.4±6.9	75.7±1.4	67.3±1.3	88.0±11.6	82.7±0.0	69.1±0.4
CluStream-C - MDBSCAN	82.0±0.0	85.0±0.0	65.8±0.0	95.7±0.0	98.4±0.0	77.2±0.0
CluStream-W - MDBSCAN	83.3±0.0	82.1±0.0	64.5±0.0	95.7±0.0	88.2±0.0	70.6±0.0
CluStream-S - MDBSCAN	88.4±0.0	85.1±0.0	64.0±0.0	95.7±0.0	87.9±0.0	74.1±0.0
CluStream-G - MDBSCAN	89.1±4.8	79.4±0.8	67.9±0.5	95.0±0.3	88.0±0.0	78.3±0.1
CluStream-C - DPC	93.1±0.0	75.1±0.0	70.4±0.0	92.2±0.0	95.9±0.0	71.6±0.0
CluStream-W - DPC	86.1±0.0	76.2±0.0	72.8±0.0	96.4±0.0	88.6±0.0	80.7±0.0
CluStream-S - DPC	94.1±0.0	81.1±0.0	75.7±0.0	96.4±0.0	94.4±0.0	65.1±0.0
CluStream-G - DPC	92.3±1.8	78.5±0.6	80.6±0.2	94.8±2.1	87.0±0.1	66.8±0.0
CluStream-C - SNN-DPC	70.7±2.1	39.1±0.1	68.4±0.1	59.4±0.0	93.5±0.0	46.0±0.6
CluStream-W - SNN-DPC	80.1±0.0	54.2±0.5	67.3±0.0	86.9±6.2	86.5±0.0	40.0±0.0
CluStream-S - SNN-DPC	82.2±0.0	48.8±0.0	61.9±0.0	94.4±0.0	84.4±0.0	35.6±0.0
CluStream-G - SNN-DPC	75.4±2.7	65.9±0.8	74.1±0.4	67.2±6.9	95.1±0.0	46.4±0.4
CluStream-C - DBHD	82.7±0.0	75.4±0.0	81.7±0.0	95.7±0.0	89.1±0.0	70.6±0.0
CluStream-W - DBHD	82.7±0.0	75.4±0.0	81.7±0.0	95.3±0.0	89.1±0.0	70.6±0.0
CluStream-S - DBHD	82.7±0.0	75.4±0.0	81.7±0.0	95.7±0.0	89.1±0.0	70.6±0.0
CluStream-G - DBHD	86.6±4.8	77.8±0.5	84.7±0.3	92.8±8.4	86.8±0.3	69.3±0.6

Table 21: Completeness Scores for evaluated datasets for the best parameters according to the sum of ARI and AMI (×100). The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	Completeness	Completeness	Completeness	Completeness	Completeness	Completeness
STREAMKmeans	68.5±4.0	70.5±1.6	76.7±0.7	88.9±0.0	83.6±0.2	34.4±0.0
DenStream	77.2±0.0	75.1±0.0	68.3±0.0	84.8±0.0	**97.9**±0.0	44.8±0.0
DBSTREAM	83.4±0.0	75.2±0.0	83.0±0.0	65.4±0.0	76.7±0.0	39.9±0.0
EMCStream	76.5±1.0	79.8±2.2	82.5±0.4	90.5±1.1	68.1±1.8	47.7±5.6
MCMSTStream	85.4±0.0	83.4±0.0	79.3±0.0	89.6±0.0	87.0±0.0	35.3±0.0
GB-FuzzyStream	50.2±1.5	52.5±0.8	53.1±0.5	-	-	22.7±0.4
CluStream-O - var. k	73.5±0.0	62.9±0.0	75.4±0.0	84.6±0.0	75.1±0.0	40.3±0.0
CluStream-O - fixed k	63.1±0.0	61.4±0.0	78.4±0.0	84.6±0.0	69.8±0.0	41.7±0.0
CluStream-O - k=100	42.3±0.0	62.3±0.0	48.5±0.0	16.8±0.0	53.6±0.0	38.7±0.0
CluStream - Wk-Means	59.6±0.7	75.1±1.4	76.8±1.1	93.5±0.6	65.4±0.1	43.5±0.8
CluStream-C - k-Means	60.2±1.6	68.0±1.5	79.5±0.4	87.9±2.8	68.4±0.1	41.5±2.2
CluStream-W - k-Means	59.6±0.7	75.1±1.4	76.8±1.1	93.5±0.6	65.4±0.1	43.5±0.8
CluStream-S - k-Means	60.4±1.7	74.8±1.3	77.8±0.5	93.5±1.1	65.9±0.1	42.7±0.8
CluStream-G - k-Means	59.6±1.2	75.5±0.9	77.8±0.6	93.2±0.1	65.9±0.1	42.6±0.8
CluStream-C - SubKMeans	58.6±1.0	65.1±1.4	78.3±0.4	88.1±0.0	68.3±0.1	40.5±1.5
CluStream-W - SubKMeans	59.0±0.7	78.2±2.5	74.9±1.0	92.9±0.8	65.5±0.1	44.1±0.5
CluStream-S - SubKMeans	58.9±1.0	76.4±1.7	75.5±0.5	92.9±1.3	65.9±0.1	43.2±0.6
CluStream-G - SubKMeans	59.0±1.3	77.3±1.3	77.2±0.7	93.2±0.1	65.9±0.1	43.3±0.6
CluStream-C - X-Means	77.0±4.2	68.0±2.5	78.4±0.7	35.6±1.3	68.9±0.1	41.5±0.1
CluStream-W - X-Means	42.5±0.0	65.6±0.3	77.4±1.5	29.4±0.0	53.8±0.0	38.7±0.0
CluStream-S - X-Means	42.3±0.0	64.1±0.2	71.9±0.9	28.3±0.0	53.9±0.0	38.8±0.0
CluStream-G - X-Means	50.1±4.6	65.7±0.4	78.5±1.3	27.1±0.3	56.4±0.0	38.8±0.0
CluStream-C - P-Dip-M	**100.0**±0.0	**100.0**±0.0	**94.6**±0.2	**100.0**±0.0	69.2±0.0	**73.4**±0.3
CluStream-W - P-Dip-M	45.4±0.2	-	48.8±0.0	19.0±0.1	-	-
CluStream-S - P-Dip-M	45.5±0.0	-	50.3±0.1	18.5±0.1	-	-
CluStream-G - P-Dip-M	62.7±1.1	66.9±0.8	81.9±0.6	39.3±2.7	64.8±0.0	41.1±0.1
CluStream-C - SC	69.3±0.1	76.5±0.6	77.2±0.1	92.3±0.0	71.0±0.1	50.9±0.8
CluStream-W - SC	70.1±0.9	71.8±0.5	77.6±0.5	93.1±0.0	66.3±0.1	57.2±0.3
CluStream-S - SC	75.2±0.8	73.0±0.3	77.0±0.4	93.1±0.0	66.5±0.1	57.3±1.3
CluStream-G - SC	73.2±1.3	70.7±0.5	77.0±0.3	93.2±0.1	65.6±0.0	57.2±0.8
CluStream-C - SCAR	63.1±0.2	71.7±0.6	76.5±0.0	71.7±17.0	77.5±0.3	44.5±0.8
CluStream-W - SCAR	65.5±0.7	72.7±0.7	63.0±0.3	56.6±4.7	61.3±0.1	47.2±0.6
CluStream-S - SCAR	71.8±1.1	73.9±0.7	67.9±0.2	59.5±8.7	61.3±0.1	46.6±0.7
CluStream-G - SCAR	70.2±1.7	70.0±0.6	68.2±0.2	50.8±16.0	63.7±0.2	46.2±1.1
CluStream-C - SpectACl	76.0±1.0	75.8±0.7	81.3±0.5	87.7±9.0	69.3±0.1	40.3±1.9
CluStream-W - SpectACl	82.3±1.6	76.1±1.0	68.2±0.4	92.9±1.7	73.1±0.1	42.0±0.7
CluStream-S - SpectACl	79.9±3.1	77.8±1.5	72.8±0.8	96.5±0.0	73.0±0.2	43.1±0.3
CluStream-G - SpectACl	74.5±1.8	77.0±1.5	68.7±0.3	93.4±0.4	72.9±0.2	42.4±0.8
CluStream-C - DBSCAN	90.6±0.0	64.0±0.0	88.7±0.0	85.5±0.0	66.1±0.0	40.4±0.0
CluStream-W - DBSCAN	90.6±0.0	83.8±0.0	89.2±0.0	85.8±0.0	72.8±0.0	43.3±0.0
CluStream-S - DBSCAN	90.3±0.0	82.4±0.0	88.6±0.0	85.7±0.0	77.1±0.0	43.5±0.0
CluStream-G - DBSCAN	76.0±1.9	77.8±1.2	86.8±0.2	86.0±3.8	76.7±0.0	41.9±0.0
CluStream-C - HDBSCAN	86.6±0.0	82.0±0.0	84.6±0.0	92.6±0.0	70.8±0.0	46.0±0.0
CluStream-W - HDBSCAN	89.2±0.0	76.6±0.0	83.2±0.0	93.2±0.0	74.7±0.0	53.1±0.0
CluStream-S - HDBSCAN	89.2±0.0	75.3±0.0	78.9±0.0	93.2±0.0	76.5±0.0	48.7±0.0
CluStream-G - HDBSCAN	73.0±4.3	73.9±0.2	84.0±0.5	82.6±4.8	75.5±0.0	48.7±0.0
CluStream-C - RNN-DBS	61.1±0.0	57.0±0.0	69.7±0.0	95.2±0.0	75.3±0.0	47.2±0.0
CluStream-W - RNN-DBS	93.0±0.0	66.9±0.0	50.5±0.0	57.2±0.0	57.2±0.0	39.9±0.0
CluStream-S - RNN-DBS	76.1±0.0	65.3±0.0	53.1±0.0	54.6±0.0	56.4±0.0	41.8±0.0
CluStream-G - RNN-DBS	74.6±2.6	52.9±0.6	66.3±1.6	58.3±6.5	60.1±0.0	43.4±0.1
CluStream-C - MDBSCAN	91.7±0.0	63.6±0.0	84.7±0.0	96.1±0.0	66.1±0.0	41.5±0.0
CluStream-W - MDBSCAN	91.6±0.0	65.5±0.0	86.9±0.0	96.2±0.0	80.4±0.0	45.6±0.0
CluStream-S - MDBSCAN	86.8±0.0	64.1±0.0	87.2±0.0	96.2±0.0	80.9±0.0	44.6±0.0
CluStream-G - MDBSCAN	74.2±2.1	65.7±0.8	87.3±0.1	95.5±0.3	81.0±0.0	43.1±0.0
CluStream-C - DPC	65.3±0.0	70.9±0.0	85.8±0.0	77.7±0.0	75.0±0.0	43.4±0.0
CluStream-W - DPC	67.3±0.0	70.0±0.0	79.2±0.0	88.0±0.0	78.0±0.0	40.1±0.0
CluStream-S - DPC	64.6±0.0	68.6±0.0	73.4±0.0	88.0±0.0	80.3±0.0	41.9±0.0
CluStream-G - DPC	63.1±0.4	68.1±0.5	79.6±0.1	65.2±1.0	79.2±0.0	46.2±0.0
CluStream-C - SNN-DPC	67.0±0.5	73.2±0.4	71.7±0.2	65.0±0.0	67.4±0.0	50.6±0.5
CluStream-W - SNN-DPC	72.8±0.0	81.5±0.5	71.4±0.0	86.3±6.4	66.4±0.0	52.0±0.0
CluStream-S - SNN-DPC	76.0±0.0	81.3±0.0	73.0±0.0	94.1±0.0	66.1±0.0	51.7±0.0
CluStream-G - SNN-DPC	71.4±1.4	76.3±0.4	82.4±0.1	70.1±6.3	69.1±0.0	49.6±0.2
CluStream-C - DBHD	71.6±0.0	69.4±0.0	76.5±0.0	96.2±0.0	72.3±0.0	45.3±0.0
CluStream-W - DBHD	71.6±0.0	69.4±0.0	76.5±0.0	95.8±0.0	72.3±0.0	45.3±0.0
CluStream-S - DBHD	71.6±0.0	69.4±0.0	76.5±0.0	96.2±0.0	72.3±0.0	45.3±0.0
CluStream-G - DBHD	81.9±3.6	71.9±0.6	84.4±0.4	45.9±5.1	57.0±0.1	45.1±0.3

Table 22: Average reported cluster number per evaluation batch for the evaluated datasets for the best parameters according to the sum of ARI and AMI (×100). The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	Cluster Number	Cluster Number	Cluster Number	Cluster Number	Cluster Number	Cluster Number
STREAMKmeans	5.2±0.6	11.0±0.0	8.0±0.0	2.0±0.0	6.0±0.3	2.1±0.0
DenStream	5.0±0.0	10.0±0.0	10.0±0.0	2.3±0.0	2.0±0.0	20.1±0.0
DBSTREAM	4.0±0.0	22.6±0.0	4.8±0.0	3.3±0.0	16.8±0.0	68.0±0.0
EMCStream	9.0±0.0	8.0±0.4	3.6±0.2	2.0±0.0	6.5±0.2	4.1±0.2
MCMSTStream	5.0±0.0	14.2±0.0	6.8±0.0	2.8±0.0	3.1±0.0	32.6±0.0
GB-FuzzyStream	27.8±4.9	8.9±0.6	8.5±0.2	-	-	8.5±0.6
CluStream-O - var. k	5.0±0.0	96.8±0.0	12.0±0.0	2.0±0.0	10.9±0.0	32.3±0.0
CluStream-O - fixed k	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	18.2±0.0	6.0±0.0
CluStream-O - k=100	99.3±0.0	99.8±0.0	68.3±0.0	99.7±0.0	70.1±0.0	62.3±0.0
CluStream - Wk-Means	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	22.2±0.0	6.0±0.0
CluStream-C - k-Means	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	20.9±0.0	6.0±0.0
CluStream-W - k-Means	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	22.2±0.0	6.0±0.0
CluStream-S - k-Means	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	22.0±0.0	6.0±0.0
CluStream-G - k-Means	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	22.0±0.1	6.0±0.0
CluStream-C - SubKMeans	8.8±0.3	10.8±0.1	8.7±0.1	2.0±0.0	21.1±0.1	6.0±0.0
CluStream-W - SubKMeans	9.0±0.0	12.0±0.0	9.0±0.0	2.0±0.0	22.2±0.0	6.0±0.0
CluStream-S - SubKMeans	9.0±0.0	12.0±0.0	9.0±0.0	2.0±0.0	21.9±0.0	6.0±0.0
CluStream-G - SubKMeans	9.0±0.1	12.0±0.0	8.0±0.0	2.0±0.0	21.9±0.0	6.0±0.0
CluStream-C - X-Means	4.9±0.9	26.0±0.6	12.1±0.3	15.5±0.6	18.4±0.0	30.7±0.1
CluStream-W - X-Means	97.5±0.2	44.4±2.1	17.2±2.5	52.9±0.9	65.3±0.1	59.4±0.2
CluStream-S - X-Means	99.1±0.3	64.9±2.6	27.2±1.6	64.5±0.9	63.3±0.0	58.4±0.1
CluStream-G - X-Means	72.0±8.5	64.2±2.7	14.4±1.4	126.0±10.6	64.2±0.1	57.2±0.3
CluStream-C - P-Dip-M	1.0±0.0	1.0±0.0	1.6±0.0	1.2±0.0	17.1±0.0	3.9±0.1
CluStream-W - P-Dip-M	68.9±0.6	-	63.4±0.1	48.1±1.8	-	-
CluStream-S - P-Dip-M	70.3±0.5	-	52.2±0.2	55.4±1.5	-	-
CluStream-G - P-Dip-M	11.1±0.5	41.7±3.9	6.0±0.3	11.8±0.4	24.2±0.1	32.2±0.4
CluStream-C - SC	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	20.9±0.0	5.2±0.1
CluStream-W - SC	9.0±0.0	11.0±0.0	7.8±0.0	2.0±0.0	19.4±0.0	5.2±0.0
CluStream-S - SC	9.0±0.0	11.0±0.0	7.9±0.0	2.0±0.0	19.3±0.0	5.2±0.0
CluStream-G - SC	9.0±0.0	11.0±0.0	7.9±0.0	2.0±0.0	21.8±0.0	5.2±0.0
CluStream-C - SCAR	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	17.4±0.1	11.0±0.0
CluStream-W - SCAR	9.0±0.0	10.7±0.2	8.5±0.9	2.0±0.0	20.4±0.1	5.9±0.0
CluStream-S - SCAR	9.0±0.0	10.6±0.3	8.0±0.0	2.0±0.0	21.6±0.0	5.8±0.0
CluStream-G - SCAR	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	13.1±0.3	5.8±0.0
CluStream-C - SpectACl	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	20.2±0.0	5.7±0.1
CluStream-W - SpectACl	9.0±0.0	10.6±0.1	8.0±0.0	2.0±0.0	18.8±0.0	5.6±0.1
CluStream-S - SpectACl	9.0±0.0	10.8±0.1	8.0±0.0	2.0±0.0	18.9±0.0	5.7±0.1
CluStream-G - SpectACl	9.0±0.0	11.0±0.1	8.0±0.0	2.0±0.0	19.3±0.1	5.6±0.1
CluStream-C - DBSCAN	8.6±0.0	95.8±0.0	4.7±0.0	4.2±0.0	45.9±0.0	48.7±0.0
CluStream-W - DBSCAN	8.6±0.0	10.8±0.0	4.5±0.0	3.7±0.0	10.1±0.0	24.5±0.0
CluStream-S - DBSCAN	9.0±0.0	16.0±0.0	4.5±0.0	3.5±0.0	5.3±0.0	24.7±0.0
CluStream-G - DBSCAN	13.8±1.3	13.8±0.4	8.5±0.2	3.6±0.3	5.6±0.0	26.8±0.0
CluStream-C - HDBSCAN	9.6±0.0	16.6±0.0	6.1±0.0	2.5±0.0	19.1±0.0	12.2±0.0
CluStream-W - HDBSCAN	9.3±0.0	13.8±0.0	5.2±0.0	2.7±0.0	6.1±0.0	8.0±0.0
CluStream-S - HDBSCAN	9.3±0.0	16.2±0.0	5.7±0.0	2.7±0.0	5.4±0.0	8.4±0.0
CluStream-G - HDBSCAN	15.9±1.3	18.8±0.2	5.5±0.1	2.7±0.2	5.9±0.0	8.5±0.0
CluStream-C - RNN-DBS	16.6±0.0	5.6±0.0	12.0±0.0	2.0±0.0	7.5±0.0	10.9±0.0
CluStream-W - RNN-DBS	4.0±0.0	27.6±0.0	48.6±0.0	6.2±0.0	17.1±0.0	26.5±0.0
CluStream-S - RNN-DBS	8.6±0.0	39.6±0.0	24.1±0.0	3.5±0.0	22.4±0.0	17.5±0.0
CluStream-G - RNN-DBS	12.8±2.0	57.5±2.0	13.9±0.3	6.8±0.1	14.4±0.0	15.2±0.1
CluStream-C - MDBSCAN	8.0±0.0	95.6±0.0	5.4±0.0	2.0±0.0	45.9±0.0	43.9±0.0
CluStream-W - MDBSCAN	8.0±0.0	39.0±0.0	3.9±0.0	2.0±0.0	4.8±0.0	16.8±0.0
CluStream-S - MDBSCAN	9.6±0.0	73.8±0.0	3.8±0.0	2.0±0.0	4.8±0.0	15.8±0.0
CluStream-G - MDBSCAN	14.5±0.7	98.2±0.6	4.0±0.0	2.0±0.0	4.8±0.0	20.2±0.0
CluStream-C - DPC	18.6±0.0	58.8±0.0	5.2±0.0	2.7±0.0	20.2±0.0	22.6±0.0
CluStream-W - DPC	13.0±0.0	89.4±0.0	14.3±0.0	2.3±0.0	11.5±0.0	47.1±0.0
CluStream-S - DPC	18.0±0.0	91.4±0.0	20.7±0.0	2.3±0.0	10.9±0.0	27.1±0.0
CluStream-G - DPC	17.8±0.6	50.0±0.5	19.4±0.2	3.9±0.2	7.3±0.0	18.9±0.0
CluStream-C - SNN-DPC	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	19.6±0.0	6.0±0.0
CluStream-W - SNN-DPC	8.9±0.0	6.1±0.2	6.8±0.0	2.0±0.0	16.3±0.0	4.1±0.0
CluStream-S - SNN-DPC	9.0±0.0	6.2±0.0	7.2±0.0	2.0±0.0	13.6±0.0	3.9±0.0
CluStream-G - SNN-DPC	9.0±0.0	10.5±0.2	8.0±0.0	2.0±0.0	18.5±0.0	5.3±0.0
CluStream-C - DBHD	11.3±0.0	42.4±0.0	9.7±0.0	2.0±0.0	9.9±0.0	15.1±0.0
CluStream-W - DBHD	11.3±0.0	42.4±0.0	9.7±0.0	2.0±0.0	9.9±0.0	15.1±0.0
CluStream-S - DBHD	11.3±0.0	42.4±0.0	9.7±0.0	2.0±0.0	9.9±0.0	15.1±0.0
CluStream-G - DBHD	9.9±0.6	15.2±0.1	5.9±0.1	5.4±0.2	12.6±0.0	12.2±0.1

Table 23: ARI Scores for evaluated datasets for the default parameters (×100). The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	ARI	ARI	ARI	ARI	ARI	ARI
STREAMKmeans	36.5±4.3	0.3±0.2	54.9±2.9	13.3±15.8	0.0±0.0	0.0±0.0
DenStream	7.9±0.0	32.4±0.0	59.2±0.0	19.0±0.0	77.6±0.0	26.8±0.0
DBSTREAM	0.0±0.0	0.1±0.0	0.0±0.0	0.0±0.0	**92.7**±0.0	6.2±0.0
EMCStream	**48.9**±3.4	**58.4**±4.4	53.6±3.0	26.2±19.6	57.2±15.6	4.1±0.8
MCMSTStream	1.0±0.0	7.5±0.0	70.0±0.0	42.5±0.0	58.9±0.0	16.4±0.0
GB-FuzzyStream	2.9±5.7	13.3±1.2	25.4±0.5	-	-	4.6±0.3
CluStream-O - var. k	9.5±0.0	49.7±0.0	19.0±0.0	5.4±0.0	68.1±0.0	19.5±0.0
CluStream-O - fixed k	36.4±0.0	7.7±0.0	57.2±0.0	38.4±0.0	83.9±0.0	25.5±0.0
CluStream-O - k=100	9.5±0.0	49.7±0.0	19.0±0.0	5.4±0.0	68.1±0.0	19.5±0.0
CluStream - Wk-Means	36.8±1.0	50.2±2.3	75.2±0.8	**95.7**±0.4	86.7±0.4	32.0±1.1
CluStream-C - k-Means	37.1±2.3	14.4±2.7	70.2±1.0	90.9±2.5	89.9±0.0	24.7±1.2
CluStream-W - k-Means	36.8±1.0	50.2±2.3	75.2±0.8	**95.7**±0.4	86.7±0.4	32.0±1.1
CluStream-S - k-Means	35.4±1.5	48.8±1.8	76.3±0.6	94.9±0.0	86.9±0.3	30.7±0.7
CluStream-G - k-Means	36.1±1.3	50.0±2.8	**76.8**±0.8	95.4±0.0	87.0±0.3	30.8±0.8
CluStream-C - SubKMeans	35.7±1.4	15.3±2.0	70.6±1.2	91.2±2.3	89.8±0.0	24.2±1.9
CluStream-W - SubKMeans	35.4±1.7	49.9±2.8	73.7±1.1	95.3±0.5	86.6±0.3	31.9±0.5
CluStream-S - SubKMeans	35.5±1.3	49.8±2.6	74.8±0.4	94.9±0.0	87.0±0.3	31.4±0.4
CluStream-G - SubKMeans	36.1±1.4	51.2±3.2	76.1±0.9	95.4±0.0	87.0±0.3	31.5±0.6
CluStream-C - X-Means	46.0±0.8	5.7±1.0	49.7±0.9	30.5±1.8	84.6±0.1	28.1±0.3
CluStream-W - X-Means	9.7±0.1	50.2±0.2	66.5±0.9	21.2±0.0	68.2±0.0	19.5±0.0
CluStream-S - X-Means	9.5±0.0	50.0±0.1	64.2±1.1	20.0±0.0	68.2±0.0	19.5±0.0
CluStream-G - X-Means	19.4±4.7	51.4±0.5	68.7±1.0	19.3±0.1	73.6±0.1	19.5±0.0
CluStream-C - P-Dip-M	0.0±0.0	0.0±0.0	3.3±0.0	24.9±0.0	89.5±0.1	12.7±0.4
CluStream-W - P-Dip-M	13.4±0.2	-	24.5±0.1	6.5±0.1	-	-
CluStream-S - P-Dip-M	13.2±0.1	-	24.0±0.1	6.4±0.0	-	-
CluStream-G - P-Dip-M	39.6±2.5	50.9±0.5	70.8±0.5	32.1±3.2	81.4±0.0	22.4±0.2
CluStream-C - SC	30.3±1.0	10.2±2.0	57.5±0.9	90.9±0.0	90.4±0.0	23.0±1.0
CluStream-W - SC	25.7±0.4	37.2±4.2	73.5±0.5	94.9±0.0	51.7±0.3	22.0±0.5
CluStream-S - SC	25.7±0.9	29.9±3.4	72.9±0.5	94.9±0.0	48.8±0.5	22.8±0.3
CluStream-G - SC	24.8±0.2	31.8±2.6	73.1±0.3	95.4±0.1	48.9±0.5	22.8±0.3
CluStream-C - SCAR	30.0±2.6	2.2±1.0	45.8±1.7	32.9±2.7	89.7±0.2	22.1±1.4
CluStream-W - SCAR	13.5±1.4	33.4±1.9	17.2±0.3	5.3±3.4	63.3±0.3	11.6±0.9
CluStream-S - SCAR	11.1±2.3	24.9±0.8	16.9±0.6	6.9±3.1	61.3±0.3	9.9±0.3
CluStream-G - SCAR	15.7±3.5	47.8±5.0	30.7±0.9	8.1±2.7	66.3±0.3	11.1±1.0
CluStream-C - SpectACl	10.8±1.3	19.9±4.4	21.5±1.0	28.0±4.6	86.7±0.1	22.3±0.8
CluStream-W - SpectACl	5.9±0.2	37.4±1.4	28.6±2.5	27.8±4.8	87.8±0.4	22.6±0.7
CluStream-S - SpectACl	5.8±0.4	37.5±1.3	26.0±1.5	30.4±10.9	88.4±0.1	23.8±1.4
CluStream-G - SpectACl	5.1±0.6	36.5±2.6	20.3±1.5	29.7±5.6	88.2±0.2	22.9±1.3
CluStream-C - DBSCAN	0.0±0.0	6.2±0.0	0.0±0.0	0.0±0.0	66.6±0.0	10.6±0.0
CluStream-W - DBSCAN	0.0±0.0	6.2±0.0	0.0±0.0	0.0±0.0	91.2±0.0	9.0±0.0
CluStream-S - DBSCAN	0.0±0.0	6.1±0.0	0.0±0.0	0.0±0.0	91.2±0.0	9.0±0.0
CluStream-G - DBSCAN	0.0±0.0	6.0±0.0	0.0±0.0	0.0±0.0	91.2±0.0	9.1±0.0
CluStream-C - HDBSCAN	25.2±0.0	3.2±0.0	61.8±0.0	88.7±0.0	83.7±0.0	28.7±0.0
CluStream-W - HDBSCAN	11.2±0.0	56.2±0.0	21.9±0.0	6.1±0.0	78.0±0.0	20.5±0.0
CluStream-S - HDBSCAN	11.4±0.0	56.4±0.0	21.3±0.0	6.0±0.0	76.9±0.0	20.4±0.0
CluStream-G - HDBSCAN	22.2±2.1	56.7±0.2	70.4±0.4	13.9±0.3	76.9±0.0	20.4±0.0
CluStream-C - RNN-DBS	15.2±0.0	0.1±0.0	11.9±0.0	72.9±0.0	78.6±0.0	17.1±0.0
CluStream-W - RNN-DBS	8.5±0.0	28.9±0.0	19.6±0.0	6.1±0.0	63.6±0.0	19.7±0.0
CluStream-S - RNN-DBS	8.2±0.0	42.0±0.0	19.6±0.0	5.7±0.0	63.1±0.0	19.7±0.0
CluStream-G - RNN-DBS	36.2±1.4	19.5±3.0	48.1±1.4	18.8±1.4	63.9±0.1	19.9±0.0
CluStream-C - MDBSCAN	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	62.3±0.0	5.5±0.0
CluStream-W - MDBSCAN	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	91.7±0.0	8.8±0.0
CluStream-S - MDBSCAN	0.0±0.0	0.1±0.0	0.0±0.0	0.0±0.0	91.5±0.0	8.8±0.0
CluStream-G - MDBSCAN	0.0±0.0	0.2±0.0	0.0±0.0	0.0±0.0	91.5±0.0	8.9±0.0
CluStream-C - DPC	14.4±0.0	7.3±0.0	48.3±0.0	71.1±0.0	32.1±0.0	8.6±0.0
CluStream-W - DPC	25.6±0.0	7.5±0.0	17.9±0.0	38.4±0.0	55.1±0.0	16.5±0.0
CluStream-S - DPC	25.3±0.0	3.3±0.0	9.4±0.0	38.4±0.0	11.5±0.0	9.0±0.0
CluStream-G - DPC	16.1±1.5	0.0±0.0	44.1±1.3	9.4±0.3	4.5±0.0	8.8±0.1
CluStream-C - SNN-DPC	45.6±1.9	15.5±0.4	57.1±0.0	31.9±0.0	82.7±0.0	29.6±0.5
CluStream-W - SNN-DPC	33.0±0.0	25.8±0.5	40.3±0.0	57.1±0.0	81.8±0.1	29.9±0.0
CluStream-S - SNN-DPC	30.9±0.0	26.0±0.0	42.8±0.0	68.0±0.0	79.8±0.0	27.4±0.0
CluStream-G - SNN-DPC	43.5±1.6	15.0±1.7	69.1±1.0	46.4±9.9	89.7±0.1	31.5±1.5
CluStream-C - DBHD	43.6±0.0	37.7±0.0	66.6±0.0	29.2±0.0	88.2±0.0	**35.6**±0.0
CluStream-W - DBHD	43.6±0.0	37.7±0.0	66.6±0.0	29.2±0.0	88.2±0.0	**35.6**±0.0
CluStream-S - DBHD	43.6±0.0	37.7±0.0	66.6±0.0	29.2±0.0	88.2±0.0	**35.6**±0.0
CluStream-G - DBHD	5.6±0.1	22.6±1.1	5.9±0.1	2.5±0.1	61.6±0.0	5.5±0.1

Table 24: AMI Scores for evaluated datasets for the default parameters (×100). The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	AMI	AMI	AMI	AMI	AMI	AMI
STREAMKmeans	56.6±4.4	2.3±1.3	66.5±2.2	14.4±15.4	0.0±0.1	0.0±0.0
DenStream	48.7±0.0	63.4±0.0	68.0±0.0	39.9±0.0	67.6±0.0	39.4±0.0
DBSTREAM	0.0±0.0	0.7±0.0	0.0±0.0	0.0±0.0	**84.4**±0.0	11.7±0.0
EMCStream	67.4±0.7	70.5±2.2	66.3±2.3	27.1±18.7	60.4±9.7	6.6±1.0
MCMSTStream	14.5±0.0	32.5±0.0	74.0±0.0	54.1±0.0	55.8±0.0	38.4±0.0
GB-FuzzyStream	9.9±19.7	36.2±1.0	49.0±0.4	-	-	16.7±0.9
CluStream-O - var. k	53.0±0.0	69.8±0.0	51.4±0.0	26.8±0.0	57.2±0.0	46.8±0.0
CluStream-O - fixed k	62.1±0.0	21.4±0.0	68.0±0.0	40.6±0.0	77.2±0.0	37.8±0.0
CluStream-O - k=100	53.0±0.0	69.8±0.0	51.4±0.0	26.8±0.0	57.2±0.0	46.8±0.0
CluStream - Wk-Means	62.8±0.8	66.4±1.1	78.4±0.4	**93.4**±0.5	74.9±0.2	45.2±0.6
CluStream-C - k-Means	62.8±1.7	37.2±2.9	76.2±0.7	87.7±3.1	78.3±0.0	39.4±2.0
CluStream-W - k-Means	62.8±0.8	66.4±1.1	78.4±0.4	**93.4**±0.5	74.9±0.2	45.2±0.6
CluStream-S - k-Means	61.8±1.3	65.0±1.0	78.9±0.3	92.4±0.0	75.3±0.2	44.1±0.5
CluStream-G - k-Means	62.0±1.0	66.0±1.5	**79.2**±0.4	93.1±0.1	75.3±0.2	44.0±0.7
CluStream-C - SubKMeans	61.3±1.0	40.2±2.3	76.1±0.7	87.8±3.0	78.3±0.0	38.7±1.6
CluStream-W - SubKMeans	61.5±1.3	66.3±1.5	77.3±0.5	92.9±0.6	75.0±0.2	45.6±0.6
CluStream-S - SubKMeans	61.6±1.0	65.9±1.3	77.9±0.4	92.4±0.0	75.4±0.2	44.9±0.6
CluStream-G - SubKMeans	61.9±1.0	66.9±1.5	78.8±0.5	93.0±0.1	75.4±0.2	44.9±0.5
CluStream-C - X-Means	64.4±0.3	18.6±3.1	62.7±0.8	50.0±1.6	72.9±0.1	48.5±0.3
CluStream-W - X-Means	53.2±0.0	72.9±0.3	73.4±0.5	41.5±0.1	57.6±0.0	47.0±0.0
CluStream-S - X-Means	53.0±0.0	71.5±0.2	72.0±0.6	39.8±0.1	57.3±0.0	46.9±0.0
CluStream-G - X-Means	58.9±0.7	71.0±0.4	75.0±0.5	36.8±0.6	58.6±0.0	46.9±0.0
CluStream-C - P-Dip-M	0.0±0.0	0.0±0.0	5.0±0.0	24.9±0.0	79.0±0.1	20.3±0.5
CluStream-W - P-Dip-M	57.5±0.4	-	56.1±0.0	29.6±0.1	-	-
CluStream-S - P-Dip-M	57.7±0.0	-	55.7±0.0	29.3±0.1	-	-
CluStream-G - P-Dip-M	66.7±1.2	70.2±0.4	77.3±0.3	49.8±1.6	67.5±0.0	50.2±0.2
CluStream-C - SC	52.6±1.0	31.1±3.6	68.2±0.5	87.0±0.0	79.6±0.1	36.3±0.8
CluStream-W - SC	53.3±0.5	55.2±2.6	77.1±0.4	92.4±0.0	51.3±0.3	35.1±0.3
CluStream-S - SC	53.7±0.9	50.4±2.8	76.7±0.3	92.4±0.0	50.0±0.4	35.6±0.3
CluStream-G - SC	51.9±0.3	51.9±2.2	76.8±0.2	93.2±0.1	50.0±0.4	35.6±0.3
CluStream-C - SCAR	50.2±1.7	15.1±1.7	57.9±1.2	35.5±2.4	76.2±0.2	33.5±1.8
CluStream-W - SCAR	44.5±1.7	58.3±1.6	41.7±0.2	13.4±2.7	58.4±0.2	31.3±0.7
CluStream-S - SCAR	42.9±2.1	52.6±1.2	41.7±0.4	14.3±1.9	56.3±0.2	30.4±0.3
CluStream-G - SCAR	45.6±2.3	65.8±2.4	52.2±0.6	14.7±2.2	60.8±0.1	32.1±0.8
CluStream-C - SpectACl	29.4±2.0	42.3±4.4	32.8±1.2	24.4±4.0	72.4±0.1	32.7±0.6
CluStream-W - SpectACl	28.6±0.5	59.3±1.1	41.7±1.9	33.2±3.4	74.2±0.2	32.1±1.2
CluStream-S - SpectACl	28.6±0.9	58.8±0.9	39.2±1.2	34.2±6.6	74.7±0.1	33.3±0.8
CluStream-G - SpectACl	24.4±1.0	58.2±1.8	34.1±1.6	33.6±3.5	74.6±0.1	32.5±0.9
CluStream-C - DBSCAN	0.0±0.0	25.2±0.0	0.0±0.0	0.0±0.0	64.1±0.0	19.3±0.0
CluStream-W - DBSCAN	0.0±0.0	25.2±0.0	0.0±0.0	0.0±0.0	81.3±0.0	20.0±0.0
CluStream-S - DBSCAN	0.0±0.0	25.0±0.0	0.0±0.0	0.0±0.0	80.7±0.0	20.0±0.0
CluStream-G - DBSCAN	0.0±0.0	24.3±0.1	0.0±0.0	0.0±0.0	80.8±0.0	20.1±0.0
CluStream-C - HDBSCAN	47.5±0.0	8.0±0.0	74.4±0.0	87.4±0.0	77.2±0.0	40.6±0.0
CluStream-W - HDBSCAN	54.4±0.0	76.3±0.0	54.9±0.0	29.0±0.0	65.9±0.0	49.4±0.0
CluStream-S - HDBSCAN	54.9±0.0	76.8±0.0	54.5±0.0	28.7±0.0	64.2±0.0	49.2±0.0
CluStream-G - HDBSCAN	54.9±4.0	**77.0**±0.2	78.1±0.4	33.9±0.4	64.3±0.0	49.2±0.0
CluStream-C - RNN-DBS	30.3±0.0	1.0±0.0	19.6±0.0	72.1±0.0	75.6±0.0	26.6±0.0
CluStream-W - RNN-DBS	48.7±0.0	56.7±0.0	51.7±0.0	27.8±0.0	58.4±0.0	47.9±0.0
CluStream-S - RNN-DBS	49.0±0.0	67.0±0.0	51.9±0.0	27.7±0.0	56.2±0.0	47.8±0.0
CluStream-G - RNN-DBS	66.1±1.8	42.3±3.6	60.8±1.5	38.0±1.2	57.4±0.0	48.2±0.0
CluStream-C - MDBSCAN	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	63.0±0.0	10.7±0.0
CluStream-W - MDBSCAN	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	81.9±0.0	19.3±0.0
CluStream-S - MDBSCAN	0.0±0.0	0.9±0.0	0.0±0.0	0.0±0.0	81.5±0.0	19.3±0.0
CluStream-G - MDBSCAN	0.0±0.0	1.3±0.3	0.0±0.0	0.0±0.0	81.5±0.0	19.4±0.0
CluStream-C - DPC	32.8±0.0	14.3±0.0	62.5±0.0	73.8±0.0	37.8±0.0	14.2±0.0
CluStream-W - DPC	49.2±0.0	20.6±0.0	25.4±0.0	40.5±0.0	52.1±0.0	24.8±0.0
CluStream-S - DPC	48.5±0.0	9.2±0.0	13.6±0.0	40.5±0.0	10.9±0.0	11.9±0.0
CluStream-G - DPC	37.1±1.8	0.0±0.0	59.7±1.4	16.1±0.1	4.8±0.0	12.3±0.1
CluStream-C - SNN-DPC	66.8±0.1	34.3±0.6	68.0±0.0	35.7±0.0	71.0±0.0	47.0±0.5
CluStream-W - SNN-DPC	56.3±0.0	50.8±0.2	55.2±0.0	56.0±0.0	72.8±0.1	43.8±0.0
CluStream-S - SNN-DPC	56.7±0.0	50.5±0.0	58.0±0.0	66.5±0.0	71.1±0.0	40.7±0.0
CluStream-G - SNN-DPC	69.0±0.5	35.1±2.7	76.7±0.5	52.0±8.6	78.4±0.0	47.3±1.3
CluStream-C - DBHD	**72.7**±0.0	60.2±0.0	74.7±0.0	46.1±0.0	75.4±0.0	**54.0**±0.0
CluStream-W - DBHD	**72.7**±0.0	60.2±0.0	74.7±0.0	46.1±0.0	75.4±0.0	**54.0**±0.0
CluStream-S - DBHD	**72.7**±0.0	60.2±0.0	74.7±0.0	46.1±0.0	75.4±0.0	**54.0**±0.0
CluStream-G - DBHD	43.5±0.2	59.1±0.5	39.5±0.1	22.9±0.2	51.7±0.0	37.4±0.2

Table 25: NMI Scores for evaluated datasets for the default parameters (×100). The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	NMI	NMI	NMI	NMI	NMI	NMI
STREAMKmeans	57.3±4.3	3.4±1.3	66.8±2.2	14.4±15.4	0.0±0.1	0.0±0.0
DenStream	56.2±0.0	66.7±0.0	68.9±0.0	40.3±0.0	68.4±0.0	40.1±0.0
DBSTREAM	0.0±0.0	0.8±0.0	0.0±0.0	0.0±0.0	**84.6**±0.0	12.0±0.0
EMCStream	67.8±0.7	71.0±2.2	66.4±2.3	27.1±18.7	60.7±9.6	6.7±1.0
MCMSTStream	17.2±0.0	34.2±0.0	74.4±0.0	54.4±0.0	56.4±0.0	41.0±0.0
GB-FuzzyStream	10.6±21.2	37.4±1.0	49.4±0.4	-	-	17.4±0.9
CluStream-O - var. k	59.4±0.0	73.2±0.0	55.4±0.0	28.8±0.0	60.4±0.0	50.7±0.0
CluStream-O - fixed k	62.9±0.0	24.0±0.0	68.4±0.0	40.7±0.0	77.9±0.0	38.3±0.0
CluStream-O - k=100	59.4±0.0	73.2±0.0	55.4±0.0	28.8±0.0	60.4±0.0	50.7±0.0
CluStream - Wk-Means	63.6±0.8	67.2±1.0	78.6±0.4	**93.4**±0.5	75.7±0.2	45.6±0.6
CluStream-C - k-Means	63.7±1.7	39.3±2.8	76.5±0.7	87.7±3.1	79.0±0.0	39.9±1.9
CluStream-W - k-Means	63.6±0.8	67.2±1.0	78.6±0.4	**93.4**±0.5	75.7±0.2	45.6±0.6
CluStream-S - k-Means	62.7±1.2	65.9±0.9	79.2±0.3	92.4±0.0	76.0±0.2	44.5±0.5
CluStream-G - k-Means	62.8±1.0	66.9±1.5	**79.4**±0.4	93.1±0.1	76.0±0.2	44.4±0.7
CluStream-C - SubKMeans	62.1±1.0	42.1±2.2	76.3±0.7	87.8±3.0	79.0±0.0	39.2±1.6
CluStream-W - SubKMeans	62.3±1.3	67.2±1.4	77.6±0.5	92.9±0.6	75.8±0.2	46.0±0.6
CluStream-S - SubKMeans	62.4±1.0	66.8±1.3	78.1±0.4	92.4±0.0	76.2±0.2	45.2±0.6
CluStream-G - SubKMeans	62.7±1.0	67.8±1.5	79.0±0.5	93.1±0.1	76.2±0.2	45.2±0.5
CluStream-C - X-Means	64.7±0.3	19.0±3.0	62.9±0.8	50.3±1.6	73.8±0.1	49.5±0.3
CluStream-W - X-Means	59.6±0.0	74.8±0.3	74.2±0.4	42.6±0.0	60.7±0.0	50.8±0.0
CluStream-S - X-Means	59.4±0.0	74.2±0.2	72.9±0.5	41.1±0.0	60.5±0.0	50.7±0.0
CluStream-G - X-Means	63.1±0.4	73.6±0.3	75.8±0.4	39.3±0.4	61.8±0.0	50.7±0.0
CluStream-C - P-Dip-M	0.0±0.0	0.0±0.0	5.0±0.0	24.9±0.0	79.4±0.1	20.5±0.5
CluStream-W - P-Dip-M	62.1±0.4	-	58.0±0.0	30.8±0.1	-	-
CluStream-S - P-Dip-M	62.4±0.0	-	57.7±0.1	30.5±0.1	-	-
CluStream-G - P-Dip-M	67.6±1.2	71.5±0.4	77.5±0.3	50.0±1.6	69.1±0.0	52.8±0.2
CluStream-C - SC	53.7±1.0	33.4±3.4	68.6±0.5	87.0±0.0	80.2±0.1	36.8±0.8
CluStream-W - SC	54.3±0.5	56.4±2.5	77.3±0.4	92.4±0.0	53.0±0.2	35.7±0.3
CluStream-S - SC	54.7±0.9	51.8±2.7	76.9±0.3	92.4±0.0	51.7±0.4	36.2±0.3
CluStream-G - SC	53.0±0.3	53.2±2.1	77.0±0.2	93.2±0.1	51.7±0.4	36.2±0.3
CluStream-C - SCAR	51.3±1.6	17.6±1.6	58.4±1.1	35.5±2.4	77.0±0.2	34.0±1.8
CluStream-W - SCAR	46.0±1.7	59.3±1.6	42.3±0.2	13.5±2.7	59.5±0.2	31.8±0.7
CluStream-S - SCAR	44.3±2.0	53.9±1.2	42.3±0.4	14.4±1.9	57.5±0.2	31.0±0.3
CluStream-G - SCAR	47.0±2.3	66.6±2.4	52.7±0.6	14.8±2.2	61.9±0.1	32.6±0.8
CluStream-C - SpectACl	31.0±2.0	44.0±4.2	33.6±1.1	24.5±4.0	73.3±0.1	33.2±0.6
CluStream-W - SpectACl	30.5±0.5	60.3±1.1	42.4±1.9	33.2±3.4	75.0±0.2	32.6±1.2
CluStream-S - SpectACl	30.4±0.9	59.9±0.8	39.9±1.2	34.2±6.6	75.5±0.1	33.7±0.8
CluStream-G - SpectACl	26.2±1.0	59.2±1.8	34.9±1.5	33.6±3.5	75.4±0.1	32.9±0.9
CluStream-C - DBSCAN	0.0±0.0	25.5±0.0	0.0±0.0	0.0±0.0	64.5±0.0	19.6±0.0
CluStream-W - DBSCAN	0.0±0.0	25.5±0.0	0.0±0.0	0.0±0.0	81.7±0.0	20.7±0.0
CluStream-S - DBSCAN	0.0±0.0	25.4±0.0	0.0±0.0	0.0±0.0	81.2±0.0	20.7±0.0
CluStream-G - DBSCAN	0.0±0.0	24.8±0.1	0.0±0.0	0.0±0.0	81.2±0.0	20.8±0.0
CluStream-C - HDBSCAN	48.0±0.0	8.1±0.0	74.5±0.0	87.5±0.0	77.5±0.0	41.0±0.0
CluStream-W - HDBSCAN	59.6±0.0	77.1±0.0	56.8±0.0	30.1±0.0	66.9±0.0	51.5±0.0
CluStream-S - HDBSCAN	60.1±0.0	**77.8**±0.0	56.6±0.0	29.8±0.0	65.6±0.0	51.5±0.0
CluStream-G - HDBSCAN	57.4±4.5	**77.8**±0.2	78.5±0.4	34.7±0.4	65.6±0.0	51.5±0.0
CluStream-C - RNN-DBS	30.5±0.0	1.4±0.0	19.8±0.0	72.1±0.0	75.9±0.0	26.9±0.0
CluStream-W - RNN-DBS	54.3±0.0	57.7±0.0	53.5±0.0	28.8±0.0	59.4±0.0	49.9±0.0
CluStream-S - RNN-DBS	54.7±0.0	68.1±0.0	53.9±0.0	28.7±0.0	57.7±0.0	50.0±0.0
CluStream-G - RNN-DBS	67.8±1.7	43.4±3.5	61.3±1.4	38.5±1.2	58.8±0.0	50.3±0.0
CluStream-C - MDBSCAN	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	63.4±0.0	10.9±0.0
CluStream-W - MDBSCAN	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	82.2±0.0	19.8±0.0
CluStream-S - MDBSCAN	0.0±0.0	1.2±0.0	0.0±0.0	0.0±0.0	81.9±0.0	19.8±0.0
CluStream-G - MDBSCAN	0.0±0.0	1.6±0.3	0.0±0.0	0.0±0.0	81.9±0.0	19.9±0.0
CluStream-C - DPC	33.2±0.0	14.5±0.0	62.6±0.0	73.8±0.0	38.0±0.0	14.3±0.0
CluStream-W - DPC	49.8±0.0	28.0±0.0	25.6±0.0	40.6±0.0	52.4±0.0	25.2±0.0
CluStream-S - DPC	49.2±0.0	11.9±0.0	13.7±0.0	40.6±0.0	11.0±0.0	12.1±0.0
CluStream-G - DPC	38.0±1.8	0.0±0.0	59.8±1.4	16.2±0.1	4.8±0.0	12.4±0.1
CluStream-C - SNN-DPC	67.6±0.1	36.1±0.6	68.3±0.0	35.8±0.0	71.9±0.0	47.4±0.5
CluStream-W - SNN-DPC	56.8±0.0	51.5±0.2	55.4±0.0	56.0±0.0	73.3±0.1	44.1±0.0
CluStream-S - SNN-DPC	57.2±0.0	51.1±0.0	58.2±0.0	66.6±0.0	71.7±0.0	41.0±0.0
CluStream-G - SNN-DPC	69.6±0.5	37.0±2.6	77.0±0.5	52.0±8.6	79.0±0.0	47.7±1.2
CluStream-C - DBHD	**73.6**±0.0	61.7±0.0	75.1±0.0	46.4±0.0	76.0±0.0	**54.8**±0.0
CluStream-W - DBHD	**73.6**±0.0	61.7±0.0	75.1±0.0	46.4±0.0	76.0±0.0	**54.8**±0.0
CluStream-S - DBHD	**73.6**±0.0	61.7±0.0	75.1±0.0	46.4±0.0	76.0±0.0	**54.8**±0.0
CluStream-G - DBHD	54.1±0.2	65.0±0.4	47.3±0.1	25.4±0.1	55.0±0.0	43.8±0.2

Table 26: Accuracy Scores for evaluated datasets for the default parameters (×100). The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	Accuracy	Accuracy	Accuracy	Accuracy	Accuracy	Accuracy
STREAMKmeans	51.8±2.4	21.6±0.4	66.0±2.1	66.6±6.9	56.8±0.0	34.4±0.0
DenStream	14.1±0.0	44.5±0.0	64.6±0.0	33.3±0.0	71.7±0.0	46.0±0.0
DBSTREAM	29.9±0.0	20.9±0.0	26.4±0.0	61.1±0.0	**89.6**±0.0	39.7±0.0
EMCStream	59.0±3.1	**65.6**±3.3	66.3±2.6	73.5±9.4	78.2±6.5	36.9±0.6
MCMSTStream	35.8±0.0	31.7±0.0	78.3±0.0	55.5±0.0	71.3±0.0	37.5±0.0
GB-FuzzyStream	31.2±2.5	40.1±0.9	55.8±0.5	-	-	35.3±0.6
CluStream-O - var. k	15.8±0.0	50.8±0.0	22.6±0.0	11.4±0.0	61.0±0.0	26.1±0.0
CluStream-O - fixed k	49.3±0.0	27.8±0.0	68.2±0.0	80.1±0.0	81.3±0.0	51.0±0.0
CluStream-O - k=100	15.8±0.0	50.8±0.0	22.6±0.0	11.4±0.0	61.0±0.0	26.1±0.0
CluStream - Wk-Means	49.2±1.5	60.2±2.1	81.2±0.7	**98.9**±0.1	75.5±0.3	53.4±0.6
CluStream-C - k-Means	50.2±2.5	30.9±2.3	77.4±0.8	97.6±0.7	81.5±0.1	50.1±0.6
CluStream-W - k-Means	49.2±1.5	60.2±2.1	81.2±0.7	**98.9**±0.1	75.5±0.3	53.4±0.6
CluStream-S - k-Means	48.1±1.9	59.4±1.6	82.3±0.6	98.7±0.0	76.1±0.2	51.9±0.4
CluStream-G - k-Means	47.9±1.5	59.6±2.4	**82.4**±0.7	98.8±0.0	76.1±0.2	51.9±0.5
CluStream-C - SubKMeans	48.3±0.6	31.8±1.4	78.0±1.0	97.7±0.6	81.5±0.1	50.1±1.2
CluStream-W - SubKMeans	48.8±2.0	59.4±2.0	80.2±1.0	98.8±0.1	75.9±0.4	53.2±0.9
CluStream-S - SubKMeans	48.6±1.9	59.3±1.8	81.2±0.5	98.7±0.0	76.5±0.4	52.9±0.5
CluStream-G - SubKMeans	48.2±1.5	60.0±2.5	81.8±0.9	98.8±0.0	76.5±0.4	53.1±0.5
CluStream-C - X-Means	57.9±0.6	27.3±1.0	62.2±0.6	41.3±2.3	75.5±0.2	41.1±0.5
CluStream-W - X-Means	16.5±0.2	52.6±0.4	71.4±0.9	29.5±0.0	61.1±0.0	26.1±0.0
CluStream-S - X-Means	15.9±0.1	51.6±0.2	69.0±1.1	27.4±0.0	61.0±0.0	26.1±0.0
CluStream-G - X-Means	28.0±5.5	55.4±0.4	72.0±1.1	26.8±0.4	63.6±0.0	26.2±0.0
CluStream-C - P-Dip-M	29.9±0.0	20.9±0.0	28.4±0.0	70.8±0.0	84.1±0.0	41.8±0.4
CluStream-W - P-Dip-M	21.3±0.2	-	27.3±0.1	12.2±0.3	-	-
CluStream-S - P-Dip-M	20.9±0.1	-	26.8±0.1	12.4±0.0	-	-
CluStream-G - P-Dip-M	50.1±2.3	56.7±0.4	79.6±0.5	43.2±2.7	70.2±0.0	28.3±0.2
CluStream-C - SC	45.7±0.6	27.8±1.6	68.3±0.7	97.6±0.0	84.2±0.1	49.4±0.6
CluStream-W - SC	42.9±0.7	51.9±2.7	81.6±0.4	98.7±0.0	70.5±0.1	48.8±0.3
CluStream-S - SC	43.2±0.7	45.1±3.3	81.0±0.5	98.7±0.0	70.9±0.2	48.4±0.2
CluStream-G - SC	42.2±0.5	46.5±2.3	80.9±0.3	98.8±0.0	70.9±0.2	48.4±0.3
CluStream-C - SCAR	46.6±2.1	25.7±0.4	60.0±1.2	78.2±1.2	84.3±0.2	50.7±0.9
CluStream-W - SCAR	43.5±1.1	51.3±1.5	44.8±0.4	62.0±3.0	67.7±0.0	43.6±0.8
CluStream-S - SCAR	41.6±1.7	47.6±0.7	44.9±0.4	63.9±3.3	66.7±0.2	43.6±0.6
CluStream-G - SCAR	42.9±2.4	58.7±2.8	52.0±0.7	65.3±2.5	62.1±0.1	43.9±0.8
CluStream-C - SpectACl	33.5±2.1	36.8±2.6	44.4±0.6	74.0±2.0	78.4±0.1	47.9±1.0
CluStream-W - SpectACl	35.9±0.3	50.7±1.0	48.4±2.0	73.7±2.0	78.3±0.3	45.8±1.0
CluStream-S - SpectACl	35.6±0.5	50.5±1.4	47.0±1.3	75.0±4.2	78.8±0.1	47.4±1.2
CluStream-G - SpectACl	32.9±0.9	50.0±2.3	43.3±1.2	74.7±2.5	78.8±0.1	46.6±1.2
CluStream-C - DBSCAN	29.9±0.0	30.5±0.0	26.4±0.0	61.1±0.0	85.3±0.0	41.0±0.0
CluStream-W - DBSCAN	29.9±0.0	30.5±0.0	26.4±0.0	61.1±0.0	86.1±0.0	38.7±0.0
CluStream-S - DBSCAN	29.9±0.0	30.3±0.0	26.4±0.0	61.1±0.0	86.3±0.0	38.7±0.0
CluStream-G - DBSCAN	29.9±0.0	30.1±0.0	26.4±0.0	61.1±0.0	86.4±0.0	39.0±0.0
CluStream-C - HDBSCAN	46.2±0.0	24.2±0.0	72.5±0.0	95.2±0.0	87.0±0.0	52.5±0.0
CluStream-W - HDBSCAN	18.9±0.0	63.6±0.0	28.0±0.0	13.0±0.0	68.0±0.0	27.1±0.0
CluStream-S - HDBSCAN	19.3±0.0	62.3±0.0	26.8±0.0	12.4±0.0	66.7±0.0	26.9±0.0
CluStream-G - HDBSCAN	38.3±2.3	63.2±0.5	77.4±0.4	26.3±0.6	66.7±0.0	26.9±0.0
CluStream-C - RNN-DBS	38.8±0.0	21.5±0.0	35.8±0.0	88.8±0.0	86.2±0.0	47.0±0.0
CluStream-W - RNN-DBS	19.8±0.0	46.4±0.0	25.7±0.0	16.0±0.0	65.6±0.0	28.1±0.0
CluStream-S - RNN-DBS	19.2±0.0	52.2±0.0	25.7±0.0	14.8±0.0	63.6±0.0	27.5±0.0
CluStream-G - RNN-DBS	48.3±1.0	42.3±2.7	60.8±1.0	33.4±1.8	63.8±0.0	27.2±0.1
CluStream-C - MDBSCAN	29.9±0.0	20.9±0.0	26.4±0.0	61.1±0.0	81.0±0.0	37.8±0.0
CluStream-W - MDBSCAN	29.9±0.0	20.9±0.0	26.4±0.0	61.1±0.0	87.7±0.0	38.8±0.0
CluStream-S - MDBSCAN	29.9±0.0	21.4±0.0	26.4±0.0	61.1±0.0	87.4±0.0	38.8±0.0
CluStream-G - MDBSCAN	29.9±0.0	21.5±0.1	26.4±0.0	61.1±0.0	87.4±0.0	39.1±0.0
CluStream-C - DPC	46.0±0.0	28.8±0.0	60.9±0.0	91.9±0.0	70.8±0.0	42.0±0.0
CluStream-W - DPC	44.5±0.0	25.0±0.0	39.0±0.0	72.4±0.0	76.7±0.0	46.5±0.0
CluStream-S - DPC	44.3±0.0	22.6±0.0	33.2±0.0	72.4±0.0	61.0±0.0	41.0±0.0
CluStream-G - DPC	38.4±1.4	20.9±0.0	57.9±0.9	60.8±0.4	58.7±0.0	41.6±0.0
CluStream-C - SNN-DPC	**60.3**±1.0	33.3±0.6	67.4±0.0	74.4±0.0	74.6±0.0	**55.4**±1.2
CluStream-W - SNN-DPC	53.1±0.0	46.1±0.0	57.4±0.0	87.6±0.0	78.4±0.1	54.4±0.0
CluStream-S - SNN-DPC	52.1±0.0	45.1±0.0	58.6±0.0	90.8±0.0	79.0±0.0	53.9±0.0
CluStream-G - SNN-DPC	56.5±2.9	33.7±1.8	76.6±0.8	78.3±4.1	82.6±0.1	54.3±1.3
CluStream-C - DBHD	55.1±0.0	47.8±0.0	70.2±0.0	37.4±0.0	79.3±0.0	48.2±0.0
CluStream-W - DBHD	55.1±0.0	47.8±0.0	70.2±0.0	37.4±0.0	79.3±0.0	48.2±0.0
CluStream-S - DBHD	55.1±0.0	47.8±0.0	70.2±0.0	37.4±0.0	79.3±0.0	48.2±0.0
CluStream-G - DBHD	11.5±0.3	27.2±1.2	9.6±0.2	7.0±0.3	54.3±0.0	10.7±0.3

Table 27: Precision Scores for evaluated datasets for the default parameters (×100). The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	Precision	Precision	Precision	Precision	Precision	Precision
STREAMKmeans	48.4±4.2	13.1±0.1	54.5±2.6	58.4±7.2	40.9±0.0	25.9±0.0
DenStream	90.4±0.0	77.6±0.0	78.7±0.0	91.3±0.0	98.8±0.0	49.8±0.0
DBSTREAM	18.6±0.0	13.0±0.0	19.9±0.0	52.4±0.0	98.7±0.0	29.0±0.0
EMCStream	59.9±1.4	56.1±2.7	53.6±2.6	65.3±9.6	74.3±9.0	28.3±0.4
MCMSTStream	19.1±0.0	16.9±0.0	79.6±0.0	99.4±0.0	75.3±0.0	39.2±0.0
GB-FuzzyStream	23.8±10.5	20.7±0.9	36.8±0.4	-	-	28.6±0.2
CluStream-O - var. k	**99.9**±0.0	73.2±0.0	**93.1**±0.0	99.5±0.0	**100.0**±0.0	85.6±0.0
CluStream-O - fixed k	56.6±0.0	16.7±0.0	58.0±0.0	67.7±0.0	99.7±0.0	42.4±0.0
CluStream-O - k=100	**99.9**±0.0	73.2±0.0	**93.1**±0.0	99.5±0.0	**100.0**±0.0	85.6±0.0
CluStream - Wk-Means	59.4±1.3	47.8±1.7	81.1±0.6	97.8±0.0	99.8±0.0	52.1±1.0
CluStream-C - k-Means	59.5±2.4	20.0±1.5	70.5±0.7	95.6±1.5	99.8±0.0	44.0±1.2
CluStream-W - k-Means	59.4±1.3	47.8±1.7	81.1±0.6	97.8±0.0	99.8±0.0	52.1±1.0
CluStream-S - k-Means	58.2±1.6	45.9±1.4	81.2±0.6	97.7±0.0	99.8±0.0	51.0±0.7
CluStream-G - k-Means	58.7±1.4	47.2±2.3	82.2±0.6	98.0±0.0	99.8±0.0	51.1±0.8
CluStream-C - SubKMeans	57.2±1.5	20.5±1.2	71.8±0.8	95.7±1.4	99.8±0.0	43.4±1.4
CluStream-W - SubKMeans	57.3±1.5	48.4±1.8	80.3±0.2	97.8±0.0	99.8±0.0	52.2±0.8
CluStream-S - SubKMeans	57.6±1.3	47.8±2.1	80.6±0.6	97.7±0.0	99.8±0.0	51.8±0.5
CluStream-G - SubKMeans	58.6±1.6	48.7±2.8	82.0±0.5	98.0±0.0	99.8±0.0	51.7±0.6
CluStream-C - X-Means	49.8±0.5	15.6±0.4	50.2±0.7	98.6±0.5	99.2±0.1	62.7±0.5
CluStream-W - X-Means	**99.9**±0.0	72.7±0.4	77.1±0.4	99.5±0.0	99.9±0.0	85.6±0.0
CluStream-S - X-Means	**99.9**±0.0	73.3±0.0	76.4±0.5	99.5±0.0	**100.0**±0.0	85.6±0.0
CluStream-G - X-Means	92.9±7.5	66.8±0.2	81.1±1.1	**99.7**±0.2	**100.0**±0.0	85.6±0.0
CluStream-C - P-Dip-M	18.6±0.0	12.9±0.0	21.5±0.0	64.3±0.0	98.1±0.1	36.6±0.7
CluStream-W - P-Dip-M	97.4±1.9	-	90.0±0.1	99.5±0.0	-	-
CluStream-S - P-Dip-M	99.3±0.2	-	90.3±0.2	99.5±0.0	-	-
CluStream-G - P-Dip-M	67.2±2.7	60.8±0.7	68.7±0.5	97.7±0.2	99.9±0.0	84.4±0.3
CluStream-C - SC	43.8±1.2	17.8±1.0	57.7±0.8	95.4±0.0	99.7±0.0	42.9±0.7
CluStream-W - SC	44.4±0.8	34.9±3.1	76.8±0.4	97.7±0.0	66.9±0.2	42.3±0.3
CluStream-S - SC	44.1±1.2	29.7±2.3	76.7±0.6	97.7±0.0	64.9±0.3	43.1±0.2
CluStream-G - SC	43.3±0.4	31.2±1.8	77.0±0.3	98.0±0.0	64.9±0.4	43.0±0.2
CluStream-C - SCAR	44.2±2.5	14.0±0.5	51.6±1.8	66.1±1.0	97.6±0.1	40.2±1.2
CluStream-W - SCAR	26.0±0.9	34.9±1.6	30.5±0.2	54.0±1.0	85.0±0.3	32.1±0.5
CluStream-S - SCAR	24.8±1.4	28.4±0.8	30.3±0.4	54.4±0.9	82.9±0.2	30.9±0.2
CluStream-G - SCAR	29.2±2.7	51.8±4.5	43.6±0.8	54.7±0.9	97.0±0.2	32.0±0.6
CluStream-C - SpectACl	26.7±1.0	24.1±2.8	33.9±1.1	64.3±2.0	97.4±0.1	42.7±1.0
CluStream-W - SpectACl	21.8±0.1	39.5±1.6	37.2±1.8	66.1±2.5	99.9±0.0	44.1±1.0
CluStream-S - SpectACl	21.7±0.2	38.9±1.1	35.3±1.2	67.2±5.6	99.9±0.0	45.0±1.2
CluStream-G - SpectACl	21.5±0.3	38.2±2.5	31.4±1.1	67.0±2.9	99.8±0.0	44.3±1.1
CluStream-C - DBSCAN	18.6±0.0	15.7±0.0	19.9±0.0	52.4±0.0	74.5±0.0	30.9±0.0
CluStream-W - DBSCAN	18.6±0.0	15.7±0.0	19.9±0.0	52.4±0.0	99.4±0.0	30.3±0.0
CluStream-S - DBSCAN	18.6±0.0	15.7±0.0	19.9±0.0	52.4±0.0	99.5±0.0	30.3±0.0
CluStream-G - DBSCAN	18.6±0.0	15.6±0.0	19.9±0.0	52.4±0.0	99.5±0.0	30.4±0.0
CluStream-C - HDBSCAN	34.0±0.0	14.5±0.0	60.4±0.0	98.6±0.0	90.1±0.0	44.8±0.0
CluStream-W - HDBSCAN	86.2±0.0	67.6±0.0	82.0±0.0	95.3±0.0	99.1±0.0	80.8±0.0
CluStream-S - HDBSCAN	90.6±0.0	68.8±0.0	84.4±0.0	96.4±0.0	99.5±0.0	82.3±0.0
CluStream-G - HDBSCAN	48.9±8.5	68.4±0.3	70.8±0.3	90.1±0.7	99.5±0.0	82.2±0.0
CluStream-C - RNN-DBS	25.6±0.0	13.0±0.0	26.1±0.0	88.0±0.0	85.2±0.0	36.0±0.0
CluStream-W - RNN-DBS	52.4±0.0	35.3±0.0	70.8±0.0	87.4±0.0	87.6±0.0	72.1±0.0
CluStream-S - RNN-DBS	52.2±0.0	51.9±0.0	72.8±0.0	89.0±0.0	87.9±0.0	74.4±0.0
CluStream-G - RNN-DBS	70.0±5.9	29.3±3.3	51.7±0.8	97.4±1.0	89.0±0.1	76.0±0.1
CluStream-C - MDBSCAN	18.6±0.0	12.9±0.0	19.9±0.0	52.4±0.0	71.4±0.0	28.6±0.0
CluStream-W - MDBSCAN	18.6±0.0	12.9±0.0	19.9±0.0	52.4±0.0	99.2±0.0	30.2±0.0
CluStream-S - MDBSCAN	18.6±0.0	13.0±0.0	19.9±0.0	52.4±0.0	99.4±0.0	30.2±0.0
CluStream-G - MDBSCAN	18.6±0.0	13.0±0.0	19.9±0.0	52.4±0.0	99.4±0.0	30.3±0.0
CluStream-C - DPC	26.1±0.0	16.6±0.0	48.4±0.0	89.4±0.0	53.4±0.0	30.5±0.0
CluStream-W - DPC	38.1±0.0	16.4±0.0	30.0±0.0	74.5±0.0	73.7±0.0	38.3±0.0
CluStream-S - DPC	37.9±0.0	14.5±0.0	25.2±0.0	74.5±0.0	47.7±0.0	30.6±0.0
CluStream-G - DPC	30.0±1.6	12.9±0.0	45.2±0.9	59.6±0.4	43.1±0.0	30.0±0.1
CluStream-C - SNN-DPC	59.6±0.4	20.7±0.2	60.8±0.0	67.1±0.0	98.5±0.0	45.7±0.5
CluStream-W - SNN-DPC	38.2±0.0	27.0±0.4	44.1±0.0	77.2±0.0	95.3±0.1	44.6±0.0
CluStream-S - SNN-DPC	37.6±0.0	27.0±0.0	46.5±0.0	82.2±0.0	92.1±0.0	42.2±0.0
CluStream-G - SNN-DPC	58.7±1.3	20.5±0.9	67.4±1.2	74.4±4.7	99.7±0.0	47.0±0.8
CluStream-C - DBHD	78.8±0.0	35.3±0.0	83.9±0.0	98.9±0.0	98.9±0.0	66.6±0.0
CluStream-W - DBHD	78.8±0.0	35.3±0.0	83.9±0.0	98.9±0.0	98.9±0.0	66.6±0.0
CluStream-S - DBHD	78.8±0.0	35.3±0.0	83.9±0.0	98.9±0.0	98.9±0.0	66.6±0.0
CluStream-G - DBHD	94.1±1.4	**87.0**±1.0	91.2±0.3	99.4±0.1	99.6±0.0	**90.0**±0.4

Table 28: Recall Scores for evaluated datasets for the default parameters (×100). The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	Recall	Recall	Recall	Recall	Recall	Recall
STREAMKmeans	48.6±4.2	97.8±0.7	87.7±0.8	96.3±3.0	**100.0**±0.0	**100.0**±0.0
DenStream	5.2±0.0	23.9±0.0	58.3±0.0	22.8±0.0	75.5±0.0	38.9±0.0
DBSTREAM	**100.0**±0.0	99.3±0.0	**100.0**±0.0	**100.0**±0.0	92.6±0.0	78.9±0.0
EMCStream	57.9±6.2	77.5±5.9	89.3±0.5	80.2±8.3	80.6±12.6	83.7±1.1
MCMSTStream	71.2±0.0	54.8±0.0	73.3±0.0	43.8±0.0	80.4±0.0	44.4±0.0
GB-FuzzyStream	85.3±29.3	52.6±0.5	51.7±0.3	-	-	52.3±0.5
CluStream-O - var. k	6.1±0.0	46.2±0.0	13.1±0.0	5.6±0.0	64.6±0.0	15.6±0.0
CluStream-O - fixed k	38.7±0.0	92.3±0.0	84.6±0.0	89.0±0.0	81.8±0.0	56.3±0.0
CluStream-O - k=100	6.1±0.0	46.2±0.0	13.1±0.0	5.6±0.0	64.6±0.0	15.6±0.0
CluStream - Wk-Means	37.5±0.7	76.3±2.5	80.2±1.2	98.1±0.4	84.8±0.4	47.8±1.0
CluStream-C - k-Means	37.7±1.7	90.3±2.0	85.9±0.9	95.9±0.9	88.4±0.0	53.2±2.0
CluStream-W - k-Means	37.5±0.7	76.3±2.5	80.2±1.2	98.1±0.4	84.8±0.4	47.8±1.0
CluStream-S - k-Means	36.1±1.1	77.4±3.4	82.1±0.9	97.4±0.0	85.0±0.4	47.2±1.5
CluStream-G - k-Means	36.8±1.1	77.8±2.7	81.6±1.0	97.5±0.0	85.1±0.4	47.3±1.4
CluStream-C - SubKMeans	37.3±1.5	91.5±0.8	84.6±1.0	96.0±0.7	88.4±0.0	52.5±1.5
CluStream-W - SubKMeans	36.8±1.5	72.9±3.9	78.7±1.5	97.8±0.5	84.7±0.3	48.1±0.7
CluStream-S - SubKMeans	36.7±1.2	74.7±2.7	80.0±1.2	97.4±0.0	85.1±0.4	47.2±0.8
CluStream-G - SubKMeans	36.9±1.2	76.6±3.3	80.7±1.3	97.5±0.0	85.1±0.4	47.6±1.0
CluStream-C - X-Means	68.5±0.7	94.3±1.2	91.5±0.4	31.7±1.8	83.1±0.2	32.0±0.7
CluStream-W - X-Means	6.2±0.0	47.2±0.2	77.8±1.4	21.7±0.0	64.6±0.0	15.6±0.0
CluStream-S - X-Means	6.1±0.0	46.5±0.1	75.7±1.2	20.5±0.0	64.6±0.0	15.6±0.0
CluStream-G - X-Means	17.7±9.0	52.9±0.5	75.2±1.9	19.8±0.1	70.3±0.1	15.6±0.0
CluStream-C - P-Dip-M	**100.0**±0.0	**100.0**±0.0	99.5±0.0	**100.0**±0.0	89.5±0.0	82.5±0.3
CluStream-W - P-Dip-M	8.8±0.1	-	17.7±0.1	6.8±0.1	-	-
CluStream-S - P-Dip-M	8.6±0.1	-	17.2±0.0	6.7±0.0	-	-
CluStream-G - P-Dip-M	37.1±3.6	57.3±0.6	91.9±0.1	34.6±3.3	78.9±0.0	18.3±0.1
CluStream-C - SC	42.6±0.6	91.9±0.3	85.1±0.2	96.0±0.0	89.1±0.0	55.3±1.5
CluStream-W - SC	32.2±0.4	82.8±0.9	82.5±0.6	97.4±0.0	88.6±0.0	61.0±0.3
CluStream-S - SC	32.5±0.6	85.1±0.9	81.9±0.4	97.4±0.0	89.5±0.1	57.7±0.8
CluStream-G - SC	31.8±0.3	85.8±1.3	81.8±0.4	97.5±0.1	89.5±0.0	57.7±0.8
CluStream-C - SCAR	41.1±2.0	84.0±1.6	70.7±1.0	86.7±0.7	90.3±0.1	53.4±1.8
CluStream-W - SCAR	56.7±0.8	67.9±1.3	52.2±0.5	87.7±1.9	73.2±0.1	60.3±0.7
CluStream-S - SCAR	52.4±3.1	68.9±2.3	52.8±0.5	88.5±1.5	73.6±0.2	63.8±1.1
CluStream-G - SCAR	42.5±3.0	59.7±3.4	48.8±0.6	89.4±1.7	64.6±0.3	57.6±1.4
CluStream-C - SpectACl	31.5±2.5	72.3±4.3	54.6±1.3	75.2±3.4	87.0±0.1	47.7±0.7
CluStream-W - SpectACl	48.3±0.2	60.2±1.8	69.1±1.5	71.0±4.4	86.0±0.5	41.5±1.8
CluStream-S - SpectACl	48.4±0.2	62.1±2.6	68.7±1.3	70.9±5.6	86.7±0.1	44.0±2.0
CluStream-G - SpectACl	42.3±1.0	62.2±3.3	70.8±1.8	69.4±4.5	86.5±0.2	43.4±2.1
CluStream-C - DBSCAN	**100.0**±0.0	99.9±0.0	**100.0**±0.0	**100.0**±0.0	91.3±0.0	88.6±0.0
CluStream-W - DBSCAN	**100.0**±0.0	99.9±0.0	**100.0**±0.0	**100.0**±0.0	90.3±0.0	88.0±0.0
CluStream-S - DBSCAN	**100.0**±0.0	99.5±0.0	**100.0**±0.0	**100.0**±0.0	90.2±0.0	88.0±0.0
CluStream-G - DBSCAN	**100.0**±0.0	99.3±0.0	**100.0**±0.0	**100.0**±0.0	90.2±0.0	88.1±0.0
CluStream-C - HDBSCAN	80.0±0.0	99.0±0.0	92.0±0.0	90.1±0.0	91.9±0.0	72.8±0.0
CluStream-W - HDBSCAN	7.8±0.0	60.1±0.0	16.3±0.0	6.6±0.0	75.6±0.0	16.9±0.0
CluStream-S - HDBSCAN	7.7±0.0	58.9±0.0	15.6±0.0	6.5±0.0	74.2±0.0	16.6±0.0
CluStream-G - HDBSCAN	37.5±20.2	59.9±0.1	88.2±0.8	16.7±0.4	74.3±0.0	16.7±0.0
CluStream-C - RNN-DBS	99.9±0.0	99.1±0.0	97.5±0.0	98.3±0.0	93.3±0.0	88.7±0.0
CluStream-W - RNN-DBS	9.5±0.0	59.2±0.0	15.7±0.0	7.9±0.0	68.6±0.0	17.6±0.0
CluStream-S - RNN-DBS	9.1±0.0	52.0±0.0	15.3±0.0	7.0±0.0	67.7±0.0	17.1±0.0
CluStream-G - RNN-DBS	32.8±2.2	64.6±1.7	84.4±1.0	19.8±1.3	67.6±0.0	17.0±0.0
CluStream-C - MDBSCAN	**100.0**±0.0	**100.0**±0.0	**100.0**±0.0	**100.0**±0.0	93.6±0.0	94.0±0.0
CluStream-W - MDBSCAN	**100.0**±0.0	**100.0**±0.0	**100.0**±0.0	**100.0**±0.0	91.0±0.0	88.6±0.0
CluStream-S - MDBSCAN	**100.0**±0.0	99.2±0.0	**100.0**±0.0	**100.0**±0.0	90.7±0.0	88.6±0.0
CluStream-G - MDBSCAN	**100.0**±0.0	99.0±0.1	**100.0**±0.0	**100.0**±0.0	90.7±0.0	88.7±0.0
CluStream-C - DPC	68.2±0.0	86.1±0.0	92.4±0.0	88.6±0.0	97.5±0.0	91.1±0.0
CluStream-W - DPC	50.1±0.0	92.2±0.0	95.4±0.0	89.7±0.0	95.2±0.0	76.9±0.0
CluStream-S - DPC	49.8±0.0	96.7±0.0	97.4±0.0	89.7±0.0	99.0±0.0	88.5±0.0
CluStream-G - DPC	43.5±2.0	**100.0**±0.0	94.5±0.1	76.4±0.2	99.8±0.0	90.4±0.1
CluStream-C - SNN-DPC	51.7±3.4	91.1±0.0	78.1±0.0	85.8±0.0	81.6±0.0	61.2±1.1
CluStream-W - SNN-DPC	71.7±0.0	86.5±0.1	83.7±0.0	84.5±0.0	83.6±0.1	65.8±0.0
CluStream-S - SNN-DPC	64.4±0.0	87.5±0.0	83.2±0.0	91.3±0.0	85.3±0.0	68.1±0.0
CluStream-G - SNN-DPC	48.5±2.6	89.9±1.4	90.9±0.2	89.0±3.9	88.2±0.1	67.3±1.0
CluStream-C - DBHD	37.0±0.0	89.1±0.0	65.5±0.0	30.5±0.0	87.3±0.0	39.9±0.0
CluStream-W - DBHD	37.0±0.0	89.1±0.0	65.5±0.0	30.5±0.0	87.3±0.0	39.9±0.0
CluStream-S - DBHD	37.0±0.0	89.1±0.0	65.5±0.0	30.5±0.0	87.3±0.0	39.9±0.0
CluStream-G - DBHD	3.6±0.1	15.4±0.9	3.9±0.0	2.7±0.1	57.9±0.0	3.9±0.1

Table 29: F1 Scores for evaluated datasets for the default parameters (×100). The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	F1	F1	F1	F1	F1	F1
STREAMKmeans	48.3±3.4	23.1±0.1	66.0±1.9	71.7±4.1	58.0±0.0	40.8±0.0
DenStream	9.8±0.0	36.5±0.0	65.6±0.0	36.1±0.0	85.5±0.0	42.9±0.0
DBSTREAM	31.4±0.0	23.0±0.0	33.0±0.0	68.8±0.0	**95.6**±0.0	41.5±0.0
EMCStream	**58.2**±3.0	**64.6**±3.8	64.7±2.1	70.3±5.0	75.8±8.8	40.6±0.6
MCMSTStream	30.0±0.0	25.8±0.0	75.5±0.0	56.9±0.0	76.9±0.0	38.8±0.0
GB-FuzzyStream	31.0±0.8	29.5±0.9	42.5±0.4	-	-	36.2±0.3
CluStream-O - var. k	11.4±0.0	54.7±0.0	22.8±0.0	10.6±0.0	78.1±0.0	25.6±0.0
CluStream-O - fixed k	46.0±0.0	28.0±0.0	67.5±0.0	76.4±0.0	89.8±0.0	46.7±0.0
CluStream-O - k=100	11.4±0.0	54.7±0.0	22.8±0.0	10.6±0.0	78.1±0.0	25.6±0.0
CluStream - Wk-Means	45.9±0.9	58.2±1.8	80.1±0.6	**98.0**±0.2	91.6±0.3	48.5±0.7
CluStream-C - k-Means	46.2±1.9	32.5±1.8	76.5±0.8	95.7±1.2	93.7±0.0	45.8±0.9
CluStream-W - k-Means	45.9±0.9	58.2±1.8	80.1±0.6	**98.0**±0.2	91.6±0.3	48.5±0.7
CluStream-S - k-Means	44.6±1.3	57.2±1.6	81.0±0.4	97.5±0.0	91.8±0.2	47.6±0.7
CluStream-G - k-Means	45.2±1.2	58.2±2.1	**81.3**±0.6	97.8±0.0	91.8±0.2	47.6±0.7
CluStream-C - SubKMeans	45.1±1.3	33.3±1.4	76.8±0.9	95.8±1.1	93.7±0.0	45.4±1.4
CluStream-W - SubKMeans	44.8±1.5	57.7±2.5	78.8±0.9	97.8±0.3	91.6±0.2	48.5±0.3
CluStream-S - SubKMeans	44.8±1.2	57.8±2.1	79.7±0.4	97.5±0.0	91.9±0.2	48.1±0.3
CluStream-G - SubKMeans	45.3±1.3	59.0±2.5	80.7±0.8	97.8±0.0	91.8±0.2	48.2±0.5
CluStream-C - X-Means	57.6±0.6	26.7±0.7	63.0±0.7	44.5±2.2	90.3±0.1	40.3±0.4
CluStream-W - X-Means	11.7±0.1	55.2±0.2	73.0±0.9	29.8±0.0	78.1±0.0	25.6±0.0
CluStream-S - X-Means	11.5±0.0	54.9±0.1	71.0±1.0	27.9±0.0	78.1±0.0	25.6±0.0
CluStream-G - X-Means	23.4±6.1	57.0±0.4	74.2±1.0	26.4±0.2	82.3±0.1	25.6±0.0
CluStream-C - P-Dip-M	31.4±0.0	22.9±0.0	34.8±0.0	76.6±0.0	93.6±0.0	44.4±0.3
CluStream-W - P-Dip-M	16.0±0.1	-	29.2±0.1	12.6±0.3	-	-
CluStream-S - P-Dip-M	15.8±0.1	-	28.6±0.1	12.5±0.0	-	-
CluStream-G - P-Dip-M	47.5±2.8	57.0±0.4	77.5±0.3	46.3±2.2	88.0±0.0	29.0±0.2
CluStream-C - SC	43.1±0.7	29.7±1.4	67.6±0.6	95.7±0.0	94.1±0.0	45.3±0.6
CluStream-W - SC	37.3±0.3	48.7±3.1	78.9±0.4	97.5±0.0	75.3±0.1	45.6±0.3
CluStream-S - SC	37.4±0.7	43.5±2.4	78.4±0.4	97.5±0.0	74.3±0.2	45.3±0.3
CluStream-G - SC	36.6±0.2	44.9±1.9	78.5±0.2	97.8±0.0	74.3±0.2	45.3±0.3
CluStream-C - SCAR	42.5±2.1	23.9±0.6	58.3±1.2	74.2±0.7	93.8±0.1	44.7±1.0
CluStream-W - SCAR	35.6±0.9	45.0±1.4	37.9±0.2	66.8±1.0	77.6±0.1	41.4±0.6
CluStream-S - SCAR	33.6±1.6	38.9±0.7	37.8±0.4	67.3±1.1	76.7±0.2	41.0±0.2
CluStream-G - SCAR	34.5±2.6	55.1±4.1	45.3±0.6	67.9±0.9	77.1±0.2	40.4±0.7
CluStream-C - SpectACl	28.6±1.2	35.6±3.0	40.5±0.3	69.1±2.4	91.8±0.0	43.2±0.5
CluStream-W - SpectACl	30.0±0.1	47.3±0.9	46.8±1.4	67.9±2.3	92.4±0.3	41.5±0.7
CluStream-S - SpectACl	30.0±0.2	47.5±1.1	45.2±0.8	68.5±4.8	92.8±0.1	42.8±1.0
CluStream-G - SpectACl	28.5±0.4	46.8±2.1	42.1±0.8	67.8±3.1	92.7±0.1	42.3±1.1
CluStream-C - DBSCAN	31.4±0.0	27.2±0.0	33.0±0.0	68.8±0.0	81.8±0.0	44.9±0.0
CluStream-W - DBSCAN	31.4±0.0	27.2±0.0	33.0±0.0	68.8±0.0	94.6±0.0	44.0±0.0
CluStream-S - DBSCAN	31.4±0.0	27.1±0.0	33.0±0.0	68.8±0.0	94.6±0.0	44.0±0.0
CluStream-G - DBSCAN	31.4±0.0	27.0±0.0	33.0±0.0	68.8±0.0	94.6±0.0	44.0±0.0
CluStream-C - HDBSCAN	44.3±0.0	25.1±0.0	71.4±0.0	93.8±0.0	90.7±0.0	51.7±0.0
CluStream-W - HDBSCAN	14.1±0.0	61.6±0.0	26.8±0.0	12.4±0.0	85.7±0.0	27.1±0.0
CluStream-S - HDBSCAN	14.1±0.0	61.6±0.0	26.0±0.0	12.1±0.0	84.9±0.0	26.9±0.0
CluStream-G - HDBSCAN	33.3±3.7	61.9±0.1	77.0±0.4	26.9±0.5	84.9±0.0	26.9±0.0
CluStream-C - RNN-DBS	40.6±0.0	23.0±0.0	39.8±0.0	91.2±0.0	88.4±0.0	47.8±0.0
CluStream-W - RNN-DBS	14.7±0.0	40.4±0.0	25.3±0.0	14.4±0.0	76.7±0.0	27.7±0.0
CluStream-S - RNN-DBS	14.3±0.0	49.7±0.0	25.0±0.0	13.0±0.0	76.2±0.0	27.1±0.0
CluStream-G - RNN-DBS	43.6±1.4	34.6±2.1	61.6±1.0	31.6±1.7	76.6±0.0	27.1±0.0
CluStream-C - MDBSCAN	31.4±0.0	22.9±0.0	33.0±0.0	68.8±0.0	80.4±0.0	43.1±0.0
CluStream-W - MDBSCAN	31.4±0.0	22.9±0.0	33.0±0.0	68.8±0.0	94.9±0.0	44.0±0.0
CluStream-S - MDBSCAN	31.4±0.0	23.0±0.0	33.0±0.0	68.8±0.0	94.8±0.0	44.0±0.0
CluStream-G - MDBSCAN	31.4±0.0	23.0±0.0	33.0±0.0	68.8±0.0	94.8±0.0	44.1±0.0
CluStream-C - DPC	37.6±0.0	27.5±0.0	62.1±0.0	87.5±0.0	68.6±0.0	43.4±0.0
CluStream-W - DPC	41.8±0.0	27.8±0.0	43.4±0.0	77.5±0.0	79.8±0.0	45.2±0.0
CluStream-S - DPC	41.6±0.0	25.1±0.0	38.3±0.0	77.5±0.0	62.5±0.0	43.2±0.0
CluStream-G - DPC	34.7±0.7	22.9±0.0	59.1±0.7	62.9±0.2	59.7±0.0	43.6±0.1
CluStream-C - SNN-DPC	55.0±1.9	33.4±0.3	66.5±0.0	74.1±0.0	89.0±0.0	50.6±0.3
CluStream-W - SNN-DPC	49.6±0.0	40.6±0.3	55.9±0.0	80.6±0.0	88.8±0.1	51.0±0.0
CluStream-S - SNN-DPC	47.1±0.0	40.8±0.0	57.5±0.0	86.3±0.0	88.0±0.0	50.2±0.0
CluStream-G - SNN-DPC	53.0±1.6	33.0±1.2	76.3±0.8	79.9±3.9	93.6±0.0	**52.1**±1.0
CluStream-C - DBHD	50.2±0.0	49.5±0.0	72.3±0.0	45.6±0.0	92.7±0.0	48.3±0.0
CluStream-W - DBHD	50.2±0.0	49.5±0.0	72.3±0.0	45.6±0.0	92.7±0.0	48.3±0.0
CluStream-S - DBHD	50.2±0.0	49.5±0.0	72.3±0.0	45.6±0.0	92.7±0.0	48.3±0.0
CluStream-G - DBHD	6.9±0.1	25.5±1.2	7.4±0.1	5.2±0.1	73.0±0.0	7.5±0.2

Table 30: FMI Scores for evaluated datasets for the default parameters (×100). The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	FMI	FMI	FMI	FMI	FMI	FMI
STREAMKmeans	48.4±3.5	35.8±0.0	68.5±1.5	74.4±3.4	63.9±0.0	50.6±0.0
DenStream	21.6±0.0	43.0±0.0	66.9±0.0	45.2±0.0	86.3±0.0	43.6±0.0
DBSTREAM	43.1±0.0	35.9±0.0	44.3±0.0	72.4±0.0	**95.6**±0.0	47.1±0.0
EMCStream	**58.6**±3.2	**65.7**±4.0	67.9±1.6	71.5±4.5	76.6±8.5	47.5±0.5
MCMSTStream	36.8±0.0	30.4±0.0	76.0±0.0	63.4±0.0	77.3±0.0	40.3±0.0
GB-FuzzyStream	41.0±4.3	32.9±0.8	43.4±0.3	-	-	38.2±0.3
CluStream-O - var. k	24.6±0.0	57.1±0.0	34.7±0.0	23.4±0.0	80.1±0.0	35.5±0.0
CluStream-O - fixed k	46.8±0.0	38.9±0.0	69.3±0.0	77.4±0.0	90.3±0.0	48.0±0.0
CluStream-O - k=100	24.6±0.0	57.1±0.0	34.7±0.0	23.4±0.0	80.1±0.0	35.5±0.0
CluStream - Wk-Means	47.2±0.9	60.1±1.8	80.4±0.6	**98.0**±0.2	92.0±0.2	49.2±0.7
CluStream-C - k-Means	47.4±2.0	42.3±1.1	77.4±0.8	95.7±1.2	93.9±0.0	47.1±1.0
CluStream-W - k-Means	47.2±0.9	60.1±1.8	80.4±0.6	**98.0**±0.2	92.0±0.2	49.2±0.7
CluStream-S - k-Means	45.9±1.3	59.4±1.7	81.3±0.4	97.5±0.0	92.1±0.2	48.4±0.7
CluStream-G - k-Means	46.5±1.2	60.3±1.9	**81.6**±0.6	97.8±0.0	92.1±0.2	48.4±0.8
CluStream-C - SubKMeans	46.2±1.3	43.1±1.1	77.5±0.9	95.8±1.0	93.9±0.0	46.6±1.4
CluStream-W - SubKMeans	45.9±1.5	59.1±2.6	79.2±0.8	97.8±0.3	91.9±0.2	49.3±0.4
CluStream-S - SubKMeans	46.0±1.2	59.5±2.0	80.0±0.4	97.5±0.0	92.2±0.2	48.8±0.3
CluStream-G - SubKMeans	46.5±1.3	60.8±2.3	81.0±0.7	97.8±0.0	92.2±0.2	48.9±0.5
CluStream-C - X-Means	58.4±0.6	38.3±0.8	66.7±0.6	53.0±1.8	90.7±0.1	43.6±0.4
CluStream-W - X-Means	24.9±0.1	57.4±0.1	75.1±0.7	39.8±0.0	80.2±0.0	35.5±0.0
CluStream-S - X-Means	24.6±0.0	57.3±0.1	73.4±0.8	37.9±0.0	80.1±0.0	35.5±0.0
CluStream-G - X-Means	35.0±4.1	58.4±0.4	76.1±0.8	35.9±0.3	83.7±0.0	35.5±0.0
CluStream-C - P-Dip-M	43.1±0.0	36.0±0.0	45.7±0.0	79.3±0.0	93.7±0.0	51.2±0.3
CluStream-W - P-Dip-M	29.0±0.4	-	39.4±0.1	25.8±0.3	-	-
CluStream-S - P-Dip-M	29.1±0.1	-	39.0±0.1	25.7±0.0	-	-
CluStream-G - P-Dip-M	49.8±2.0	58.0±0.4	78.9±0.3	54.1±2.0	88.7±0.0	38.1±0.1
CluStream-C - SC	43.2±0.7	40.3±1.1	69.5±0.5	95.7±0.0	94.2±0.0	47.1±0.7
CluStream-W - SC	37.8±0.3	53.5±2.3	79.3±0.4	97.5±0.0	76.5±0.1	48.4±0.3
CluStream-S - SC	37.8±0.7	49.9±1.8	78.8±0.4	97.5±0.0	75.7±0.2	47.7±0.3
CluStream-G - SC	37.1±0.1	51.1±1.4	79.0±0.2	97.8±0.0	75.7±0.2	47.6±0.3
CluStream-C - SCAR	42.6±2.1	34.2±0.4	59.7±1.1	75.3±0.6	93.9±0.1	45.7±1.1
CluStream-W - SCAR	38.3±0.8	48.1±1.2	39.6±0.3	68.8±1.0	78.3±0.1	43.7±0.6
CluStream-S - SCAR	36.0±1.7	43.3±0.9	39.6±0.4	69.3±1.1	77.5±0.2	44.0±0.4
CluStream-G - SCAR	35.1±2.7	55.4±3.9	45.8±0.6	69.9±0.9	78.9±0.2	42.5±0.7
CluStream-C - SpectACl	28.8±1.3	41.3±2.2	42.2±0.2	69.4±2.5	92.0±0.0	44.2±0.5
CluStream-W - SpectACl	32.4±0.1	48.5±0.7	49.8±0.9	68.2±2.4	92.6±0.3	42.1±0.8
CluStream-S - SpectACl	32.4±0.2	49.0±1.2	48.4±0.5	68.8±4.8	93.0±0.1	43.6±1.1
CluStream-G - SpectACl	30.2±0.5	48.4±2.0	46.2±0.5	68.0±3.2	92.9±0.1	43.0±1.0
CluStream-C - DBSCAN	43.1±0.0	39.7±0.0	44.3±0.0	72.4±0.0	82.4±0.0	51.6±0.0
CluStream-W - DBSCAN	43.1±0.0	39.7±0.0	44.3±0.0	72.4±0.0	94.7±0.0	50.8±0.0
CluStream-S - DBSCAN	43.1±0.0	39.5±0.0	44.3±0.0	72.4±0.0	94.7±0.0	50.8±0.0
CluStream-G - DBSCAN	43.1±0.0	39.4±0.0	44.3±0.0	72.4±0.0	94.7±0.0	50.9±0.0
CluStream-C - HDBSCAN	50.1±0.0	37.6±0.0	73.7±0.0	94.1±0.0	90.8±0.0	**55.0**±0.0
CluStream-W - HDBSCAN	25.5±0.0	62.7±0.0	36.2±0.0	24.9±0.0	86.5±0.0	36.0±0.0
CluStream-S - HDBSCAN	26.2±0.0	62.7±0.0	35.9±0.0	24.7±0.0	85.9±0.0	36.0±0.0
CluStream-G - HDBSCAN	37.9±5.5	63.0±0.2	78.2±0.4	37.0±0.4	85.9±0.0	36.0±0.0
CluStream-C - RNN-DBS	50.4±0.0	35.9±0.0	49.2±0.0	92.1±0.0	88.8±0.0	54.3±0.0
CluStream-W - RNN-DBS	20.8±0.0	43.6±0.0	32.9±0.0	26.1±0.0	77.4±0.0	35.0±0.0
CluStream-S - RNN-DBS	20.4±0.0	50.8±0.0	33.0±0.0	24.9±0.0	77.0±0.0	34.9±0.0
CluStream-G - RNN-DBS	47.2±1.1	39.9±1.6	64.6±0.9	42.3±1.6	77.4±0.0	35.2±0.0
CluStream-C - MDBSCAN	43.1±0.0	36.0±0.0	44.3±0.0	72.4±0.0	81.4±0.0	51.2±0.0
CluStream-W - MDBSCAN	43.1±0.0	36.0±0.0	44.3±0.0	72.4±0.0	95.0±0.0	51.0±0.0
CluStream-S - MDBSCAN	43.1±0.0	35.9±0.0	44.3±0.0	72.4±0.0	94.9±0.0	50.9±0.0
CluStream-G - MDBSCAN	43.1±0.0	35.9±0.0	44.3±0.0	72.4±0.0	94.9±0.0	51.0±0.0
CluStream-C - DPC	42.1±0.0	37.3±0.0	66.0±0.0	88.2±0.0	71.9±0.0	51.1±0.0
CluStream-W - DPC	42.9±0.0	38.8±0.0	51.7±0.0	79.8±0.0	82.0±0.0	50.8±0.0
CluStream-S - DPC	42.6±0.0	37.3±0.0	48.1±0.0	79.8±0.0	67.7±0.0	50.4±0.0
CluStream-G - DPC	35.7±0.6	36.0±0.0	64.1±0.6	65.4±0.2	65.3±0.0	51.0±0.1
CluStream-C - SNN-DPC	55.3±1.7	43.1±0.2	67.9±0.0	75.3±0.0	89.5±0.0	52.0±0.3
CluStream-W - SNN-DPC	52.2±0.0	47.9±0.2	59.6±0.0	80.7±0.0	89.1±0.1	53.0±0.0
CluStream-S - SNN-DPC	49.0±0.0	48.2±0.0	60.9±0.0	86.5±0.0	88.3±0.0	52.5±0.0
CluStream-G - SNN-DPC	53.3±1.5	42.6±1.0	77.7±0.7	80.8±3.8	93.8±0.0	54.5±1.0
CluStream-C - DBHD	53.9±0.0	55.4±0.0	73.5±0.0	54.1±0.0	92.9±0.0	50.7±0.0
CluStream-W - DBHD	53.9±0.0	55.4±0.0	73.5±0.0	54.1±0.0	92.9±0.0	50.7±0.0
CluStream-S - DBHD	53.9±0.0	55.4±0.0	73.5±0.0	54.1±0.0	92.9±0.0	50.7±0.0
CluStream-G - DBHD	18.4±0.2	35.7±1.0	18.6±0.1	16.1±0.2	75.8±0.0	18.6±0.3

Table 31: Purity Scores for evaluated datasets for the default parameters (×100). The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	Purity	Purity	Purity	Purity	Purity	Purity
STREAMKmeans	61.9±2.8	22.2±0.6	68.0±2.6	67.0±6.6	56.8±0.0	34.4±0.0
DenStream	96.9±0.0	89.0±0.0	87.2±0.0	96.8±0.0	97.1±0.0	64.7±0.0
DBSTREAM	29.9±0.0	20.9±0.0	26.4±0.0	61.1±0.0	97.2±0.0	41.0±0.0
EMCStream	70.2±1.1	68.9±1.4	67.1±2.7	73.9±9.0	83.4±5.3	38.0±0.4
MCMSTStream	40.7±0.0	42.1±0.0	87.7±0.0	99.5±0.0	79.0±0.0	68.3±0.0
GB-FuzzyStream	39.1±18.3	43.3±0.4	62.1±0.4	-	-	44.2±0.6
CluStream-O - var. k	**99.9**±0.0	90.7±0.0	**95.4**±0.0	**99.9**±0.0	**99.6**±0.0	93.9±0.0
CluStream-O - fixed k	68.4±0.0	32.7±0.0	71.8±0.0	80.1±0.0	99.1±0.0	59.8±0.0
CluStream-O - k=100	**99.9**±0.0	90.7±0.0	**95.4**±0.0	**99.9**±0.0	**99.6**±0.0	93.9±0.0
CluStream - Wk-Means	69.8±1.6	67.2±1.5	88.7±0.3	98.9±0.1	99.0±0.0	66.9±0.4
CluStream-C - k-Means	70.1±1.8	37.1±2.3	81.3±0.6	97.6±0.7	99.1±0.0	61.0±1.0
CluStream-W - k-Means	69.8±1.6	67.2±1.5	88.7±0.3	98.9±0.1	99.0±0.0	66.9±0.4
CluStream-S - k-Means	69.2±1.6	65.7±1.3	88.8±0.4	98.7±0.0	99.0±0.0	65.6±0.5
CluStream-G - k-Means	70.0±1.3	66.4±2.3	89.6±0.4	98.8±0.0	99.0±0.0	65.6±0.7
CluStream-C - SubKMeans	68.9±1.4	38.4±1.5	82.3±0.6	97.7±0.6	99.1±0.0	60.9±1.0
CluStream-W - SubKMeans	68.3±1.7	67.7±1.3	88.2±0.1	98.8±0.1	99.0±0.0	67.4±0.6
CluStream-S - SubKMeans	68.6±1.2	67.0±1.7	88.3±0.3	98.7±0.0	99.0±0.0	66.8±0.5
CluStream-G - SubKMeans	69.8±1.3	67.4±2.1	89.5±0.3	98.8±0.0	99.0±0.0	66.8±0.5
CluStream-C - X-Means	59.8±0.4	27.0±1.1	62.9±0.7	99.0±0.4	98.8±0.0	77.6±0.5
CluStream-W - X-Means	**99.9**±0.0	89.2±0.8	85.4±0.3	**99.9**±0.0	99.5±0.0	93.9±0.0
CluStream-S - X-Means	**99.9**±0.0	90.7±0.1	84.8±0.4	**99.9**±0.0	**99.6**±0.0	93.9±0.0
CluStream-G - X-Means	94.7±5.8	88.3±0.2	88.1±0.8	**99.9**±0.0	**99.6**±0.0	93.9±0.0
CluStream-C - P-Dip-M	29.9±0.0	20.6±0.0	28.4±0.0	70.8±0.0	98.0±0.0	48.3±0.5
CluStream-W - P-Dip-M	98.7±0.8	-	93.5±0.0	**99.9**±0.0	-	-
CluStream-S - P-Dip-M	99.5±0.2	-	93.8±0.1	**99.9**±0.0	-	-
CluStream-G - P-Dip-M	78.8±1.9	81.3±0.8	79.7±0.5	98.5±0.1	99.2±0.0	92.9±0.2
CluStream-C - SC	60.3±1.2	34.5±1.5	71.5±0.7	97.6±0.0	99.0±0.0	58.6±0.6
CluStream-W - SC	61.7±0.2	57.4±2.8	85.7±0.4	98.7±0.0	81.9±0.2	57.8±0.3
CluStream-S - SC	61.6±0.9	50.9±2.9	85.8±0.4	98.7±0.0	80.3±0.2	58.1±0.3
CluStream-G - SC	61.4±0.1	52.0±2.3	85.9±0.2	98.8±0.0	80.3±0.2	58.2±0.3
CluStream-C - SCAR	59.2±2.6	30.2±0.8	66.2±1.5	78.2±1.2	97.4±0.1	57.5±1.1
CluStream-W - SCAR	57.2±1.2	58.0±1.5	58.5±0.3	65.6±1.8	90.7±0.2	53.7±0.7
CluStream-S - SCAR	57.2±1.3	54.8±0.4	58.3±0.3	66.5±1.7	89.8±0.2	52.7±0.4
CluStream-G - SCAR	60.7±2.0	69.0±2.8	69.7±0.6	67.1±1.4	95.7±0.1	54.8±0.6
CluStream-C - SpectACl	46.7±1.1	43.1±2.4	49.8±1.1	75.5±2.1	97.5±0.0	57.6±0.6
CluStream-W - SpectACl	46.6±0.2	59.3±2.0	52.8±2.1	74.9±2.3	98.5±0.0	57.4±0.8
CluStream-S - SpectACl	46.6±0.7	58.7±1.7	51.5±1.2	75.6±4.2	98.5±0.0	58.6±0.9
CluStream-G - SpectACl	44.2±1.0	58.3±2.0	47.5±1.4	75.9±2.5	98.5±0.0	57.9±1.0
CluStream-C - DBSCAN	29.9±0.0	30.5±0.0	26.4±0.0	61.1±0.0	88.5±0.0	43.3±0.0
CluStream-W - DBSCAN	29.9±0.0	30.5±0.0	26.4±0.0	61.1±0.0	98.1±0.0	44.9±0.0
CluStream-S - DBSCAN	29.9±0.0	30.5±0.0	26.4±0.0	61.1±0.0	98.4±0.0	44.9±0.0
CluStream-G - DBSCAN	29.9±0.0	30.4±0.0	26.4±0.0	61.1±0.0	98.4±0.0	44.9±0.0
CluStream-C - HDBSCAN	49.4±0.0	23.2±0.0	73.2±0.0	98.4±0.0	94.7±0.0	58.9±0.0
CluStream-W - HDBSCAN	96.4±0.0	84.4±0.0	92.6±0.0	99.0±0.0	97.2±0.0	91.0±0.0
CluStream-S - HDBSCAN	97.3±0.0	86.3±0.0	93.0±0.0	99.2±0.0	97.8±0.0	91.6±0.0
CluStream-G - HDBSCAN	75.6±10.0	85.8±0.3	81.9±0.3	96.9±0.7	97.8±0.0	91.6±0.0
CluStream-C - RNN-DBS	38.8±0.0	21.2±0.0	35.9±0.0	90.2±0.0	91.6±0.0	48.6±0.0
CluStream-W - RNN-DBS	86.8±0.0	61.0±0.0	86.5±0.0	96.5±0.0	93.2±0.0	87.7±0.0
CluStream-S - RNN-DBS	89.0±0.0	73.0±0.0	88.0±0.0	96.8±0.0	93.4±0.0	88.5±0.0
CluStream-G - RNN-DBS	84.6±3.9	49.9±2.8	65.7±0.7	98.5±0.4	94.1±0.0	88.8±0.0
CluStream-C - MDBSCAN	29.9±0.0	20.6±0.0	26.4±0.0	61.1±0.0	83.8±0.0	39.6±0.0
CluStream-W - MDBSCAN	29.9±0.0	20.6±0.0	26.4±0.0	61.1±0.0	97.9±0.0	44.7±0.0
CluStream-S - MDBSCAN	29.9±0.0	21.1±0.0	26.4±0.0	61.1±0.0	98.4±0.0	44.7±0.0
CluStream-G - MDBSCAN	29.9±0.0	21.3±0.1	26.4±0.0	61.1±0.0	98.4±0.0	44.7±0.0
CluStream-C - DPC	46.0±0.0	28.8±0.0	61.1±0.0	93.2±0.0	70.9±0.0	42.5±0.0
CluStream-W - DPC	53.6±0.0	32.8±0.0	39.6±0.0	79.6±0.0	81.6±0.0	51.2±0.0
CluStream-S - DPC	53.4±0.0	25.9±0.0	33.4±0.0	79.6±0.0	62.0±0.0	42.0±0.0
CluStream-G - DPC	46.9±1.7	20.6±0.0	57.9±0.9	69.2±0.2	58.7±0.0	41.6±0.0
CluStream-C - SNN-DPC	70.9±0.1	36.3±0.4	74.5±0.0	76.2±0.0	97.8±0.0	64.3±0.7
CluStream-W - SNN-DPC	57.1±0.0	47.3±0.1	58.9±0.0	87.6±0.0	95.0±0.1	58.4±0.0
CluStream-S - SNN-DPC	58.5±0.0	46.1±0.0	60.7±0.0	90.8±0.0	93.7±0.0	56.6±0.0
CluStream-G - SNN-DPC	73.2±1.4	37.8±2.0	79.2±0.8	79.8±4.1	98.9±0.0	64.4±0.7
CluStream-C - DBHD	85.3±0.0	55.7±0.0	89.7±0.0	99.0±0.0	98.1±0.0	80.3±0.0
CluStream-W - DBHD	85.3±0.0	55.7±0.0	89.7±0.0	99.0±0.0	98.1±0.0	80.3±0.0
CluStream-S - DBHD	85.3±0.0	55.7±0.0	89.7±0.0	99.0±0.0	98.1±0.0	80.3±0.0
CluStream-G - DBHD	97.7±0.3	**94.5**±0.4	94.8±0.1	99.8±0.1	98.8±0.0	**95.8**±0.3

Table 32: Homogeneity Scores for evaluated datasets for the default parameters (×100). The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	Homogeneity	Homogeneity	Homogeneity	Homogeneity	Homogeneity	Homogeneity
STREAMKmeans	55.1±4.4	1.8±0.7	59.6±3.2	13.7±15.3	0.0±0.0	0.0±0.0
DenStream	96.0±0.0	87.5±0.0	81.6±0.0	90.1±0.0	90.6±0.0	46.8±0.0
DBSTREAM	0.0±0.0	0.4±0.0	0.0±0.0	0.0±0.0	90.2±0.0	9.0±0.0
EMCStream	65.5±1.3	65.3±1.5	57.2±3.0	27.3±19.1	58.5±10.7	5.7±0.6
MCMSTStream	12.6±0.0	27.1±0.0	78.8±0.0	97.3±0.0	56.4±0.0	50.7±0.0
GB-FuzzyStream	13.0±26.0	31.0±0.9	47.6±0.4	-	-	16.2±0.9
CluStream-O - var. k	**99.8**±0.0	89.1±0.0	93.2±0.0	99.5±0.0	**99.1**±0.0	91.4±0.0
CluStream-O - fixed k	66.6±0.0	15.8±0.0	64.0±0.0	36.3±0.0	97.3±0.0	36.8±0.0
CluStream-O - k=100	**99.8**±0.0	89.1±0.0	93.2±0.0	99.5±0.0	**99.1**±0.0	91.4±0.0
CluStream - Wk-Means	68.1±0.9	62.1±1.3	80.9±0.2	93.3±0.4	97.3±0.0	48.8±0.8
CluStream-C - k-Means	68.2±1.8	27.9±2.6	74.7±0.7	87.6±3.3	97.5±0.0	40.2±1.9
CluStream-W - k-Means	68.1±0.9	62.1±1.3	80.9±0.2	93.3±0.4	97.3±0.0	48.8±0.8
CluStream-S - k-Means	67.3±1.3	60.1±1.3	81.0±0.2	92.5±0.0	97.3±0.0	47.5±0.6
CluStream-G - k-Means	67.4±1.0	61.4±1.9	81.7±0.3	93.2±0.1	97.4±0.0	47.4±0.9
CluStream-C - SubKMeans	66.1±1.2	30.0±2.1	75.2±0.7	87.7±3.2	97.4±0.0	39.5±1.6
CluStream-W - SubKMeans	66.7±1.3	62.9±1.4	80.2±0.1	92.9±0.5	97.3±0.0	49.3±0.8
CluStream-S - SubKMeans	66.8±1.0	62.0±1.5	80.4±0.1	92.5±0.0	97.4±0.0	48.6±0.7
CluStream-G - SubKMeans	67.2±1.1	62.8±2.1	81.5±0.2	93.2±0.1	97.4±0.0	48.4±0.7
CluStream-C - X-Means	55.8±0.3	11.2±1.8	53.2±0.8	96.5±1.0	96.3±0.1	67.1±0.5
CluStream-W - X-Means	**99.8**±0.0	88.0±0.6	79.1±0.3	99.5±0.0	98.9±0.0	91.4±0.0
CluStream-S - X-Means	**99.8**±0.0	89.1±0.1	78.9±0.4	99.5±0.0	**99.1**±0.0	91.4±0.0
CluStream-G - X-Means	93.7±6.8	85.4±0.2	82.2±0.8	**99.6**±0.2	**99.1**±0.0	91.4±0.0
CluStream-C - P-Dip-M	0.0±0.0	0.0±0.0	3.5±0.0	24.9±0.0	93.0±0.1	21.3±0.8
CluStream-W - P-Dip-M	98.5±0.8	-	89.6±0.1	99.5±0.0	-	-
CluStream-S - P-Dip-M	99.4±0.2	-	90.0±0.2	99.5±0.0	-	-
CluStream-G - P-Dip-M	75.3±2.6	77.1±0.7	70.9±0.4	93.7±0.3	97.9±0.0	89.8±0.3
CluStream-C - SC	52.4±1.1	22.8±2.7	63.4±0.7	86.8±0.0	97.2±0.0	36.7±0.7
CluStream-W - SC	57.2±0.6	47.3±3.1	77.5±0.4	92.5±0.0	55.7±0.4	35.4±0.3
CluStream-S - SC	57.5±1.0	41.6±3.0	77.3±0.3	92.5±0.0	52.4±0.5	36.3±0.3
CluStream-G - SC	55.7±0.2	43.2±2.1	77.6±0.2	93.3±0.1	52.4±0.6	36.3±0.3
CluStream-C - SCAR	51.2±1.9	11.2±1.4	55.9±1.6	31.8±2.3	90.6±0.1	32.6±1.9
CluStream-W - SCAR	40.4±1.8	53.8±2.0	40.7±0.3	9.7±2.3	75.2±0.4	28.4±0.6
CluStream-S - SCAR	39.1±2.1	47.5±1.2	40.4±0.4	10.3±1.4	73.0±0.3	26.8±0.5
CluStream-G - SCAR	45.0±2.4	65.9±2.7	54.9±0.8	10.6±1.9	88.2±0.2	29.8±0.9
CluStream-C - SpectACl	30.3±2.0	35.5±4.4	30.9±1.6	23.1±3.7	92.3±0.1	34.1±0.8
CluStream-W - SpectACl	26.4±0.5	56.3±1.5	36.9±2.3	33.3±3.6	96.1±0.0	34.7±1.4
CluStream-S - SpectACl	26.3±0.8	55.2±0.6	34.4±1.5	34.3±6.9	96.3±0.0	35.7±0.8
CluStream-G - SpectACl	23.5±0.9	54.6±2.3	29.0±1.7	33.8±3.8	96.3±0.0	34.8±1.1
CluStream-C - DBSCAN	0.0±0.0	14.7±0.0	0.0±0.0	0.0±0.0	60.8±0.0	14.6±0.0
CluStream-W - DBSCAN	0.0±0.0	14.7±0.0	0.0±0.0	0.0±0.0	93.0±0.0	17.2±0.0
CluStream-S - DBSCAN	0.0±0.0	14.7±0.0	0.0±0.0	0.0±0.0	94.2±0.0	17.2±0.0
CluStream-G - DBSCAN	0.0±0.0	14.3±0.0	0.0±0.0	0.0±0.0	94.2±0.0	17.2±0.0
CluStream-C - HDBSCAN	37.1±0.0	5.4±0.0	67.2±0.0	94.5±0.0	81.1±0.0	38.1±0.0
CluStream-W - HDBSCAN	95.1±0.0	82.0±0.0	88.0±0.0	96.1±0.0	91.3±0.0	86.9±0.0
CluStream-S - HDBSCAN	96.6±0.0	83.9±0.0	88.9±0.0	96.6±0.0	93.5±0.0	87.9±0.0
CluStream-G - HDBSCAN	70.2±13.6	83.4±0.2	77.1±0.4	91.9±1.1	93.4±0.0	87.8±0.0
CluStream-C - RNN-DBS	19.9±0.0	0.7±0.0	14.7±0.0	74.7±0.0	75.3±0.0	22.7±0.0
CluStream-W - RNN-DBS	83.0±0.0	54.5±0.0	81.0±0.0	89.2±0.0	78.2±0.0	81.8±0.0
CluStream-S - RNN-DBS	84.4±0.0	70.9±0.0	82.7±0.0	90.6±0.0	79.5±0.0	83.0±0.0
CluStream-G - RNN-DBS	82.8±3.7	39.6±3.5	56.5±1.3	94.9±1.1	81.1±0.1	83.7±0.0
CluStream-C - MDBSCAN	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	56.8±0.0	8.3±0.0
CluStream-W - MDBSCAN	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	92.7±0.0	16.6±0.0
CluStream-S - MDBSCAN	0.0±0.0	0.6±0.0	0.0±0.0	0.0±0.0	94.5±0.0	16.6±0.0
CluStream-G - MDBSCAN	0.0±0.0	0.8±0.2	0.0±0.0	0.0±0.0	94.5±0.0	16.6±0.0
CluStream-C - DPC	24.3±0.0	9.5±0.0	51.8±0.0	78.8±0.0	27.9±0.0	11.2±0.0
CluStream-W - DPC	45.3±0.0	19.4±0.0	20.5±0.0	45.6±0.0	55.6±0.0	24.9±0.0
CluStream-S - DPC	44.7±0.0	8.4±0.0	11.0±0.0	45.6±0.0	11.6±0.0	10.5±0.0
CluStream-G - DPC	34.1±2.0	0.0±0.0	47.8±1.2	20.4±0.3	4.0±0.0	8.8±0.1
CluStream-C - SNN-DPC	68.8±0.7	25.6±0.4	66.4±0.0	34.0±0.0	93.2±0.0	46.0±0.6
CluStream-W - SNN-DPC	46.3±0.0	39.1±0.3	47.1±0.0	53.9±0.0	85.8±0.1	40.0±0.0
CluStream-S - SNN-DPC	48.1±0.0	38.2±0.0	50.2±0.0	64.0±0.0	81.9±0.0	35.6±0.0
CluStream-G - SNN-DPC	71.6±0.7	26.1±2.1	72.7±0.7	51.1±8.7	96.7±0.0	46.1±1.1
CluStream-C - DBHD	85.4±0.0	51.8±0.0	85.2±0.0	95.7±0.0	94.3±0.0	70.6±0.0
CluStream-W - DBHD	85.4±0.0	51.8±0.0	85.2±0.0	95.7±0.0	94.3±0.0	70.6±0.0
CluStream-S - DBHD	85.4±0.0	51.8±0.0	85.2±0.0	95.7±0.0	94.3±0.0	70.6±0.0
CluStream-G - DBHD	97.6±0.3	**94.8**±0.4	**93.3**±0.1	99.3±0.2	97.1±0.0	**94.4**±0.2

Table 33: Completeness Scores for evaluated datasets for the default parameters (×100). The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	Completeness	Completeness	Completeness	Completeness	Completeness	Completeness
STREAMKmeans	59.9±4.7	38.7±4.4	77.7±0.5	85.6±7.5	**99.7**±0.3	**100.0**±0.0
DenStream	39.8±0.0	53.9±0.0	60.4±0.0	26.0±0.0	55.0±0.0	35.8±0.0
DBSTREAM	**100.0**±0.0	87.4±0.0	**100.0**±0.0	**100.0**±0.0	79.7±0.0	48.4±0.0
EMCStream	70.9±2.3	78.2±3.2	82.5±0.4	52.5±8.1	66.7±10.7	68.2±6.5
MCMSTStream	30.2±0.0	47.0±0.0	70.9±0.0	39.1±0.0	60.8±0.0	35.3±0.0
GB-FuzzyStream	89.0±22.0	47.4±0.9	51.9±0.4	-	-	19.6±1.1
CluStream-O - var. k	42.3±0.0	62.3±0.0	39.6±0.0	16.8±0.0	43.5±0.0	35.3±0.0
CluStream-O - fixed k	59.5±0.0	55.1±0.0	74.7±0.0	47.9±0.0	65.1±0.0	41.7±0.0
CluStream-O - k=100	42.3±0.0	62.3±0.0	39.6±0.0	16.8±0.0	43.5±0.0	35.3±0.0
CluStream - Wk-Means	59.6±0.7	73.6±1.0	76.9±0.7	93.5±0.6	61.9±0.3	43.5±0.8
CluStream-C - k-Means	59.7±1.6	68.0±1.5	79.0±0.8	87.9±2.8	66.4±0.1	41.5±2.2
CluStream-W - k-Means	59.6±0.7	73.6±1.0	76.9±0.7	93.5±0.6	61.9±0.3	43.5±0.8
CluStream-S - k-Means	58.7±1.2	73.2±1.2	77.8±0.5	92.3±0.0	62.4±0.2	42.7±0.8
CluStream-G - k-Means	58.8±1.0	73.9±1.2	77.8±0.6	92.9±0.1	62.4±0.2	42.6±0.8
CluStream-C - SubKMeans	58.6±1.0	71.3±1.7	78.1±0.8	88.0±2.7	66.4±0.0	40.5±1.5
CluStream-W - SubKMeans	58.5±1.3	72.2±1.8	75.6±0.8	92.9±0.8	62.1±0.2	44.1±0.5
CluStream-S - SubKMeans	58.6±1.0	72.6±1.3	76.4±0.8	92.3±0.0	62.6±0.2	43.2±0.6
CluStream-G - SubKMeans	58.8±1.0	73.9±1.2	77.2±0.7	92.9±0.1	62.6±0.2	43.3±0.6
CluStream-C - X-Means	77.0±0.3	68.8±5.3	81.7±0.8	35.6±1.3	60.3±0.2	40.3±0.3
CluStream-W - X-Means	42.5±0.0	65.4±0.2	74.0±0.8	29.4±0.0	43.8±0.0	35.4±0.0
CluStream-S - X-Means	42.3±0.0	63.8±0.2	72.5±0.8	28.3±0.0	43.6±0.0	35.3±0.0
CluStream-G - X-Means	50.1±4.6	65.0±0.4	73.2±1.0	27.1±0.3	44.9±0.0	35.3±0.0
CluStream-C - P-Dip-M	**100.0**±0.0	**100.0**±0.0	98.7±0.0	**100.0**±0.0	69.5±0.1	73.4±0.3
CluStream-W - P-Dip-M	45.4±0.2	-	43.2±0.0	18.2±0.1	-	-
CluStream-S - P-Dip-M	45.5±0.0	-	42.8±0.0	18.0±0.0	-	-
CluStream-G - P-Dip-M	61.5±1.8	67.9±0.4	86.4±0.1	36.1±2.6	53.5±0.0	37.6±0.1
CluStream-C - SC	55.1±1.0	64.5±2.9	75.7±0.3	87.2±0.0	68.4±0.1	39.4±1.0
CluStream-W - SC	51.8±0.4	70.5±0.8	77.6±0.5	92.3±0.0	51.6±0.1	40.6±0.4
CluStream-S - SC	52.3±0.8	70.1±1.3	77.0±0.4	92.3±0.0	52.4±0.3	39.9±0.4
CluStream-G - SC	50.6±0.3	71.1±1.4	77.0±0.3	93.0±0.1	52.3±0.3	39.9±0.4
CluStream-C - SCAR	51.3±1.5	44.5±1.3	62.2±0.8	42.6±1.9	67.0±0.2	36.5±1.9
CluStream-W - SCAR	53.6±1.5	66.6±0.9	44.7±0.2	23.0±3.1	49.7±0.1	36.7±0.8
CluStream-S - SCAR	51.3±2.2	64.1±1.2	44.9±0.4	24.7±2.8	48.0±0.2	37.6±0.5
CluStream-G - SCAR	49.1±2.3	67.5±2.1	51.2±0.5	25.9±2.4	47.7±0.1	37.0±0.9
CluStream-C - SpectACl	32.0±2.2	59.7±2.4	38.1±0.7	26.4±4.5	60.8±0.1	33.5±0.4
CluStream-W - SpectACl	36.0±0.6	65.2±0.8	52.0±0.7	33.5±3.2	61.5±0.2	31.5±1.3
CluStream-S - SpectACl	36.0±0.9	65.5±1.3	49.7±0.4	34.3±6.2	62.1±0.1	33.1±1.1
CluStream-G - SpectACl	29.7±1.2	64.9±1.5	46.7±1.0	33.6±3.4	62.0±0.1	32.3±0.9
CluStream-C - DBSCAN	**100.0**±0.0	98.7±0.0	**100.0**±0.0	**100.0**±0.0	69.5±0.0	53.5±0.0
CluStream-W - DBSCAN	**100.0**±0.0	98.7±0.0	**100.0**±0.0	**100.0**±0.0	72.8±0.0	50.3±0.0
CluStream-S - DBSCAN	**100.0**±0.0	96.1±0.0	**100.0**±0.0	**100.0**±0.0	71.3±0.0	50.9±0.0
CluStream-G - DBSCAN	**100.0**±0.0	93.7±0.4	**100.0**±0.0	**100.0**±0.0	71.4±0.0	51.1±0.0
CluStream-C - HDBSCAN	80.9±0.0	96.3±0.0	86.0±0.0	82.5±0.0	74.9±0.0	49.8±0.0
CluStream-W - HDBSCAN	43.4±0.0	73.9±0.0	42.2±0.0	17.8±0.0	52.8±0.0	36.8±0.0
CluStream-S - HDBSCAN	43.6±0.0	73.2±0.0	41.8±0.0	17.7±0.0	50.5±0.0	36.6±0.0
CluStream-G - HDBSCAN	59.0±13.6	73.9±0.2	81.1±0.7	21.5±0.2	50.6±0.0	36.6±0.0
CluStream-C - RNN-DBS	98.9±0.0	37.9±0.0	67.4±0.0	95.2±0.0	78.1±0.0	47.3±0.0
CluStream-W - RNN-DBS	40.5±0.0	65.9±0.0	40.2±0.0	17.2±0.0	48.0±0.0	36.1±0.0
CluStream-S - RNN-DBS	40.6±0.0	66.5±0.0	40.2±0.0	17.1±0.0	45.4±0.0	36.0±0.0
CluStream-G - RNN-DBS	57.7±1.1	58.6±1.7	71.1±1.9	24.3±0.9	46.2±0.0	36.1±0.0
CluStream-C - MDBSCAN	**100.0**±0.0	**100.0**±0.0	**100.0**±0.0	**100.0**±0.0	74.2±0.0	81.5±0.0
CluStream-W - MDBSCAN	**100.0**±0.0	**100.0**±0.0	**100.0**±0.0	**100.0**±0.0	73.9±0.0	72.5±0.0
CluStream-S - MDBSCAN	**100.0**±0.0	76.5±0.0	**100.0**±0.0	**100.0**±0.0	72.3±0.0	66.3±0.0
CluStream-G - MDBSCAN	**100.0**±0.0	70.2±5.1	**100.0**±0.0	**100.0**±0.0	72.4±0.0	66.5±0.0
CluStream-C - DPC	54.3±0.0	71.0±0.0	86.5±0.0	72.6±0.0	84.3±0.0	79.6±0.0
CluStream-W - DPC	57.5±0.0	51.5±0.0	88.9±0.0	87.3±0.0	85.2±0.0	53.2±0.0
CluStream-S - DPC	56.8±0.0	81.1±0.0	92.7±0.0	87.3±0.0	96.9±0.0	72.9±0.0
CluStream-G - DPC	43.9±1.8	**100.0**±0.0	88.2±0.1	64.2±0.1	99.0±0.0	71.9±0.1
CluStream-C - SNN-DPC	66.4±0.4	66.2±0.1	71.8±0.0	41.3±0.0	58.7±0.0	50.6±0.5
CluStream-W - SNN-DPC	73.7±0.0	77.4±0.1	70.9±0.0	58.6±0.0	64.3±0.1	52.0±0.0
CluStream-S - SNN-DPC	71.1±0.0	78.7±0.0	72.9±0.0	69.7±0.0	64.2±0.0	51.7±0.0
CluStream-G - SNN-DPC	67.8±0.9	67.3±2.5	82.7±0.3	59.3±2.5	66.8±0.1	53.0±1.3
CluStream-C - DBHD	64.8±0.0	77.5±0.0	67.8±0.0	30.7±0.0	63.7±0.0	45.3±0.0
CluStream-W - DBHD	64.8±0.0	77.5±0.0	67.8±0.0	30.7±0.0	63.7±0.0	45.3±0.0
CluStream-S - DBHD	64.8±0.0	77.5±0.0	67.8±0.0	30.7±0.0	63.7±0.0	45.3±0.0
CluStream-G - DBHD	37.4±0.1	49.6±0.4	31.8±0.1	14.5±0.1	38.4±0.0	28.7±0.1

Table 34: Average reported cluster number per evaluation batch for the evaluated datasets for the default parameters (×100). The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	Cluster Number	Cluster Number	Cluster Number	Cluster Number	Cluster Number	Cluster Number
STREAMKmeans	6.5±0.5	5.0±1.2	6.7±0.5	1.3±0.2	1.0±0.0	1.0±0.0
DenStream	112.5±0.0	53.6±0.0	25.2±0.0	17.5±0.0	16.1±0.0	11.7±0.0
DBSTREAM	1.0±0.0	1.4±0.0	1.0±0.0	1.0±0.0	5.2±0.0	2.5±0.0
EMCStream	6.5±0.3	7.5±0.2	3.6±0.2	1.8±0.2	3.5±0.4	1.9±0.1
MCMSTStream	12.5±0.0	10.6±0.0	10.6±0.0	13.0±0.0	8.4±0.0	32.6±0.0
GB-FuzzyStream	8.3±14.5	7.2±0.1	6.6±0.2	-	-	6.8±0.5
CluStream-O - var. k	99.3±0.0	99.8±0.0	100.0±0.0	99.7±0.0	99.5±0.0	99.3±0.0
CluStream-O - fixed k	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	23.0±0.0	6.0±0.0
CluStream-O - k=100	99.3±0.0	99.8±0.0	100.0±0.0	99.7±0.0	99.5±0.0	99.3±0.0
CluStream - Wk-Means	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	23.0±0.0	6.0±0.0
CluStream-C - k-Means	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	23.0±0.0	6.0±0.0
CluStream-W - k-Means	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	23.0±0.0	6.0±0.0
CluStream-S - k-Means	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	23.0±0.0	6.0±0.0
CluStream-G - k-Means	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	23.0±0.0	6.0±0.0
CluStream-C - SubKMeans	8.8±0.3	11.0±0.0	8.0±0.0	2.0±0.0	23.0±0.0	6.0±0.0
CluStream-W - SubKMeans	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	23.0±0.0	6.0±0.0
CluStream-S - SubKMeans	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	23.0±0.0	6.0±0.0
CluStream-G - SubKMeans	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	23.0±0.0	6.0±0.0
CluStream-C - X-Means	4.0±0.0	2.0±0.0	4.4±0.1	15.5±0.6	29.8±0.3	20.9±0.6
CluStream-W - X-Means	97.5±0.2	47.3±1.9	24.2±1.6	52.9±0.9	90.2±0.0	95.0±0.5
CluStream-S - X-Means	99.1±0.3	74.0±1.9	27.2±1.3	64.5±0.9	97.5±0.0	97.5±0.3
CluStream-G - X-Means	72.0±8.5	71.5±3.4	25.2±1.2	126.0±10.6	98.7±0.1	97.4±0.3
CluStream-C - P-Dip-M	1.0±0.0	1.0±0.0	1.1±0.0	1.2±0.0	13.6±0.1	3.9±0.1
CluStream-W - P-Dip-M	68.9±0.6	-	44.5±0.6	59.6±0.6	-	-
CluStream-S - P-Dip-M	70.3±0.5	-	49.5±0.4	63.5±1.5	-	-
CluStream-G - P-Dip-M	11.0±1.5	24.6±1.7	4.3±0.0	11.9±0.6	48.2±0.1	62.0±0.5
CluStream-C - SC	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	23.0±0.0	6.0±0.0
CluStream-W - SC	9.0±0.0	11.0±0.0	7.8±0.0	2.0±0.0	23.0±0.0	6.0±0.0
CluStream-S - SC	9.0±0.0	11.0±0.0	7.9±0.0	2.0±0.0	23.0±0.0	6.0±0.0
CluStream-G - SC	9.0±0.0	11.0±0.0	7.9±0.0	2.0±0.0	23.0±0.0	6.0±0.0
CluStream-C - SCAR	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	22.9±0.0	6.0±0.0
CluStream-W - SCAR	9.0±0.0	10.9±0.1	8.0±0.0	2.0±0.0	18.9±0.1	6.0±0.0
CluStream-S - SCAR	8.7±0.0	11.0±0.0	7.9±0.0	2.0±0.0	20.4±0.1	6.0±0.0
CluStream-G - SCAR	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	19.4±0.2	6.0±0.0
CluStream-C - SpectACl	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	23.0±0.0	6.0±0.0
CluStream-W - SpectACl	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	22.9±0.0	6.0±0.0
CluStream-S - SpectACl	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	23.0±0.0	6.0±0.0
CluStream-G - SpectACl	9.0±0.1	11.0±0.0	7.9±0.0	2.0±0.0	23.0±0.0	6.0±0.0
CluStream-C - DBSCAN	1.0±0.0	2.0±0.0	1.0±0.0	1.0±0.0	4.7±0.0	2.9±0.0
CluStream-W - DBSCAN	1.0±0.0	2.0±0.0	1.0±0.0	1.0±0.0	10.1±0.0	5.9±0.0
CluStream-S - DBSCAN	1.0±0.0	2.6±0.0	1.0±0.0	1.0±0.0	14.1±0.0	6.2±0.0
CluStream-G - DBSCAN	1.0±0.0	2.8±0.1	1.0±0.0	1.0±0.0	14.1±0.0	6.1±0.0
CluStream-C - HDBSCAN	4.0±0.0	1.4±0.0	4.8±0.0	2.8±0.0	6.3±0.0	4.5±0.0
CluStream-W - HDBSCAN	72.9±0.0	17.0±0.0	42.6±0.0	55.4±0.0	20.3±0.0	46.7±0.0
CluStream-S - HDBSCAN	75.2±0.0	20.6±0.0	46.9±0.0	59.3±0.0	31.1±0.0	51.6±0.0
CluStream-G - HDBSCAN	32.6±10.8	18.8±0.2	11.0±0.6	36.2±1.6	30.9±0.0	51.4±0.1
CluStream-C - RNN-DBS	2.0±0.0	2.0±0.0	2.3±0.0	2.0±0.0	5.1±0.0	3.2±0.0
CluStream-W - RNN-DBS	69.5±0.0	11.2±0.0	38.0±0.0	50.4±0.0	16.6±0.0	42.1±0.0
CluStream-S - RNN-DBS	71.5±0.0	18.2±0.0	41.8±0.0	53.9±0.0	26.9±0.0	45.9±0.0
CluStream-G - RNN-DBS	23.2±1.6	10.4±0.7	8.8±0.3	24.7±1.2	25.6±0.0	45.2±0.1
CluStream-C - MDBSCAN	1.0±0.0	1.0±0.0	1.0±0.0	1.0±0.0	3.7±0.0	2.1±0.0
CluStream-W - MDBSCAN	1.0±0.0	1.0±0.0	1.0±0.0	1.0±0.0	9.1±0.0	5.2±0.0
CluStream-S - MDBSCAN	1.0±0.0	1.6±0.0	1.0±0.0	1.0±0.0	13.1±0.0	5.5±0.0
CluStream-G - MDBSCAN	1.0±0.0	1.8±0.1	1.0±0.0	1.0±0.0	13.1±0.0	5.3±0.0
CluStream-C - DPC	2.7±0.0	1.6±0.0	3.1±0.0	2.5±0.0	1.8±0.0	1.6±0.0
CluStream-W - DPC	5.4±0.0	52.4±0.0	2.8±0.0	1.8±0.0	7.3±0.0	4.4±0.0
CluStream-S - DPC	5.4±0.0	19.8±0.0	1.8±0.0	1.8±0.0	2.4±0.0	2.8±0.0
CluStream-G - DPC	5.4±0.3	1.0±0.0	2.7±0.0	2.0±0.0	1.1±0.0	1.5±0.0
CluStream-C - SNN-DPC	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	23.0±0.0	6.0±0.0
CluStream-W - SNN-DPC	4.0±0.0	5.8±0.0	4.0±0.0	2.0±0.0	10.4±0.0	4.1±0.0
CluStream-S - SNN-DPC	4.7±0.0	5.0±0.0	4.2±0.0	2.0±0.0	10.3±0.0	3.9±0.0
CluStream-G - SNN-DPC	9.0±0.0	10.9±0.1	8.0±0.0	2.0±0.1	22.1±0.0	6.0±0.0
CluStream-C - DBHD	13.3±0.0	14.2±0.0	13.1±0.0	12.0±0.0	16.4±0.0	15.1±0.0
CluStream-W - DBHD	13.3±0.0	14.2±0.0	13.1±0.0	12.0±0.0	16.4±0.0	15.1±0.0
CluStream-S - DBHD	13.3±0.0	14.2±0.0	13.1±0.0	12.0±0.0	16.4±0.0	15.1±0.0
CluStream-G - DBHD	170.5±2.3	108.7±1.5	166.0±0.8	134.8±2.7	83.0±0.1	154.8±1.6

Table 35: ARI Scores for evaluated datasets using the default parameters for the online phase, but the best-performing parameters according to the sum of ARI and AMI for the offline phase (×100). Competitors are included with default parameters. The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	ARI	ARI	ARI	ARI	ARI	ARI
STREAMKmeans	36.5±4.3	0.3±0.2	54.9±2.9	13.3±15.8	0.0±0.0	0.0±0.0
DenStream	7.9±0.0	32.4±0.0	59.2±0.0	19.0±0.0	77.6±0.0	26.8±0.0
DBSTREAM	0.0±0.0	0.1±0.0	0.0±0.0	0.0±0.0	**92.7**±0.0	6.2±0.0
EMCStream	48.9±3.4	58.4±4.4	53.6±3.0	26.2±19.6	57.2±15.6	4.1±0.8
MCMSTStream	1.0±0.0	7.5±0.0	70.0±0.0	42.5±0.0	58.9±0.0	16.4±0.0
GB-FuzzyStream	2.9±5.7	13.3±1.2	25.4±0.5	-	-	4.6±0.3
CluStream-O - var. k	9.5±0.0	49.7±0.0	19.0±0.0	5.4±0.0	68.1±0.0	19.5±0.0
CluStream-O - fixed k	36.4±0.0	7.7±0.0	57.2±0.0	38.4±0.0	83.9±0.0	25.5±0.0
CluStream-O - k=100	9.5±0.0	49.7±0.0	19.0±0.0	5.4±0.0	68.1±0.0	19.5±0.0
CluStream - Wk-Means	36.8±1.0	50.2±2.3	75.2±0.8	95.7±0.4	86.7±0.4	32.0±1.1
CluStream-C - k-Means	37.1±2.3	14.4±2.7	70.2±1.0	90.9±2.5	89.9±0.0	24.7±1.2
CluStream-W - k-Means	36.8±1.0	50.2±2.3	75.2±0.8	95.7±0.4	86.7±0.4	32.0±1.1
CluStream-S - k-Means	35.4±1.5	48.8±1.8	76.3±0.6	94.9±0.0	86.9±0.3	30.7±0.7
CluStream-G - k-Means	36.1±1.3	50.0±2.8	76.8±0.8	95.4±0.0	87.0±0.3	30.8±0.8
CluStream-C - SubKMeans	35.7±1.4	34.8±2.9	70.6±1.2	91.4±2.2	89.8±0.0	24.5±1.9
CluStream-W - SubKMeans	35.4±1.7	52.0±3.5	74.5±1.5	95.3±0.5	86.6±0.3	31.9±0.5
CluStream-S - SubKMeans	35.5±1.3	52.6±2.7	75.4±0.7	94.9±0.0	87.0±0.3	31.6±0.6
CluStream-G - SubKMeans	36.1±1.4	53.2±3.5	76.1±0.9	95.4±0.0	87.0±0.3	31.6±0.6
CluStream-C - X-Means	46.0±0.8	19.2±8.4	73.5±0.8	32.7±0.7	86.1±0.1	28.1±0.3
CluStream-W - X-Means	10.0±0.2	50.2±0.2	67.8±1.2	21.2±0.0	68.2±0.0	19.5±0.0
CluStream-S - X-Means	9.7±0.0	50.0±0.0	68.7±0.6	20.5±0.5	68.2±0.0	19.5±0.0
CluStream-G - X-Means	21.5±4.4	51.9±0.5	73.4±1.2	19.3±0.1	73.8±0.1	19.5±0.0
CluStream-C - P-Dip-M	0.0±0.0	0.0±0.0	3.3±0.0	29.9±10.0	89.3±0.1	20.9±0.7
CluStream-W - P-Dip-M	14.4±0.2	-	25.4±0.2	12.2±2.7	-	-
CluStream-S - P-Dip-M	13.9±0.1	-	24.9±0.2	13.5±0.1	-	-
CluStream-G - P-Dip-M	40.4±1.1	50.9±0.5	73.0±0.6	40.9±0.6	82.2±0.0	22.7±0.2
CluStream-C - SC	44.4±0.6	44.2±1.7	76.3±0.0	94.9±0.0	90.3±0.0	29.9±1.7
CluStream-W - SC	48.5±2.4	50.3±0.6	73.5±0.5	94.9±0.0	85.5±0.1	42.3±1.1
CluStream-S - SC	47.3±0.2	53.6±0.1	72.9±0.5	94.9±0.0	85.2±0.1	**44.5**±0.7
CluStream-G - SC	44.9±3.4	52.0±1.2	73.1±0.3	95.4±0.1	85.5±0.1	37.0±1.8
CluStream-C - SCAR	41.8±1.2	44.9±2.9	73.3±0.2	83.5±11.9	87.5±0.2	31.5±1.3
CluStream-W - SCAR	41.9±2.1	53.8±0.5	57.8±0.2	51.3±14.6	74.7±0.4	36.5±0.6
CluStream-S - SCAR	45.1±2.1	52.4±0.7	58.3±0.3	37.2±13.9	71.0±0.2	35.0±1.9
CluStream-G - SCAR	45.8±2.4	52.0±1.3	58.4±0.4	53.7±9.2	74.8±0.2	37.6±0.5
CluStream-C - SpectACl	44.6±1.6	54.3±1.7	66.8±1.3	84.7±12.1	86.7±0.1	29.9±1.4
CluStream-W - SpectACl	49.8±1.5	**59.4**±1.0	28.6±2.5	97.7±0.0	90.7±0.1	34.6±0.9
CluStream-S - SpectACl	48.7±4.3	57.3±1.9	68.4±0.7	97.7±0.0	90.3±0.2	34.4±0.8
CluStream-G - SpectACl	48.2±3.2	53.6±2.0	20.3±1.5	94.2±6.3	90.5±0.3	33.1±1.7
CluStream-C - DBSCAN	46.3±0.0	46.2±0.0	63.5±0.0	93.2±0.0	91.2±0.0	28.3±0.0
CluStream-W - DBSCAN	47.1±0.0	49.3±0.0	64.5±0.0	93.1±0.0	91.4±0.0	28.4±0.0
CluStream-S - DBSCAN	46.5±0.0	48.6±0.0	66.4±0.0	93.0±0.0	91.5±0.0	28.6±0.0
CluStream-G - DBSCAN	44.5±2.9	53.7±0.9	73.6±0.3	75.5±4.8	91.5±0.0	28.8±0.1
CluStream-C - HDBSCAN	48.5±0.0	46.6±0.0	65.5±0.0	98.2±0.0	84.4±0.0	33.9±0.0
CluStream-W - HDBSCAN	47.9±0.0	57.9±0.0	62.9±0.0	98.2±0.0	88.4±0.0	35.0±0.0
CluStream-S - HDBSCAN	48.0±0.0	56.8±0.0	62.4±0.0	98.2±0.0	89.4±0.0	34.8±0.0
CluStream-G - HDBSCAN	47.7±3.4	56.8±0.1	74.0±0.4	89.1±1.1	89.4±0.0	35.5±0.4
CluStream-C - RNN-DBS	34.9±0.0	12.5±0.0	63.2±0.0	74.7±0.0	86.2±0.0	31.8±0.0
CluStream-W - RNN-DBS	40.8±0.0	50.1±0.0	26.8±0.0	53.5±0.0	60.9±0.0	30.4±0.0
CluStream-S - RNN-DBS	40.8±0.0	49.7±0.0	19.6±0.0	59.6±0.0	61.3±0.0	33.3±0.0
CluStream-G - RNN-DBS	40.9±1.6	28.8±0.8	53.5±2.0	40.3±12.0	64.5±0.1	30.7±0.3
CluStream-C - MDBSCAN	47.1±0.0	52.3±0.0	67.5±0.0	98.0±0.0	91.2±0.0	29.6±0.0
CluStream-W - MDBSCAN	49.4±0.0	53.7±0.0	63.2±0.0	**99.5**±0.0	90.4±0.0	31.5±0.0
CluStream-S - MDBSCAN	48.6±0.0	53.5±0.0	63.6±0.0	**99.5**±0.0	91.8±0.0	30.7±0.0
CluStream-G - MDBSCAN	44.8±2.9	49.2±1.3	66.0±0.6	93.9±3.0	91.9±0.0	27.9±0.0
CluStream-C - DPC	42.2±0.0	46.1±0.0	70.7±0.0	88.4±0.0	88.8±0.0	21.5±0.0
CluStream-W - DPC	45.6±0.0	58.9±0.0	67.0±0.0	74.0±0.0	89.6±0.0	29.3±0.0
CluStream-S - DPC	47.3±0.0	59.1±0.0	67.2±0.0	75.1±0.0	89.6±0.0	28.9±0.0
CluStream-G - DPC	38.1±1.0	54.8±0.3	76.4±0.5	71.9±11.1	82.3±0.2	29.1±0.0
CluStream-C - SNN-DPC	45.6±1.9	22.9±0.0	58.3±0.0	31.9±0.0	82.7±0.0	29.6±0.5
CluStream-W - SNN-DPC	47.8±0.0	34.6±1.1	40.3±0.0	87.1±0.0	81.8±0.1	33.6±0.0
CluStream-S - SNN-DPC	47.9±0.0	32.6±0.0	42.8±0.0	81.7±0.0	81.9±0.0	28.5±0.0
CluStream-G - SNN-DPC	43.5±3.9	42.7±2.1	69.1±1.0	62.1±9.4	90.1±0.0	31.5±1.5
CluStream-C - DBHD	**52.9**±0.0	52.1±0.0	71.4±0.0	95.6±0.0	88.2±0.0	43.7±0.0
CluStream-W - DBHD	**52.9**±0.0	52.1±0.0	71.4±0.0	95.6±0.0	88.2±0.0	43.7±0.0
CluStream-S - DBHD	**52.9**±0.0	52.1±0.0	71.4±0.0	95.6±0.0	88.2±0.0	43.7±0.0
CluStream-G - DBHD	44.8±1.8	49.8±1.0	**77.8**±0.3	31.7±8.1	68.2±0.1	33.5±0.3

Table 36: AMI Scores for evaluated datasets using the default parameters for the online phase, but the best-performing parameters according to the sum of ARI and AMI for the offline phase (×100). Competitors are included with default parameters. The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	AMI	AMI	AMI	AMI	AMI	AMI
STREAMKmeans	56.6±4.4	2.3±1.3	66.5±2.2	14.4±15.4	0.0±0.1	0.0±0.0
DenStream	48.7±0.0	63.4±0.0	68.0±0.0	39.9±0.0	67.6±0.0	39.4±0.0
DBSTREAM	0.0±0.0	0.7±0.0	0.0±0.0	0.0±0.0	84.4±0.0	11.7±0.0
EMCStream	67.4±0.7	70.5±2.2	66.3±2.3	27.1±18.7	60.4±9.7	6.6±1.0
MCMSTStream	14.5±0.0	32.5±0.0	74.0±0.0	54.1±0.0	55.8±0.0	38.4±0.0
GB-FuzzyStream	9.9±19.7	36.2±1.0	49.0±0.4	-	-	16.7±0.9
CluStream-O - var. k	53.0±0.0	69.8±0.0	51.4±0.0	26.8±0.0	57.2±0.0	46.8±0.0
CluStream-O - fixed k	62.1±0.0	21.4±0.0	68.0±0.0	40.6±0.0	77.2±0.0	37.8±0.0
CluStream-O - k=100	53.0±0.0	69.8±0.0	51.4±0.0	26.8±0.0	57.2±0.0	46.8±0.0
CluStream - Wk-Means	62.8±0.8	66.4±1.1	78.4±0.4	93.4±0.5	74.9±0.2	45.2±0.6
CluStream-C - k-Means	62.8±1.7	37.2±2.9	76.2±0.7	87.7±3.1	78.3±0.0	39.4±2.0
CluStream-W - k-Means	62.8±0.8	66.4±1.1	78.4±0.4	93.4±0.5	74.9±0.2	45.2±0.6
CluStream-S - k-Means	61.8±1.3	65.0±1.0	78.9±0.3	92.4±0.0	75.3±0.2	44.1±0.5
CluStream-G - k-Means	62.0±1.0	66.0±1.5	79.2±0.4	93.1±0.1	75.3±0.2	44.0±0.7
CluStream-C - SubKMeans	61.3±1.0	53.9±1.8	76.1±0.7	88.1±2.8	78.3±0.0	39.1±1.5
CluStream-W - SubKMeans	61.5±1.3	69.1±1.8	78.2±0.6	92.9±0.6	75.0±0.2	45.6±0.6
CluStream-S - SubKMeans	61.6±1.0	69.2±1.5	78.5±0.3	92.4±0.0	75.4±0.2	45.3±0.5
CluStream-G - SubKMeans	61.9±1.0	69.0±1.8	78.8±0.5	93.0±0.1	75.4±0.2	45.2±0.4
CluStream-C - X-Means	64.4±0.3	41.1±7.8	78.1±0.3	51.2±0.9	75.3±0.1	48.5±0.3
CluStream-W - X-Means	53.4±0.2	72.9±0.3	74.5±0.6	41.5±0.0	57.9±0.0	47.1±0.0
CluStream-S - X-Means	53.1±0.1	71.8±0.1	74.7±0.4	40.5±0.9	57.3±0.0	46.9±0.0
CluStream-G - X-Means	60.9±1.0	71.5±0.3	77.2±0.6	36.8±0.6	58.7±0.0	46.9±0.0
CluStream-C - P-Dip-M	0.0±0.0	0.0±0.0	5.0±0.0	29.9±10.0	79.3±0.1	33.0±0.6
CluStream-W - P-Dip-M	58.5±0.2	-	56.7±0.0	33.5±1.4	-	-
CluStream-S - P-Dip-M	58.2±0.1	-	56.3±0.1	34.1±0.2	-	-
CluStream-G - P-Dip-M	66.0±0.9	70.2±0.4	78.4±0.3	54.8±0.3	68.6±0.0	50.7±0.2
CluStream-C - SC	64.6±0.6	61.6±1.0	79.6±0.0	92.4±0.0	79.7±0.0	45.0±0.5
CluStream-W - SC	73.6±1.6	68.7±0.3	77.1±0.4	92.4±0.0	75.1±0.1	56.8±0.8
CluStream-S - SC	72.5±0.3	70.7±0.1	76.7±0.3	92.4±0.0	73.7±0.1	**58.2**±0.5
CluStream-G - SC	71.8±2.3	70.2±0.7	76.8±0.2	93.2±0.2	74.0±0.1	50.9±1.1
CluStream-C - SCAR	66.4±0.5	61.7±1.5	77.1±0.1	80.8±11.3	79.1±0.1	46.1±1.0
CluStream-W - SCAR	66.0±1.4	69.8±0.5	69.1±0.1	54.6±13.0	71.0±0.3	48.7±0.4
CluStream-S - SCAR	69.7±1.4	69.5±0.3	69.2±0.1	39.8±12.7	65.5±0.3	48.5±1.6
CluStream-G - SCAR	71.2±1.7	69.6±0.7	69.5±0.1	54.2±8.0	65.2±0.1	49.8±0.3
CluStream-C - SpectACl	69.1±0.7	73.3±0.8	76.3±0.7	84.4±11.9	72.4±0.1	43.3±1.2
CluStream-W - SpectACl	71.6±0.8	75.7±0.4	41.7±1.9	96.4±0.0	80.7±0.1	46.8±1.0
CluStream-S - SpectACl	71.1±2.9	74.5±1.0	76.9±0.2	96.4±0.0	81.7±0.1	47.1±0.7
CluStream-G - SpectACl	70.8±2.2	73.2±1.0	34.1±1.6	93.3±5.1	81.9±0.2	45.7±1.4
CluStream-C - DBSCAN	72.8±0.0	66.1±0.0	76.0±0.0	93.8±0.0	79.5±0.0	49.7±0.0
CluStream-W - DBSCAN	71.3±0.0	73.6±0.0	77.3±0.0	93.4±0.0	83.6±0.0	49.9±0.0
CluStream-S - DBSCAN	73.1±0.0	72.8±0.0	78.4±0.0	93.2±0.0	83.8±0.0	50.0±0.0
CluStream-G - DBSCAN	71.2±2.6	75.6±0.5	81.5±0.2	75.9±4.0	83.8±0.0	50.2±0.1
CluStream-C - HDBSCAN	72.3±0.0	67.5±0.0	76.6±0.0	96.9±0.0	77.0±0.0	53.1±0.0
CluStream-W - HDBSCAN	71.7±0.0	**77.4**±0.0	75.3±0.0	96.9±0.0	81.6±0.0	55.9±0.0
CluStream-S - HDBSCAN	71.9±0.0	77.1±0.0	72.3±0.0	96.9±0.0	81.4±0.0	57.0±0.0
CluStream-G - HDBSCAN	70.6±2.5	77.0±0.2	**80.2**±0.3	89.8±1.1	81.4±0.0	53.4±0.2
CluStream-C - RNN-DBS	67.0±0.0	23.8±0.0	71.4±0.0	74.7±0.0	76.7±0.0	49.0±0.0
CluStream-W - RNN-DBS	66.4±0.0	71.8±0.0	51.4±0.0	62.2±0.0	61.1±0.0	51.3±0.0
CluStream-S - RNN-DBS	65.4±0.0	71.1±0.0	51.9±0.0	67.4±0.0	61.6±0.0	52.4±0.0
CluStream-G - RNN-DBS	68.0±2.1	47.0±3.4	63.9±1.1	49.9±11.2	63.7±0.0	53.0±0.1
CluStream-C - MDBSCAN	71.3±0.0	70.4±0.0	74.9±0.0	96.2±0.0	81.0±0.0	51.9±0.0
CluStream-W - MDBSCAN	75.8±0.0	70.6±0.0	73.4±0.0	**99.0**±0.0	84.1±0.0	52.5±0.0
CluStream-S - MDBSCAN	74.6±0.0	70.5±0.0	73.8±0.0	**99.0**±0.0	85.2±0.0	52.3±0.0
CluStream-G - MDBSCAN	72.3±2.4	68.6±0.4	75.3±0.4	93.1±1.6	**85.3**±0.0	52.2±0.0
CluStream-C - DPC	70.0±0.0	67.6±0.0	76.9±0.0	88.5±0.0	84.2±0.0	37.9±0.0
CluStream-W - DPC	65.3±0.0	70.8±0.0	74.2±0.0	77.6±0.0	75.8±0.0	51.0±0.0
CluStream-S - DPC	65.7±0.0	71.9±0.0	74.6±0.0	78.1±0.0	75.9±0.0	51.4±0.0
CluStream-G - DPC	70.2±0.9	70.7±0.1	79.4±0.2	73.8±10.4	76.3±0.2	51.6±0.0
CluStream-C - SNN-DPC	66.8±0.1	45.0±0.1	69.2±0.0	35.7±0.0	71.0±0.0	47.0±0.5
CluStream-W - SNN-DPC	64.7±0.0	58.6±0.7	55.2±0.0	87.0±0.0	72.8±0.1	45.8±0.0
CluStream-S - SNN-DPC	67.7±0.0	55.7±0.0	58.0±0.0	82.7±0.0	71.2±0.0	40.0±0.0
CluStream-G - SNN-DPC	69.4±2.3	63.1±1.2	76.7±0.5	65.7±7.7	78.6±0.0	47.3±1.3
CluStream-C - DBHD	**76.6**±0.0	75.0±0.0	77.6±0.0	93.2±0.0	75.4±0.0	58.1±0.0
CluStream-W - DBHD	**76.6**±0.0	75.0±0.0	77.6±0.0	93.2±0.0	75.4±0.0	58.1±0.0
CluStream-S - DBHD	**76.6**±0.0	75.0±0.0	77.6±0.0	93.2±0.0	75.4±0.0	58.1±0.0
CluStream-G - DBHD	73.0±0.4	72.4±0.8	**81.7**±0.3	47.5±7.7	64.6±0.1	55.3±0.2

Table 37: NMI Scores for evaluated datasets using the default parameters for the online phase, but the best-performing parameters according to the sum of ARI and AMI for the offline phase (×100). Competitors are included with default parameters. The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	NMI	NMI	NMI	NMI	NMI	NMI
STREAMKmeans	57.3±4.3	3.4±1.3	66.8±2.2	14.4±15.4	0.0±0.1	0.0±0.0
DenStream	56.2±0.0	66.7±0.0	68.9±0.0	40.3±0.0	68.4±0.0	40.1±0.0
DBSTREAM	0.0±0.0	0.8±0.0	0.0±0.0	0.0±0.0	84.6±0.0	12.0±0.0
EMCStream	67.8±0.7	71.0±2.2	66.4±2.3	27.1±18.7	60.7±9.6	6.7±1.0
MCMSTStream	17.2±0.0	34.2±0.0	74.4±0.0	54.4±0.0	56.4±0.0	41.0±0.0
GB-FuzzyStream	10.6±21.2	37.4±1.0	49.4±0.4	-	-	17.4±0.9
CluStream-O - var. k	59.4±0.0	73.2±0.0	55.4±0.0	28.8±0.0	60.4±0.0	50.7±0.0
CluStream-O - fixed k	62.9±0.0	24.0±0.0	68.4±0.0	40.7±0.0	77.9±0.0	38.3±0.0
CluStream-O - k=100	59.4±0.0	73.2±0.0	55.4±0.0	28.8±0.0	60.4±0.0	50.7±0.0
CluStream - Wk-Means	63.6±0.8	67.2±1.0	78.6±0.4	93.4±0.5	75.7±0.2	45.6±0.6
CluStream-C - k-Means	63.7±1.7	39.3±2.8	76.5±0.7	87.7±3.1	79.0±0.0	39.9±1.9
CluStream-W - k-Means	63.6±0.8	67.2±1.0	78.6±0.4	93.4±0.5	75.7±0.2	45.6±0.6
CluStream-S - k-Means	62.7±1.2	65.9±0.9	79.2±0.3	92.4±0.0	76.0±0.2	44.5±0.5
CluStream-G - k-Means	62.8±1.0	66.9±1.5	79.4±0.4	93.1±0.1	76.0±0.2	44.4±0.7
CluStream-C - SubKMeans	62.1±1.0	55.2±1.8	76.3±0.7	88.2±2.8	79.0±0.0	39.6±1.5
CluStream-W - SubKMeans	62.3±1.3	69.9±1.7	78.4±0.6	92.9±0.6	75.8±0.2	46.0±0.6
CluStream-S - SubKMeans	62.4±1.0	70.0±1.4	78.8±0.3	92.4±0.0	76.2±0.2	45.7±0.5
CluStream-G - SubKMeans	62.8±1.0	69.8±1.7	79.0±0.5	93.1±0.1	76.2±0.2	45.7±0.4
CluStream-C - X-Means	64.7±0.3	43.4±7.5	78.5±0.3	51.4±0.9	76.1±0.1	49.5±0.3
CluStream-W - X-Means	59.7±0.1	74.8±0.3	75.1±0.5	42.6±0.0	60.8±0.0	50.8±0.0
CluStream-S - X-Means	59.5±0.0	74.2±0.1	75.3±0.4	41.7±0.7	60.5±0.0	50.7±0.0
CluStream-G - X-Means	64.4±0.6	73.9±0.3	77.9±0.6	39.3±0.4	61.9±0.0	50.7±0.0
CluStream-C - P-Dip-M	0.0±0.0	0.0±0.0	5.0±0.0	29.9±10.0	79.7±0.1	33.5±0.6
CluStream-W - P-Dip-M	62.8±0.2	-	58.5±0.0	34.4±1.4	-	-
CluStream-S - P-Dip-M	62.6±0.1	-	58.1±0.1	35.0±0.2	-	-
CluStream-G - P-Dip-M	66.8±0.9	71.5±0.4	78.5±0.3	55.0±0.3	70.0±0.0	53.0±0.2
CluStream-C - SC	65.5±0.6	62.6±1.0	79.8±0.0	92.4±0.0	80.4±0.0	45.5±0.5
CluStream-W - SC	74.3±1.5	69.4±0.3	77.3±0.4	92.4±0.0	75.8±0.1	57.1±0.8
CluStream-S - SC	73.2±0.2	71.4±0.1	76.9±0.3	92.4±0.0	74.5±0.1	58.5±0.5
CluStream-G - SC	72.4±2.3	70.9±0.7	77.0±0.2	93.2±0.2	74.8±0.1	51.2±1.1
CluStream-C - SCAR	67.1±0.5	62.8±1.5	77.3±0.1	80.8±11.3	79.7±0.1	46.5±1.0
CluStream-W - SCAR	66.8±1.4	70.5±0.4	69.4±0.1	54.6±13.0	71.7±0.3	49.1±0.4
CluStream-S - SCAR	70.4±1.4	70.3±0.3	69.5±0.1	39.9±12.7	66.3±0.2	48.8±1.6
CluStream-G - SCAR	71.9±1.7	70.4±0.7	69.7±0.1	54.3±8.0	66.2±0.1	50.1±0.3
CluStream-C - SpectACl	69.7±0.7	73.9±0.8	76.6±0.7	84.4±11.9	73.3±0.1	43.7±1.2
CluStream-W - SpectACl	72.2±0.8	76.3±0.3	42.4±1.9	96.4±0.0	81.3±0.1	47.1±1.0
CluStream-S - SpectACl	71.7±2.9	75.1±0.9	77.1±0.2	96.4±0.0	82.3±0.1	47.5±0.7
CluStream-G - SpectACl	71.4±2.2	73.9±1.0	34.9±1.5	93.3±5.1	82.4±0.2	46.1±1.4
CluStream-C - DBSCAN	73.6±0.0	69.7±0.0	76.1±0.0	93.8±0.0	80.4±0.0	51.7±0.0
CluStream-W - DBSCAN	72.0±0.0	74.3±0.0	77.4±0.0	93.4±0.0	83.8±0.0	51.2±0.0
CluStream-S - DBSCAN	73.9±0.0	73.6±0.0	78.5±0.0	93.3±0.0	84.0±0.0	51.2±0.0
CluStream-G - DBSCAN	72.1±2.5	76.4±0.4	81.6±0.2	75.9±4.0	84.1±0.0	51.4±0.1
CluStream-C - HDBSCAN	73.0±0.0	68.6±0.0	76.7±0.0	96.9±0.0	77.3±0.0	54.3±0.0
CluStream-W - HDBSCAN	72.3±0.0	**78.1**±0.0	75.4±0.0	96.9±0.0	81.8±0.0	56.4±0.0
CluStream-S - HDBSCAN	72.6±0.0	77.8±0.0	72.5±0.0	96.9±0.0	81.7±0.0	57.5±0.0
CluStream-G - HDBSCAN	71.1±2.5	77.8±0.2	80.3±0.3	89.8±1.1	81.7±0.0	53.9±0.2
CluStream-C - RNN-DBS	68.3±0.0	25.0±0.0	71.9±0.0	74.7±0.0	77.1±0.0	49.9±0.0
CluStream-W - RNN-DBS	67.4±0.0	73.2±0.0	52.1±0.0	62.2±0.0	61.6±0.0	51.9±0.0
CluStream-S - RNN-DBS	66.4±0.0	72.9±0.0	53.9±0.0	67.5±0.0	62.1±0.0	52.9±0.0
CluStream-G - RNN-DBS	69.2±2.1	47.5±3.4	64.8±1.1	50.1±11.2	64.2±0.0	53.8±0.1
CluStream-C - MDBSCAN	72.0±0.0	73.6±0.0	75.1±0.0	96.2±0.0	81.4±0.0	54.3±0.0
CluStream-W - MDBSCAN	76.5±0.0	73.8±0.0	73.5±0.0	**99.0**±0.0	84.3±0.0	53.1±0.0
CluStream-S - MDBSCAN	75.3±0.0	73.7±0.0	73.9±0.0	**99.0**±0.0	85.4±0.0	52.9±0.0
CluStream-G - MDBSCAN	73.2±2.4	69.8±0.3	75.4±0.4	93.1±1.6	**85.5**±0.0	53.1±0.0
CluStream-C - DPC	70.9±0.0	69.2±0.0	77.2±0.0	88.5±0.0	84.4±0.0	39.1±0.0
CluStream-W - DPC	65.8±0.0	73.9±0.0	74.8±0.0	77.7±0.0	77.0±0.0	52.6±0.0
CluStream-S - DPC	66.2±0.0	74.9±0.0	75.0±0.0	78.1±0.0	77.0±0.0	53.5±0.0
CluStream-G - DPC	71.3±0.9	72.6±0.1	79.9±0.2	73.9±10.4	76.6±0.2	53.3±0.0
CluStream-C - SNN-DPC	67.6±0.1	46.5±0.1	69.5±0.0	35.8±0.0	71.9±0.0	47.4±0.5
CluStream-W - SNN-DPC	65.1±0.0	59.0±0.7	55.4±0.0	87.0±0.0	73.3±0.1	46.1±0.0
CluStream-S - SNN-DPC	68.1±0.0	56.3±0.0	58.2±0.0	82.7±0.0	71.9±0.0	40.2±0.0
CluStream-G - SNN-DPC	70.1±2.3	64.0±1.2	77.0±0.5	65.7±7.7	79.2±0.0	47.7±1.2
CluStream-C - DBHD	**77.2**±0.0	76.5±0.0	77.8±0.0	93.2±0.0	76.0±0.0	**58.7**±0.0
CluStream-W - DBHD	**77.2**±0.0	76.5±0.0	77.8±0.0	93.2±0.0	76.0±0.0	**58.7**±0.0
CluStream-S - DBHD	**77.2**±0.0	76.5±0.0	77.8±0.0	93.2±0.0	76.0±0.0	**58.7**±0.0
CluStream-G - DBHD	73.9±0.4	73.4±0.8	**81.8**±0.2	47.6±7.7	65.3±0.1	55.8±0.2

Table 38: Accuracy Scores for evaluated datasets using the default parameters for the online phase, but the best-performing parameters according to the sum of ARI and AMI for the offline phase (×100). Competitors are included with default parameters. The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	Accuracy	Accuracy	Accuracy	Accuracy	Accuracy	Accuracy
STREAMKmeans	51.8±2.4	21.6±0.4	66.0±2.1	66.6±6.9	56.8±0.0	34.4±0.0
DenStream	14.1±0.0	44.5±0.0	64.6±0.0	33.3±0.0	71.7±0.0	46.0±0.0
DBSTREAM	29.9±0.0	20.9±0.0	26.4±0.0	61.1±0.0	89.6±0.0	39.7±0.0
EMCStream	59.0±3.1	65.6±3.3	66.3±2.6	73.5±9.4	78.2±6.5	36.9±0.6
MCMSTStream	35.8±0.0	31.7±0.0	78.3±0.0	55.5±0.0	71.3±0.0	37.5±0.0
GB-FuzzyStream	31.2±2.5	40.1±0.9	55.8±0.5	-	-	35.3±0.6
CluStream-O - var. k	15.8±0.0	50.8±0.0	22.6±0.0	11.4±0.0	61.0±0.0	26.1±0.0
CluStream-O - fixed k	49.3±0.0	27.8±0.0	68.2±0.0	80.1±0.0	81.3±0.0	51.0±0.0
CluStream-O - k=100	15.8±0.0	50.8±0.0	22.6±0.0	11.4±0.0	61.0±0.0	26.1±0.0
CluStream - Wk-Means	49.2±1.5	60.2±2.1	81.2±0.7	98.9±0.1	75.5±0.3	53.4±0.6
CluStream-C - k-Means	50.2±2.5	30.9±2.3	77.4±0.8	97.6±0.7	81.5±0.1	50.1±0.6
CluStream-W - k-Means	49.2±1.5	60.2±2.1	81.2±0.7	98.9±0.1	75.5±0.3	53.4±0.6
CluStream-S - k-Means	48.1±1.9	59.4±1.6	82.3±0.6	98.7±0.0	76.1±0.2	51.9±0.4
CluStream-G - k-Means	47.9±1.5	59.6±2.4	82.4±0.7	98.8±0.0	76.1±0.2	51.9±0.5
CluStream-C - SubKMeans	48.3±0.6	50.7±2.8	78.0±1.0	97.7±0.6	81.5±0.1	50.2±1.3
CluStream-W - SubKMeans	48.8±2.0	62.9±2.5	79.7±1.2	98.8±0.1	75.9±0.4	53.2±0.9
CluStream-S - SubKMeans	48.6±1.9	62.8±1.4	80.7±0.8	98.7±0.0	76.5±0.4	52.9±0.6
CluStream-G - SubKMeans	48.3±1.5	62.0±2.7	81.8±0.9	98.8±0.0	76.5±0.4	52.9±0.4
CluStream-C - X-Means	57.9±0.6	34.3±5.6	78.9±0.7	43.9±0.8	78.2±0.1	41.1±0.5
CluStream-W - X-Means	17.2±0.4	52.6±0.4	73.6±1.2	29.5±0.0	61.1±0.0	26.2±0.0
CluStream-S - X-Means	16.3±0.1	52.1±0.2	74.3±0.8	28.2±1.0	61.0±0.0	26.1±0.0
CluStream-G - X-Means	30.7±5.1	56.0±0.7	76.7±1.2	26.8±0.4	63.7±0.0	26.2±0.0
CluStream-C - P-Dip-M	29.9±0.0	20.9±0.0	28.4±0.0	72.8±3.9	85.0±0.1	47.0±0.5
CluStream-W - P-Dip-M	22.7±0.3	-	27.9±0.2	20.1±3.5	-	-
CluStream-S - P-Dip-M	22.0±0.1	-	27.8±0.2	21.8±0.3	-	-
CluStream-G - P-Dip-M	49.8±1.8	56.7±0.4	81.6±0.5	51.2±1.1	70.9±0.0	28.5±0.1
CluStream-C - SC	54.4±0.5	54.2±0.5	82.0±0.0	98.7±0.0	85.1±0.0	52.9±1.1
CluStream-W - SC	60.4±2.1	59.1±0.6	81.6±0.4	98.7±0.0	77.4±0.1	60.8±0.6
CluStream-S - SC	58.1±0.5	61.9±0.2	81.0±0.5	98.7±0.0	75.9±0.1	**62.1**±0.5
CluStream-G - SC	58.1±3.5	60.6±1.1	80.9±0.3	98.8±0.0	75.2±0.1	56.9±1.3
CluStream-C - SCAR	55.4±1.3	52.7±2.1	80.4±0.1	94.4±4.6	83.9±0.2	55.2±0.8
CluStream-W - SCAR	55.0±2.5	61.7±0.5	63.8±0.2	80.3±5.7	73.7±0.3	53.9±0.5
CluStream-S - SCAR	57.5±1.4	59.8±0.6	64.3±0.2	76.0±7.2	73.8±0.2	53.1±1.5
CluStream-G - SCAR	56.7±1.9	59.9±1.4	64.5±0.4	82.9±4.8	65.6±0.1	55.4±0.4
CluStream-C - SpectACl	59.4±2.7	65.3±1.0	74.5±0.9	94.2±4.6	78.4±0.1	53.3±0.8
CluStream-W - SpectACl	61.8±2.3	**69.3**±0.9	48.4±2.0	99.4±0.0	85.4±0.1	54.9±1.2
CluStream-S - SpectACl	61.9±4.7	67.0±1.7	74.8±0.6	99.4±0.0	86.8±0.1	54.9±0.4
CluStream-G - SpectACl	59.6±3.1	65.5±1.9	43.3±1.2	98.2±2.4	86.8±0.1	54.2±1.3
CluStream-C - DBSCAN	62.7±0.0	54.9±0.0	73.9±0.0	96.5±0.0	86.7±0.0	41.6±0.0
CluStream-W - DBSCAN	63.6±0.0	61.4±0.0	75.2±0.0	96.5±0.0	85.6±0.0	41.9±0.0
CluStream-S - DBSCAN	64.1±0.0	60.6±0.0	76.5±0.0	96.4±0.0	85.6±0.0	42.3±0.0
CluStream-G - DBSCAN	59.4±2.6	63.2±0.7	81.2±0.2	87.8±2.4	85.6±0.0	42.7±0.0
CluStream-C - HDBSCAN	62.7±0.0	59.0±0.0	74.6±0.0	99.2±0.0	86.9±0.0	46.0±0.0
CluStream-W - HDBSCAN	62.5±0.0	66.7±0.0	73.9±0.0	99.2±0.0	88.8±0.0	46.8±0.0
CluStream-S - HDBSCAN	63.1±0.0	65.0±0.0	71.6±0.0	99.2±0.0	88.3±0.0	45.5±0.0
CluStream-G - HDBSCAN	61.9±1.9	64.2±0.2	82.4±0.4	93.8±0.7	88.3±0.0	50.4±0.4
CluStream-C - RNN-DBS	48.6±0.0	31.1±0.0	70.5±0.0	90.2±0.0	85.0±0.0	46.6±0.0
CluStream-W - RNN-DBS	58.3±0.0	57.0±0.0	46.0±0.0	69.4±0.0	74.2±0.0	45.7±0.0
CluStream-S - RNN-DBS	58.7±0.0	55.9±0.0	25.7±0.0	73.5±0.0	74.4±0.0	49.0±0.0
CluStream-G - RNN-DBS	53.5±1.6	44.2±1.5	62.9±1.9	61.5±5.6	75.1±0.1	43.1±0.2
CluStream-C - MDBSCAN	63.6±0.0	53.9±0.0	76.4±0.0	99.2±0.0	86.9±0.0	40.4±0.0
CluStream-W - MDBSCAN	**66.8**±0.0	55.2±0.0	73.7±0.0	**99.9**±0.0	92.4±0.0	44.0±0.0
CluStream-S - MDBSCAN	64.9±0.0	55.6±0.0	74.0±0.0	**99.9**±0.0	**93.2**±0.0	43.6±0.0
CluStream-G - MDBSCAN	60.1±2.5	55.2±1.0	75.8±0.6	97.3±2.9	**93.2**±0.0	35.9±0.0
CluStream-C - DPC	57.3±0.0	56.8±0.0	78.4±0.0	83.9±0.0	90.1±0.0	39.4±0.0
CluStream-W - DPC	54.4±0.0	62.7±0.0	74.3±0.0	83.9±0.0	81.6±0.0	42.4±0.0
CluStream-S - DPC	57.1±0.0	61.9±0.0	74.7±0.0	88.4±0.0	81.8±0.0	39.6±0.0
CluStream-G - DPC	50.3±1.1	58.5±0.3	81.4±0.5	82.6±4.2	86.5±0.1	39.1±0.0
CluStream-C - SNN-DPC	60.3±1.0	38.8±0.0	67.6±0.1	74.4±0.0	74.6±0.0	55.4±1.2
CluStream-W - SNN-DPC	58.7±0.0	49.6±0.7	57.4±0.0	96.3±0.0	78.4±0.1	57.2±0.0
CluStream-S - SNN-DPC	61.6±0.0	47.8±0.0	58.6±0.0	94.2±0.0	78.8±0.0	55.8±0.0
CluStream-G - SNN-DPC	55.8±3.1	56.3±1.6	76.6±0.8	84.2±4.5	82.8±0.0	54.3±1.3
CluStream-C - DBHD	65.2±0.0	57.9±0.0	77.4±0.0	98.9±0.0	79.3±0.0	57.8±0.0
CluStream-W - DBHD	65.2±0.0	57.9±0.0	77.4±0.0	98.9±0.0	79.3±0.0	57.8±0.0
CluStream-S - DBHD	65.2±0.0	57.9±0.0	77.4±0.0	98.9±0.0	79.3±0.0	57.8±0.0
CluStream-G - DBHD	56.4±1.4	57.7±0.7	**84.7**±0.3	51.4±3.2	69.4±0.1	44.0±0.2

Table 39: Precision Scores for evaluated datasets using the default parameters for the online phase, but the best-performing parameters according to the sum of ARI and AMI for the offline phase (×100). Competitors are included with default parameters. The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	Precision	Precision	Precision	Precision	Precision	Precision
STREAMKmeans	48.4±4.2	13.1±0.1	54.5±2.6	58.4±7.2	40.9±0.0	25.9±0.0
DenStream	90.4±0.0	**77.6**±0.0	78.7±0.0	91.3±0.0	98.8±0.0	49.8±0.0
DBSTREAM	18.6±0.0	13.0±0.0	19.9±0.0	52.4±0.0	98.7±0.0	29.0±0.0
EMCStream	59.9±1.4	56.1±2.7	53.6±2.6	65.3±9.6	74.3±9.0	28.3±0.4
MCMSTStream	19.1±0.0	16.9±0.0	79.6±0.0	99.4±0.0	75.3±0.0	39.2±0.0
GB-FuzzyStream	23.8±10.5	20.7±0.9	36.8±0.4	-	-	28.6±0.2
CluStream-O - var. k	**99.9**±0.0	73.2±0.0	**93.1**±0.0	99.5±0.0	**100.0**±0.0	**85.6**±0.0
CluStream-O - fixed k	56.6±0.0	16.7±0.0	58.0±0.0	67.7±0.0	99.7±0.0	42.4±0.0
CluStream-O - k=100	**99.9**±0.0	73.2±0.0	**93.1**±0.0	99.5±0.0	**100.0**±0.0	**85.6**±0.0
CluStream - Wk-Means	59.4±1.3	47.8±1.7	81.1±0.6	97.8±0.0	99.8±0.0	52.1±1.0
CluStream-C - k-Means	59.5±2.4	20.0±1.5	70.5±0.7	95.6±1.5	99.8±0.0	44.0±1.2
CluStream-W - k-Means	59.4±1.3	47.8±1.7	81.1±0.6	97.8±0.0	99.8±0.0	52.1±1.0
CluStream-S - k-Means	58.2±1.6	45.9±1.4	81.2±0.6	97.7±0.0	99.8±0.0	51.0±0.7
CluStream-G - k-Means	58.7±1.4	47.2±2.3	82.2±0.6	98.0±0.0	99.8±0.0	51.1±0.8
CluStream-C - SubKMeans	57.2±1.5	34.4±2.2	71.8±0.8	95.8±1.3	99.8±0.0	43.8±1.3
CluStream-W - SubKMeans	57.3±1.5	50.1±2.3	83.3±0.4	97.8±0.0	99.8±0.0	52.2±0.8
CluStream-S - SubKMeans	57.6±1.3	50.1±2.3	83.0±0.6	97.7±0.0	99.8±0.0	52.2±0.6
CluStream-G - SubKMeans	58.6±1.5	50.7±3.1	82.0±0.5	98.0±0.0	99.8±0.0	52.0±0.6
CluStream-C - X-Means	49.8±0.5	23.9±6.8	74.3±1.1	98.3±0.7	99.8±0.0	62.7±0.5
CluStream-W - X-Means	99.7±0.1	72.7±0.4	75.7±0.6	99.5±0.0	99.9±0.0	**85.6**±0.0
CluStream-S - X-Means	99.7±0.2	73.1±0.2	75.7±0.6	99.5±0.0	**100.0**±0.0	**85.6**±0.0
CluStream-G - X-Means	92.3±7.2	66.9±0.3	83.2±1.5	99.7±0.2	**100.0**±0.0	**85.6**±0.0
CluStream-C - P-Dip-M	18.6±0.0	12.9±0.0	21.5±0.0	66.6±4.8	97.5±0.1	43.5±0.8
CluStream-W - P-Dip-M	97.5±0.9	-	90.2±0.2	99.5±0.0	-	-
CluStream-S - P-Dip-M	97.7±0.4	-	89.9±0.1	99.5±0.0	-	-
CluStream-G - P-Dip-M	63.4±1.7	60.8±0.7	71.3±0.7	97.7±0.3	99.9±0.0	84.0±0.3
CluStream-C - SC	53.2±0.3	41.4±1.1	79.7±0.0	97.7±0.0	99.0±0.1	46.7±1.4
CluStream-W - SC	66.1±2.3	52.6±0.9	76.8±0.4	97.7±0.0	99.4±0.0	60.1±0.7
CluStream-S - SC	65.7±0.3	58.3±0.0	76.7±0.6	97.7±0.0	97.0±0.1	60.9±0.7
CluStream-G - SC	64.2±3.6	56.6±1.1	77.0±0.3	98.0±0.1	98.2±0.1	55.1±1.4
CluStream-C - SCAR	62.4±0.8	43.5±2.7	80.0±0.4	92.1±5.7	98.8±0.1	49.0±1.4
CluStream-W - SCAR	62.2±2.1	57.5±0.5	78.0±0.1	76.5±7.0	96.8±0.4	59.1±0.9
CluStream-S - SCAR	64.5±2.5	55.5±1.1	78.4±0.2	70.5±6.6	89.4±0.2	55.6±1.7
CluStream-G - SCAR	65.1±2.7	57.0±1.1	77.8±0.3	77.5±4.5	99.6±0.0	61.2±0.4
CluStream-C - SpectACl	61.9±1.9	57.5±2.0	65.9±1.5	92.6±5.8	97.4±0.1	48.3±1.6
CluStream-W - SpectACl	68.5±1.8	59.9±1.1	37.2±1.8	98.6±0.0	99.0±0.1	54.7±0.9
CluStream-S - SpectACl	66.7±4.6	59.6±1.3	82.7±0.3	98.6±0.0	98.2±0.2	54.4±0.7
CluStream-G - SpectACl	66.0±3.0	57.2±1.8	31.4±1.1	96.9±2.9	98.4±0.3	53.8±1.3
CluStream-C - DBSCAN	56.3±0.0	50.9±0.0	62.4±0.0	99.7±0.0	99.8±0.0	61.8±0.0
CluStream-W - DBSCAN	53.3±0.0	51.0±0.0	62.9±0.0	99.7±0.0	99.0±0.0	61.1±0.0
CluStream-S - DBSCAN	57.6±0.0	50.8±0.0	64.7±0.0	99.7±0.0	98.9±0.0	60.9±0.0
CluStream-G - DBSCAN	63.8±8.0	58.7±1.7	73.5±0.2	89.6±3.1	98.9±0.0	60.9±0.0
CluStream-C - HDBSCAN	71.1±0.0	43.6±0.0	63.0±0.0	99.7±0.0	91.3±0.0	64.2±0.0
CluStream-W - HDBSCAN	65.1±0.0	68.0±0.0	61.4±0.0	99.7±0.0	94.2±0.0	72.4±0.0
CluStream-S - HDBSCAN	65.9±0.0	68.2±0.0	75.1±0.0	99.7±0.0	95.6±0.0	74.3±0.0
CluStream-G - HDBSCAN	62.3±4.2	67.9±0.2	74.9±0.6	98.2±0.7	95.6±0.0	64.4±0.4
CluStream-C - RNN-DBS	65.7±0.0	19.5±0.0	72.3±0.0	88.0±0.0	94.1±0.0	58.2±0.0
CluStream-W - RNN-DBS	54.8±0.0	67.0±0.0	46.3±0.0	96.5±0.0	77.9±0.0	60.3±0.0
CluStream-S - RNN-DBS	54.1±0.0	67.8±0.0	72.8±0.0	99.3±0.0	78.1±0.0	60.2±0.0
CluStream-G - RNN-DBS	62.0±5.8	36.2±0.4	66.6±2.2	90.2±4.6	82.1±0.1	68.0±0.2
CluStream-C - MDBSCAN	53.3±0.0	69.4±0.0	68.3±0.0	99.4±0.0	99.3±0.0	68.5±0.0
CluStream-W - MDBSCAN	62.9±0.0	69.1±0.0	61.0±0.0	99.7±0.0	93.8±0.0	63.7±0.0
CluStream-S - MDBSCAN	58.1±0.0	68.0±0.0	61.1±0.0	99.7±0.0	94.7±0.0	67.7±0.0
CluStream-G - MDBSCAN	62.7±7.9	64.9±0.8	63.5±0.6	97.4±0.3	94.9±0.0	75.9±0.1
CluStream-C - DPC	64.4±0.0	50.5±0.0	69.7±0.0	**99.8**±0.0	94.1±0.0	51.7±0.0
CluStream-W - DPC	52.4±0.0	61.6±0.0	66.6±0.0	93.5±0.0	99.9±0.0	64.7±0.0
CluStream-S - DPC	52.8±0.0	65.5±0.0	66.8±0.0	92.3±0.0	99.9±0.0	68.2±0.0
CluStream-G - DPC	76.9±2.3	63.4±0.1	76.0±0.7	93.2±5.4	91.2±0.1	68.0±0.0
CluStream-C - SNN-DPC	59.6±0.4	25.4±0.0	63.0±0.0	67.1±0.0	98.5±0.0	45.7±0.5
CluStream-W - SNN-DPC	60.7±0.0	32.7±0.9	44.1±0.0	92.8±0.0	95.3±0.1	46.2±0.0
CluStream-S - SNN-DPC	60.6±0.0	31.5±0.0	46.5±0.0	90.3±0.0	94.0±0.0	42.6±0.0
CluStream-G - SNN-DPC	59.2±4.0	44.1±2.0	67.4±1.2	81.8±4.3	99.7±0.0	47.0±0.8
CluStream-C - DBHD	78.6±0.0	69.5±0.0	78.7±0.0	98.0±0.0	98.9±0.0	66.4±0.0
CluStream-W - DBHD	78.6±0.0	69.5±0.0	78.7±0.0	98.0±0.0	98.9±0.0	66.4±0.0
CluStream-S - DBHD	78.6±0.0	69.5±0.0	78.7±0.0	98.0±0.0	98.9±0.0	66.4±0.0
CluStream-G - DBHD	75.3±2.2	66.4±1.0	82.3±0.6	92.0±5.6	91.0±0.1	75.7±0.8

Table 40: Recall Scores for evaluated datasets using the default parameters for the online phase, but the best-performing parameters according to the sum of ARI and AMI for the offline phase (×100). Competitors are included with default parameters. The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	Recall	Recall	Recall	Recall	Recall	Recall
STREAMKmeans	48.6±4.2	97.8±0.7	87.7±0.8	96.3±3.0	**100.0**±0.0	**100.0**±0.0
DenStream	5.2±0.0	23.9±0.0	58.3±0.0	22.8±0.0	75.5±0.0	38.9±0.0
DBSTREAM	**100.0**±0.0	99.3±0.0	**100.0**±0.0	**100.0**±0.0	92.6±0.0	78.9±0.0
EMCStream	57.9±6.2	77.5±5.9	89.3±0.5	80.2±8.3	80.6±12.6	83.7±1.1
MCMSTStream	71.2±0.0	54.8±0.0	73.3±0.0	43.8±0.0	80.4±0.0	44.4±0.0
GB-FuzzyStream	85.3±29.3	52.6±0.5	51.7±0.3	-	-	52.3±0.5
CluStream-O - var. k	6.1±0.0	46.2±0.0	13.1±0.0	5.6±0.0	64.6±0.0	15.6±0.0
CluStream-O - fixed k	38.7±0.0	92.3±0.0	84.6±0.0	89.0±0.0	81.8±0.0	56.3±0.0
CluStream-O - k=100	6.1±0.0	46.2±0.0	13.1±0.0	5.6±0.0	64.6±0.0	15.6±0.0
CluStream - Wk-Means	37.5±0.7	76.3±2.5	80.2±1.2	98.1±0.4	84.8±0.4	47.8±1.0
CluStream-C - k-Means	37.7±1.7	90.3±2.0	85.9±0.9	95.9±0.9	88.4±0.0	53.2±2.0
CluStream-W - k-Means	37.5±0.7	76.3±2.5	80.2±1.2	98.1±0.4	84.8±0.4	47.8±1.0
CluStream-S - k-Means	36.1±1.1	77.4±3.4	82.1±0.9	97.4±0.0	85.0±0.4	47.2±1.5
CluStream-G - k-Means	36.8±1.1	77.8±2.7	81.6±1.0	97.5±0.0	85.1±0.4	47.3±1.4
CluStream-C - SubKMeans	37.3±1.5	74.2±3.0	84.6±1.0	96.1±0.7	88.4±0.0	52.4±1.7
CluStream-W - SubKMeans	36.8±1.5	74.6±4.3	77.2±1.8	97.8±0.5	84.7±0.3	48.1±0.7
CluStream-S - SubKMeans	36.7±1.2	76.8±3.4	78.6±1.2	97.4±0.0	85.1±0.4	47.0±0.9
CluStream-G - SubKMeans	37.0±1.1	77.4±3.3	80.7±1.3	97.5±0.0	85.1±0.4	47.4±1.0
CluStream-C - X-Means	68.5±0.7	88.5±5.1	87.0±0.3	34.2±0.6	84.1±0.1	32.0±0.7
CluStream-W - X-Means	6.4±0.1	47.2±0.2	80.7±1.5	21.7±0.0	64.6±0.0	15.6±0.0
CluStream-S - X-Means	6.2±0.0	46.7±0.1	81.7±1.2	21.0±0.5	64.6±0.0	15.6±0.0
CluStream-G - X-Means	19.3±8.7	53.4±0.5	78.4±2.0	19.8±0.1	70.5±0.1	15.6±0.0
CluStream-C - P-Dip-M	**100.0**±0.0	**100.0**±0.0	99.5±0.0	**100.0**±0.0	89.8±0.0	68.1±1.0
CluStream-W - P-Dip-M	9.5±0.1	-	18.4±0.2	12.7±2.8	-	-
CluStream-S - P-Dip-M	9.1±0.1	-	18.0±0.2	14.1±0.1	-	-
CluStream-G - P-Dip-M	40.1±2.0	57.3±0.6	91.2±0.4	43.8±0.7	79.7±0.0	18.6±0.1
CluStream-C - SC	57.5±0.8	85.6±1.7	84.1±0.1	97.4±0.0	89.6±0.0	61.6±1.3
CluStream-W - SC	49.9±1.6	63.9±0.6	82.5±0.6	97.4±0.0	83.8±0.1	57.1±1.1
CluStream-S - SC	48.5±0.5	62.8±0.1	81.9±0.4	97.4±0.0	85.7±0.0	59.1±0.8
CluStream-G - SC	46.5±1.9	60.4±1.3	81.8±0.4	97.6±0.1	84.9±0.1	52.4±1.5
CluStream-C - SCAR	42.7±1.2	79.3±1.5	78.5±0.2	96.0±0.8	86.7±0.1	54.9±1.0
CluStream-W - SCAR	43.3±1.9	64.4±0.8	56.5±0.3	85.3±5.9	74.7±0.2	45.6±0.5
CluStream-S - SCAR	45.9±1.5	63.6±0.2	56.8±0.4	76.1±4.6	77.4±0.4	46.9±1.2
CluStream-G - SCAR	46.7±2.0	60.1±2.0	57.5±0.5	83.0±3.6	71.8±0.2	44.7±0.4
CluStream-C - SpectACl	47.3±2.5	64.7±0.8	88.6±0.4	99.6±0.2	87.0±0.1	52.1±2.7
CluStream-W - SpectACl	50.2±2.3	72.4±1.1	69.1±1.5	99.2±0.0	90.1±0.1	48.4±0.8
CluStream-S - SpectACl	49.9±3.1	68.3±2.5	68.2±1.0	99.2±0.0	90.8±0.0	49.0±1.1
CluStream-G - SpectACl	49.7±3.3	64.1±2.6	70.8±1.8	97.8±2.6	90.8±0.1	47.5±1.3
CluStream-C - DBSCAN	57.9±0.0	64.8±0.0	92.1±0.0	93.7±0.0	89.9±0.0	48.0±0.0
CluStream-W - DBSCAN	64.6±0.0	72.7±0.0	92.8±0.0	93.6±0.0	91.0±0.0	48.3±0.0
CluStream-S - DBSCAN	57.3±0.0	71.6±0.0	92.8±0.0	93.5±0.0	91.1±0.0	48.5±0.0
CluStream-G - DBSCAN	49.8±4.9	63.7±1.0	89.4±0.1	89.6±1.9	91.1±0.0	48.8±0.1
CluStream-C - HDBSCAN	47.1±0.0	80.5±0.0	92.4±0.0	98.5±0.0	91.6±0.0	41.1±0.0
CluStream-W - HDBSCAN	50.4±0.0	63.5±0.0	92.6±0.0	98.5±0.0	93.7±0.0	34.6±0.0
CluStream-S - HDBSCAN	49.6±0.0	60.9±0.0	65.5±0.0	98.5±0.0	92.5±0.0	32.9±0.0
CluStream-G - HDBSCAN	52.5±2.2	60.4±0.0	86.8±0.5	90.6±0.7	92.5±0.0	39.9±0.2
CluStream-C - RNN-DBS	32.1±0.0	94.9±0.0	72.0±0.0	**100.0**±0.0	89.8±0.0	41.5±0.0
CluStream-W - RNN-DBS	48.4±0.0	49.9±0.0	41.0±0.0	57.2±0.0	80.6±0.0	36.3±0.0
CluStream-S - RNN-DBS	49.2±0.0	49.0±0.0	15.3±0.0	61.2±0.0	80.9±0.0	40.5±0.0
CluStream-G - RNN-DBS	47.9±7.7	74.5±1.1	63.1±1.5	61.0±3.5	78.5±0.0	31.5±0.3
CluStream-C - MDBSCAN	64.6±0.0	50.3±0.0	88.4±0.0	98.7±0.0	90.4±0.0	36.7±0.0
CluStream-W - MDBSCAN	59.4±0.0	52.3±0.0	92.6±0.0	99.8±0.0	95.9±0.0	44.3±0.0
CluStream-S - MDBSCAN	60.6±0.0	52.6±0.0	92.7±0.0	99.8±0.0	96.1±0.0	36.9±0.0
CluStream-G - MDBSCAN	51.0±5.1	48.1±1.6	92.8±0.1	96.6±3.5	96.0±0.0	25.3±0.0
CluStream-C - DPC	42.0±0.0	64.3±0.0	89.3±0.0	89.0±0.0	94.3±0.0	45.2±0.0
CluStream-W - DPC	61.8±0.0	68.9±0.0	88.3±0.0	79.5±0.0	88.0±0.0	35.5±0.0
CluStream-S - DPC	65.0±0.0	63.7±0.0	88.4±0.0	83.0±0.0	88.0±0.0	32.0±0.0
CluStream-G - DPC	31.7±0.5	58.9±0.9	90.2±0.2	82.2±1.0	94.1±0.1	31.5±0.0
CluStream-C - SNN-DPC	51.7±3.4	84.3±0.0	76.1±0.1	85.8±0.0	81.6±0.0	61.2±1.1
CluStream-W - SNN-DPC	66.9±0.0	87.0±0.4	83.7±0.0	96.6±0.0	83.6±0.1	71.4±0.0
CluStream-S - SNN-DPC	67.3±0.0	87.6±0.0	83.2±0.0	96.5±0.0	85.3±0.0	70.6±0.0
CluStream-G - SNN-DPC	48.4±4.2	63.9±1.6	90.9±0.2	92.5±2.9	88.7±0.0	67.3±1.0
CluStream-C - DBHD	48.8±0.0	50.3±0.0	78.0±0.0	97.8±0.0	87.3±0.0	51.9±0.0
CluStream-W - DBHD	48.8±0.0	50.3±0.0	78.0±0.0	97.8±0.0	87.3±0.0	51.9±0.0
CluStream-S - DBHD	48.8±0.0	50.3±0.0	78.0±0.0	97.8±0.0	87.3±0.0	51.9±0.0
CluStream-G - DBHD	41.7±1.8	50.4±1.0	83.8±0.6	42.9±1.1	71.5±0.1	31.5±0.2

Table 41: F1 Scores for evaluated datasets using the default parameters for the online phase, but the best-performing parameters according to the sum of ARI and AMI for the offline phase (×100). Competitors are included with default parameters. The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	F1	F1	F1	F1	F1	F1
STREAMKmeans	48.3±3.4	23.1±0.1	66.0±1.9	71.7±4.1	58.0±0.0	40.8±0.0
DenStream	9.8±0.0	36.5±0.0	65.6±0.0	36.1±0.0	85.5±0.0	42.9±0.0
DBSTREAM	31.4±0.0	23.0±0.0	33.0±0.0	68.8±0.0	**95.6**±0.0	41.5±0.0
EMCStream	58.2±3.0	64.6±3.8	64.7±2.1	70.3±5.0	75.8±8.8	40.6±0.6
MCMSTStream	30.0±0.0	25.8±0.0	75.5±0.0	56.9±0.0	76.9±0.0	38.8±0.0
GB-FuzzyStream	31.0±0.8	29.5±0.9	42.5±0.4	-	-	36.2±0.3
CluStream-O - var. k	11.4±0.0	54.7±0.0	22.8±0.0	10.6±0.0	78.1±0.0	25.6±0.0
CluStream-O - fixed k	46.0±0.0	28.0±0.0	67.5±0.0	76.4±0.0	89.8±0.0	46.7±0.0
CluStream-O - k=100	11.4±0.0	54.7±0.0	22.8±0.0	10.6±0.0	78.1±0.0	25.6±0.0
CluStream - Wk-Means	45.9±0.9	58.2±1.8	80.1±0.6	98.0±0.2	91.6±0.3	48.5±0.7
CluStream-C - k-Means	46.2±1.9	32.5±1.8	76.5±0.8	95.7±1.2	93.7±0.0	45.8±0.9
CluStream-W - k-Means	45.9±0.9	58.2±1.8	80.1±0.6	98.0±0.2	91.6±0.3	48.5±0.7
CluStream-S - k-Means	44.6±1.3	57.2±1.6	81.0±0.4	97.5±0.0	91.8±0.2	47.6±0.7
CluStream-G - k-Means	45.2±1.2	58.2±2.1	81.3±0.6	97.8±0.0	91.8±0.2	47.6±0.7
CluStream-C - SubKMeans	45.1±1.3	46.5±2.2	76.8±0.9	95.9±1.0	93.7±0.0	45.5±1.4
CluStream-W - SubKMeans	44.8±1.5	59.5±3.0	79.3±1.2	97.8±0.3	91.6±0.2	48.5±0.3
CluStream-S - SubKMeans	44.8±1.2	60.1±2.2	80.0±0.6	97.5±0.0	91.9±0.2	48.1±0.5
CluStream-G - SubKMeans	45.3±1.2	60.6±2.7	80.7±0.8	97.8±0.0	91.8±0.2	48.2±0.5
CluStream-C - X-Means	57.6±0.6	36.0±5.9	79.1±0.6	47.6±0.8	91.2±0.1	40.3±0.4
CluStream-W - X-Means	12.0±0.3	55.2±0.2	74.3±1.1	29.8±0.0	78.1±0.0	25.6±0.0
CluStream-S - X-Means	11.6±0.0	55.0±0.0	75.1±0.6	28.6±0.9	78.1±0.0	25.6±0.0
CluStream-G - X-Means	25.8±5.7	57.4±0.4	78.3±1.1	26.4±0.2	82.5±0.0	25.6±0.0
CluStream-C - P-Dip-M	31.4±0.0	22.9±0.0	34.8±0.0	78.1±3.1	93.5±0.0	46.4±0.4
CluStream-W - P-Dip-M	17.2±0.2	-	30.1±0.2	21.0±3.9	-	-
CluStream-S - P-Dip-M	16.6±0.2	-	29.6±0.2	22.9±0.1	-	-
CluStream-G - P-Dip-M	49.0±1.2	57.0±0.4	79.1±0.4	53.4±0.9	88.6±0.0	29.4±0.2
CluStream-C - SC	55.1±0.5	54.3±1.4	81.0±0.0	97.5±0.0	94.1±0.0	50.7±1.1
CluStream-W - SC	56.8±1.9	57.4±0.5	78.9±0.4	97.5±0.0	90.8±0.0	56.7±0.9
CluStream-S - SC	55.7±0.3	59.8±0.1	78.4±0.4	97.5±0.0	90.9±0.1	**58.3**±0.4
CluStream-G - SC	53.7±2.6	58.4±1.1	78.5±0.2	97.8±0.1	91.0±0.1	53.0±1.3
CluStream-C - SCAR	50.6±1.1	54.4±2.2	78.5±0.2	93.5±3.9	92.1±0.1	50.3±0.8
CluStream-W - SCAR	50.9±1.9	60.1±0.4	64.7±0.2	80.1±6.3	83.7±0.2	50.6±0.4
CluStream-S - SCAR	53.6±1.8	59.0±0.6	65.1±0.3	72.6±4.5	82.2±0.2	50.0±1.4
CluStream-G - SCAR	54.2±2.0	58.4±1.2	65.3±0.3	79.8±3.6	83.3±0.1	50.9±0.4
CluStream-C - SpectACl	53.5±1.6	60.6±1.4	74.5±0.9	95.1±3.8	91.8±0.0	48.5±0.8
CluStream-W - SpectACl	57.7±1.4	**65.2**±0.8	46.8±1.4	98.9±0.0	94.3±0.0	50.3±0.7
CluStream-S - SpectACl	56.9±3.5	63.2±1.7	74.0±0.6	98.9±0.0	94.2±0.1	50.3±0.5
CluStream-G - SpectACl	56.5±2.7	60.0±1.7	42.1±0.8	97.3±2.8	94.3±0.1	49.3±1.2
CluStream-C - DBSCAN	55.8±0.0	54.5±0.0	72.8±0.0	96.3±0.0	94.6±0.0	43.4±0.0
CluStream-W - DBSCAN	57.6±0.0	57.6±0.0	73.5±0.0	96.2±0.0	94.8±0.0	43.7±0.0
CluStream-S - DBSCAN	55.7±0.0	56.9±0.0	74.7±0.0	96.2±0.0	94.8±0.0	44.0±0.0
CluStream-G - DBSCAN	53.4±1.5	60.1±0.8	79.5±0.2	89.3±1.4	94.8±0.0	44.2±0.0
CluStream-C - HDBSCAN	56.3±0.0	55.5±0.0	73.6±0.0	99.1±0.0	91.1±0.0	46.8±0.0
CluStream-W - HDBSCAN	56.5±0.0	63.2±0.0	72.3±0.0	99.1±0.0	93.5±0.0	45.1±0.0
CluStream-S - HDBSCAN	56.4±0.0	62.2±0.0	69.4±0.0	99.1±0.0	93.8±0.0	44.3±0.0
CluStream-G - HDBSCAN	56.6±2.6	62.1±0.1	79.4±0.3	93.7±0.7	93.8±0.0	48.2±0.3
CluStream-C - RNN-DBS	43.0±0.0	31.5±0.0	70.5±0.0	92.1±0.0	91.8±0.0	46.2±0.0
CluStream-W - RNN-DBS	50.9±0.0	55.5±0.0	40.7±0.0	69.7±0.0	77.8±0.0	43.2±0.0
CluStream-S - RNN-DBS	51.0±0.0	55.2±0.0	25.0±0.0	73.7±0.0	78.1±0.0	46.7±0.0
CluStream-G - RNN-DBS	50.2±1.0	42.2±0.6	62.7±1.5	63.9±4.5	79.1±0.0	41.3±0.4
CluStream-C - MDBSCAN	57.6±0.0	57.5±0.0	75.1±0.0	99.0±0.0	94.6±0.0	40.9±0.0
CluStream-W - MDBSCAN	57.8±0.0	58.8±0.0	72.3±0.0	**99.8**±0.0	94.6±0.0	45.3±0.0
CluStream-S - MDBSCAN	57.8±0.0	58.7±0.0	72.6±0.0	**99.8**±0.0	95.3±0.0	42.8±0.0
CluStream-G - MDBSCAN	53.9±1.5	54.8±1.2	74.2±0.4	96.8±2.0	95.3±0.0	36.6±0.0
CluStream-C - DPC	50.7±0.0	54.4±0.0	77.3±0.0	93.6±0.0	93.8±0.0	39.8±0.0
CluStream-W - DPC	56.6±0.0	64.6±0.0	74.7±0.0	85.1±0.0	93.6±0.0	42.1±0.0
CluStream-S - DPC	58.1±0.0	64.4±0.0	74.8±0.0	86.7±0.0	93.6±0.0	40.0±0.0
CluStream-G - DPC	44.7±0.8	60.4±0.3	81.5±0.4	85.2±3.9	91.3±0.1	40.2±0.0
CluStream-C - SNN-DPC	55.0±1.9	38.3±0.0	67.3±0.0	74.1±0.0	89.0±0.0	50.6±0.3
CluStream-W - SNN-DPC	59.3±0.0	47.1±0.8	55.9±0.0	94.5±0.0	88.8±0.1	54.0±0.0
CluStream-S - SNN-DPC	59.1±0.0	45.7±0.0	57.5±0.0	92.9±0.0	89.1±0.0	51.4±0.0
CluStream-G - SNN-DPC	52.9±3.4	51.6±1.8	76.3±0.8	86.0±3.5	93.9±0.0	52.1±1.0
CluStream-C - DBHD	**59.6**±0.0	57.2±0.0	77.2±0.0	97.9±0.0	92.7±0.0	56.3±0.0
CluStream-W - DBHD	**59.6**±0.0	57.2±0.0	77.2±0.0	97.9±0.0	92.7±0.0	56.3±0.0
CluStream-S - DBHD	**59.6**±0.0	57.2±0.0	77.2±0.0	97.9±0.0	92.7±0.0	56.3±0.0
CluStream-G - DBHD	51.6±1.5	55.3±1.0	**82.3**±0.2	54.6±2.9	79.6±0.1	43.2±0.3

Table 42: FMI Scores for evaluated datasets using the default parameters for the online phase, but the best-performing parameters according to the sum of ARI and AMI for the offline phase (×100). Competitors are included with default parameters. The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	FMI	FMI	FMI	FMI	FMI	FMI
STREAMKmeans	48.4±3.5	35.8±0.0	68.5±1.5	74.4±3.4	63.9±0.0	50.6±0.0
DenStream	21.6±0.0	43.0±0.0	66.9±0.0	45.2±0.0	86.3±0.0	43.6±0.0
DBSTREAM	43.1±0.0	35.9±0.0	44.3±0.0	72.4±0.0	**95.6**±0.0	47.1±0.0
EMCStream	58.6±3.2	**65.7**±4.0	67.9±1.6	71.5±4.5	76.6±8.5	47.5±0.5
MCMSTStream	36.8±0.0	30.4±0.0	76.0±0.0	63.4±0.0	77.3±0.0	40.3±0.0
GB-FuzzyStream	41.0±4.3	32.9±0.8	43.4±0.3	-	-	38.2±0.3
CluStream-O - var. k	24.6±0.0	57.1±0.0	34.7±0.0	23.4±0.0	80.1±0.0	35.5±0.0
CluStream-O - fixed k	46.8±0.0	38.9±0.0	69.3±0.0	77.4±0.0	90.3±0.0	48.0±0.0
CluStream-O - k=100	24.6±0.0	57.1±0.0	34.7±0.0	23.4±0.0	80.1±0.0	35.5±0.0
CluStream - Wk-Means	47.2±0.9	60.1±1.8	80.4±0.6	98.0±0.2	92.0±0.2	49.2±0.7
CluStream-C - k-Means	47.4±2.0	42.3±1.1	77.4±0.8	95.7±1.2	93.9±0.0	47.1±1.0
CluStream-W - k-Means	47.2±0.9	60.1±1.8	80.4±0.6	98.0±0.2	92.0±0.2	49.2±0.7
CluStream-S - k-Means	45.9±1.3	59.4±1.7	81.3±0.4	97.5±0.0	92.1±0.2	48.4±0.7
CluStream-G - k-Means	46.5±1.2	60.3±1.9	81.6±0.6	97.8±0.0	92.1±0.2	48.4±0.8
CluStream-C - SubKMeans	46.2±1.3	50.2±1.9	77.5±0.9	95.9±1.0	93.9±0.0	46.7±1.4
CluStream-W - SubKMeans	45.9±1.5	60.9±3.1	79.8±1.1	97.8±0.3	91.9±0.2	49.3±0.4
CluStream-S - SubKMeans	46.0±1.2	61.7±2.2	80.4±0.6	97.5±0.0	92.2±0.2	48.8±0.5
CluStream-G - SubKMeans	46.5±1.2	62.3±2.4	81.0±0.7	97.8±0.0	92.2±0.2	48.9±0.5
CluStream-C - X-Means	58.4±0.6	44.7±3.9	79.9±0.6	55.4±0.7	91.6±0.1	43.6±0.4
CluStream-W - X-Means	25.2±0.3	57.4±0.1	76.2±0.9	39.8±0.0	80.2±0.0	35.5±0.0
CluStream-S - X-Means	24.8±0.1	57.3±0.0	76.8±0.5	38.7±0.9	80.1±0.0	35.5±0.0
CluStream-G - X-Means	37.1±3.9	58.8±0.4	79.5±0.9	35.9±0.3	83.8±0.0	35.5±0.0
CluStream-C - P-Dip-M	43.1±0.0	36.0±0.0	45.7±0.0	80.7±2.8	93.6±0.0	50.7±0.4
CluStream-W - P-Dip-M	30.2±0.2	-	40.2±0.1	33.0±3.3	-	-
CluStream-S - P-Dip-M	29.7±0.1	-	39.8±0.2	34.6±0.2	-	-
CluStream-G - P-Dip-M	50.3±0.9	58.0±0.4	80.1±0.4	60.3±0.7	89.2±0.0	38.4±0.2
CluStream-C - SC	55.2±0.5	58.6±1.4	81.4±0.0	97.5±0.0	94.2±0.0	52.3±1.1
CluStream-W - SC	57.4±2.0	57.8±0.4	79.3±0.4	97.5±0.0	91.2±0.0	57.6±0.9
CluStream-S - SC	56.4±0.2	60.2±0.1	78.8±0.4	97.5±0.0	91.1±0.1	**59.1**±0.3
CluStream-G - SC	54.5±2.6	58.4±1.1	79.0±0.2	97.8±0.1	91.3±0.1	53.4±1.3
CluStream-C - SCAR	51.6±1.1	57.7±1.8	78.9±0.1	93.8±3.6	92.4±0.1	51.1±0.8
CluStream-W - SCAR	51.8±1.8	60.6±0.4	66.0±0.2	80.5±6.3	84.7±0.1	51.4±0.4
CluStream-S - SCAR	54.4±1.8	59.3±0.5	66.3±0.3	73.0±4.3	82.8±0.2	50.6±1.4
CluStream-G - SCAR	55.1±2.0	58.5±1.2	66.4±0.3	80.0±3.5	84.5±0.1	51.9±0.4
CluStream-C - SpectACl	54.1±1.4	60.8±1.3	75.9±0.8	95.6±3.4	92.0±0.0	49.3±0.9
CluStream-W - SpectACl	58.5±1.3	**65.7**±0.8	49.8±0.9	98.9±0.0	94.4±0.0	50.9±0.7
CluStream-S - SpectACl	57.6±3.6	63.6±1.7	74.7±0.5	98.9±0.0	94.3±0.1	51.0±0.5
CluStream-G - SpectACl	57.2±2.7	60.3±1.8	46.2±0.5	97.3±2.8	94.4±0.1	49.9±1.2
CluStream-C - DBSCAN	56.5±0.0	56.1±0.0	74.9±0.0	96.5±0.0	94.7±0.0	48.4±0.0
CluStream-W - DBSCAN	58.3±0.0	59.6±0.0	75.6±0.0	96.4±0.0	94.9±0.0	48.6±0.0
CluStream-S - DBSCAN	56.5±0.0	58.9±0.0	76.6±0.0	96.4±0.0	94.9±0.0	48.8±0.0
CluStream-G - DBSCAN	55.1±1.8	60.6±0.9	80.5±0.2	89.4±1.5	94.9±0.0	48.9±0.0
CluStream-C - HDBSCAN	57.7±0.0	58.7±0.0	75.6±0.0	99.1±0.0	91.3±0.0	49.5±0.0
CluStream-W - HDBSCAN	57.1±0.0	64.4±0.0	74.5±0.0	99.1±0.0	93.7±0.0	48.9±0.0
CluStream-S - HDBSCAN	57.1±0.0	63.4±0.0	69.8±0.0	99.1±0.0	93.9±0.0	48.6±0.0
CluStream-G - HDBSCAN	57.0±2.6	63.1±0.1	80.1±0.3	94.0±0.7	93.9±0.0	50.1±0.3
CluStream-C - RNN-DBS	45.8±0.0	42.1±0.0	71.3±0.0	93.0±0.0	91.9±0.0	48.0±0.0
CluStream-W - RNN-DBS	51.3±0.0	56.9±0.0	42.1±0.0	73.1±0.0	78.5±0.0	45.6±0.0
CluStream-S - RNN-DBS	51.4±0.0	56.7±0.0	33.0±0.0	76.8±0.0	78.8±0.0	48.4±0.0
CluStream-G - RNN-DBS	52.4±1.0	47.6±0.7	63.8±1.5	69.1±4.0	79.7±0.0	45.2±0.3
CluStream-C - MDBSCAN	58.3±0.0	58.7±0.0	76.7±0.0	99.0±0.0	94.7±0.0	45.9±0.0
CluStream-W - MDBSCAN	59.5±0.0	59.8±0.0	74.5±0.0	**99.8**±0.0	94.7±0.0	49.3±0.0
CluStream-S - MDBSCAN	58.6±0.0	59.5±0.0	74.7±0.0	**99.8**±0.0	95.3±0.0	47.1±0.0
CluStream-G - MDBSCAN	55.3±1.8	55.6±1.1	76.1±0.3	96.9±1.8	95.4±0.0	42.8±0.0
CluStream-C - DPC	51.9±0.0	55.8±0.0	78.4±0.0	94.0±0.0	94.0±0.0	43.7±0.0
CluStream-W - DPC	56.9±0.0	64.9±0.0	76.0±0.0	85.8±0.0	93.8±0.0	45.8±0.0
CluStream-S - DPC	58.5±0.0	64.5±0.0	76.2±0.0	87.2±0.0	93.8±0.0	44.5±0.0
CluStream-G - DPC	49.3±1.0	60.8±0.4	82.3±0.3	86.4±3.5	91.9±0.1	44.4±0.0
CluStream-C - SNN-DPC	55.3±1.7	45.7±0.0	68.4±0.0	75.3±0.0	89.5±0.0	52.0±0.3
CluStream-W - SNN-DPC	61.4±0.0	53.0±0.5	59.6±0.0	94.6±0.0	89.1±0.1	56.3±0.0
CluStream-S - SNN-DPC	61.4±0.0	52.0±0.0	60.9±0.0	93.2±0.0	89.4±0.0	53.8±0.0
CluStream-G - SNN-DPC	53.3±3.3	52.7±1.7	77.7±0.7	86.5±3.4	94.0±0.0	54.5±1.0
CluStream-C - DBHD	**61.6**±0.0	58.5±0.0	77.7±0.0	97.9±0.0	92.9±0.0	57.7±0.0
CluStream-W - DBHD	**61.6**±0.0	58.5±0.0	77.7±0.0	97.9±0.0	92.9±0.0	57.7±0.0
CluStream-S - DBHD	**61.6**±0.0	58.5±0.0	77.7±0.0	97.9±0.0	92.9±0.0	57.7±0.0
CluStream-G - DBHD	54.8±1.4	56.8±0.9	**82.7**±0.3	60.3±2.9	80.4±0.1	48.0±0.3

Table 43: Purity Scores for evaluated datasets using the default parameters for the online phase, but the best-performing parameters according to the sum of ARI and AMI for the offline phase (×100). Competitors are included with default parameters. The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	Purity	Purity	Purity	Purity	Purity	Purity
STREAMKmeans	61.9±2.8	22.2±0.6	68.0±2.6	67.0±6.6	56.8±0.0	34.4±0.0
DenStream	96.9±0.0	89.0±0.0	87.2±0.0	96.8±0.0	97.1±0.0	64.7±0.0
DBSTREAM	29.9±0.0	20.9±0.0	26.4±0.0	61.1±0.0	97.2±0.0	41.0±0.0
EMCStream	70.2±1.1	68.9±1.4	67.1±2.7	73.9±9.0	83.4±5.3	38.0±0.4
MCMSTStream	40.7±0.0	42.1±0.0	87.7±0.0	99.5±0.0	79.0±0.0	68.3±0.0
GB-FuzzyStream	39.1±18.3	43.3±0.4	62.1±0.4	-	-	44.2±0.6
CluStream-O - var. k	**99.9**±0.0	**90.7**±0.0	**95.4**±0.0	**99.9**±0.0	**99.6**±0.0	**93.9**±0.0
CluStream-O - fixed k	68.4±0.0	32.7±0.0	71.8±0.0	80.1±0.0	99.1±0.0	59.8±0.0
CluStream-O - k=100	**99.9**±0.0	**90.7**±0.0	**95.4**±0.0	**99.9**±0.0	**99.6**±0.0	**93.9**±0.0
CluStream - Wk-Means	69.8±1.6	67.2±1.5	88.7±0.3	98.9±0.1	99.0±0.0	66.9±0.4
CluStream-C - k-Means	70.1±1.8	37.1±2.3	81.3±0.6	97.6±0.7	99.1±0.0	61.0±1.0
CluStream-W - k-Means	69.8±1.6	67.2±1.5	88.7±0.3	98.9±0.1	99.0±0.0	66.9±0.4
CluStream-S - k-Means	69.2±1.6	65.7±1.3	88.8±0.4	98.7±0.0	99.0±0.0	65.6±0.5
CluStream-G - k-Means	70.0±1.3	66.4±2.3	89.6±0.4	98.8±0.0	99.0±0.0	65.6±0.7
CluStream-C - SubKMeans	68.9±1.4	55.4±2.5	82.3±0.6	97.7±0.6	99.1±0.0	61.3±1.0
CluStream-W - SubKMeans	68.3±1.7	70.7±1.2	90.2±0.2	98.8±0.1	99.0±0.0	67.4±0.6
CluStream-S - SubKMeans	68.6±1.2	69.9±1.6	89.8±0.3	98.7±0.0	99.0±0.0	67.5±0.4
CluStream-G - SubKMeans	69.9±1.3	69.6±2.5	89.5±0.3	98.8±0.0	99.0±0.0	67.4±0.3
CluStream-C - X-Means	59.8±0.4	42.0±7.2	84.1±0.7	99.0±0.4	98.9±0.0	77.6±0.5
CluStream-W - X-Means	**99.9**±0.0	89.2±0.8	84.5±0.5	**99.9**±0.0	99.5±0.0	**93.9**±0.0
CluStream-S - X-Means	**99.9**±0.0	89.8±0.4	84.3±0.4	**99.9**±0.0	**99.6**±0.0	**93.9**±0.0
CluStream-G - X-Means	94.4±5.7	88.0±0.4	89.9±1.0	**99.9**±0.0	**99.6**±0.0	**93.9**±0.0
CluStream-C - P-Dip-M	29.9±0.0	20.6±0.0	28.4±0.0	72.8±3.9	97.7±0.0	59.8±0.7
CluStream-W - P-Dip-M	98.7±0.5	-	93.7±0.1	**99.9**±0.0	-	-
CluStream-S - P-Dip-M	98.8±0.1	-	93.5±0.1	**99.9**±0.0	-	-
CluStream-G - P-Dip-M	76.2±1.8	81.3±0.8	81.8±0.5	98.6±0.2	99.1±0.0	92.5±0.2
CluStream-C - SC	65.7±0.7	58.6±0.6	87.6±0.0	98.7±0.0	98.3±0.1	64.2±0.9
CluStream-W - SC	79.4±1.4	70.5±0.3	85.7±0.4	98.7±0.0	98.5±0.0	73.4±0.4
CluStream-S - SC	77.7±0.5	73.4±0.1	85.8±0.4	98.7±0.0	98.1±0.1	74.0±0.6
CluStream-G - SC	77.2±2.8	72.3±0.6	85.9±0.2	98.8±0.0	98.6±0.0	69.9±0.9
CluStream-C - SCAR	73.8±0.9	59.0±2.0	87.9±0.2	94.6±4.4	98.1±0.1	66.1±1.2
CluStream-W - SCAR	73.7±1.4	72.1±0.3	86.6±0.0	82.3±5.5	96.8±0.2	69.7±0.4
CluStream-S - SCAR	77.2±1.6	71.8±0.4	86.7±0.2	77.7±5.5	92.5±0.1	69.8±1.6
CluStream-G - SCAR	77.5±1.6	72.1±0.8	86.6±0.1	84.0±4.0	98.0±0.0	70.8±0.3
CluStream-C - SpectACl	75.7±1.1	74.0±1.2	77.8±0.9	94.2±4.6	97.5±0.0	65.4±1.0
CluStream-W - SpectACl	79.2±1.1	76.9±0.5	52.8±2.1	99.4±0.0	98.9±0.0	68.0±1.0
CluStream-S - SpectACl	76.5±4.1	76.7±1.1	88.1±0.4	99.4±0.0	98.5±0.1	68.1±0.7
CluStream-G - SpectACl	77.0±2.5	75.2±1.2	47.5±1.4	98.2±2.4	98.6±0.1	67.2±1.1
CluStream-C - DBSCAN	78.8±0.0	78.2±0.0	75.2±0.0	**99.9**±0.0	99.5±0.0	78.0±0.0
CluStream-W - DBSCAN	73.3±0.0	74.8±0.0	75.7±0.0	**99.9**±0.0	97.9±0.0	76.5±0.0
CluStream-S - DBSCAN	80.2±0.0	74.8±0.0	76.9±0.0	**99.9**±0.0	97.7±0.0	76.2±0.0
CluStream-G - DBSCAN	79.0±4.7	81.6±0.6	83.5±0.2	92.0±2.9	97.8±0.0	76.2±0.0
CluStream-C - HDBSCAN	82.2±0.0	65.0±0.0	75.3±0.0	**99.9**±0.0	94.9±0.0	82.7±0.0
CluStream-W - HDBSCAN	78.2±0.0	84.1±0.0	74.5±0.0	**99.9**±0.0	94.7±0.0	82.3±0.0
CluStream-S - HDBSCAN	78.8±0.0	84.7±0.0	83.9±0.0	**99.9**±0.0	94.6±0.0	83.8±0.0
CluStream-G - HDBSCAN	73.8±3.2	85.3±0.2	84.2±0.3	98.7±0.3	94.6±0.0	76.7±0.2
CluStream-C - RNN-DBS	86.0±0.0	32.3±0.0	82.6±0.0	90.2±0.0	96.3±0.0	74.9±0.0
CluStream-W - RNN-DBS	73.8±0.0	84.0±0.0	71.3±0.0	98.3±0.0	87.0±0.0	76.2±0.0
CluStream-S - RNN-DBS	72.4±0.0	84.5±0.0	88.0±0.0	99.7±0.0	87.2±0.0	75.9±0.0
CluStream-G - RNN-DBS	80.6±4.1	53.0±1.4	79.2±1.2	92.0±3.8	89.6±0.0	81.9±0.1
CluStream-C - MDBSCAN	73.3±0.0	89.6±0.0	79.4±0.0	99.7±0.0	98.3±0.0	85.2±0.0
CluStream-W - MDBSCAN	82.6±0.0	89.0±0.0	73.7±0.0	**99.9**±0.0	95.1±0.0	76.6±0.0
CluStream-S - MDBSCAN	79.7±0.0	88.5±0.0	74.0±0.0	**99.9**±0.0	95.6±0.0	80.0±0.0
CluStream-G - MDBSCAN	79.3±4.6	79.5±0.5	75.8±0.6	98.8±0.1	95.7±0.0	84.1±0.0
CluStream-C - DPC	78.0±0.0	75.0±0.0	80.9±0.0	**99.9**±0.0	95.9±0.0	68.3±0.0
CluStream-W - DPC	63.4±0.0	84.7±0.0	78.8±0.0	95.0±0.0	99.5±0.0	80.5±0.0
CluStream-S - DPC	64.7±0.0	87.3±0.0	79.1±0.0	95.0±0.0	99.5±0.0	84.8±0.0
CluStream-G - DPC	86.6±1.1	82.0±0.2	85.8±0.4	95.5±4.1	92.6±0.1	83.5±0.0
CluStream-C - SNN-DPC	70.9±0.1	43.7±0.1	76.2±0.0	76.2±0.0	97.8±0.0	64.3±0.7
CluStream-W - SNN-DPC	68.1±0.0	51.3±0.7	58.9±0.0	96.3±0.0	95.0±0.1	61.1±0.0
CluStream-S - SNN-DPC	72.4±0.0	49.5±0.0	60.7±0.0	94.2±0.0	95.0±0.0	57.4±0.0
CluStream-G - SNN-DPC	74.0±3.2	65.8±1.7	79.2±0.8	86.1±3.6	98.8±0.0	64.4±0.7
CluStream-C - DBHD	85.9±0.0	88.3±0.0	85.9±0.0	98.9±0.0	98.1±0.0	80.3±0.0
CluStream-W - DBHD	85.9±0.0	88.3±0.0	85.9±0.0	98.9±0.0	98.1±0.0	80.3±0.0
CluStream-S - DBHD	85.9±0.0	88.3±0.0	85.9±0.0	98.9±0.0	98.1±0.0	80.3±0.0
CluStream-G - DBHD	85.7±2.1	82.1±0.6	87.9±0.3	93.5±4.7	93.8±0.0	83.2±0.2

Table 44: Homogeneity Scores for evaluated datasets using the default parameters for the online phase, but the best-performing parameters according to the sum of ARI and AMI for the offline phase (×100). Competitors are included with default parameters. The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	Homogeneity	Homogeneity	Homogeneity	Homogeneity	Homogeneity	Homogeneity
STREAMKmeans	55.1±4.4	1.8±0.7	59.6±3.2	13.7±15.3	0.0±0.0	0.0±0.0
DenStream	96.0±0.0	87.5±0.0	81.6±0.0	90.1±0.0	90.6±0.0	46.8±0.0
DBSTREAM	0.0±0.0	0.4±0.0	0.0±0.0	0.0±0.0	90.2±0.0	9.0±0.0
EMCStream	65.5±1.3	65.3±1.5	57.2±3.0	27.3±19.1	58.5±10.7	5.7±0.6
MCMSTStream	12.6±0.0	27.1±0.0	78.8±0.0	97.3±0.0	56.4±0.0	50.7±0.0
GB-FuzzyStream	13.0±26.0	31.0±0.9	47.6±0.4	-	-	16.2±0.9
CluStream-O - var. k	**99.8**±0.0	**89.1**±0.0	**93.2**±0.0	99.5±0.0	**99.1**±0.0	**91.4**±0.0
CluStream-O - fixed k	66.6±0.0	15.8±0.0	64.0±0.0	36.3±0.0	97.3±0.0	36.8±0.0
CluStream-O - k=100	**99.8**±0.0	**89.1**±0.0	**93.2**±0.0	99.5±0.0	**99.1**±0.0	**91.4**±0.0
CluStream - Wk-Means	68.1±0.9	62.1±1.3	80.9±0.2	93.3±0.4	97.3±0.0	48.8±0.8
CluStream-C - k-Means	68.2±1.8	27.9±2.6	74.7±0.7	87.6±3.3	97.5±0.0	40.2±1.9
CluStream-W - k-Means	68.1±0.9	62.1±1.3	80.9±0.2	93.3±0.4	97.3±0.0	48.8±0.8
CluStream-S - k-Means	67.3±1.3	60.1±1.3	81.0±0.2	92.5±0.0	97.3±0.0	47.5±0.6
CluStream-G - k-Means	67.4±1.0	61.4±1.9	81.7±0.3	93.2±0.1	97.4±0.0	47.4±0.9
CluStream-C - SubKMeans	66.1±1.2	47.4±2.2	75.2±0.7	88.0±3.0	97.4±0.0	40.2±1.5
CluStream-W - SubKMeans	66.7±1.3	65.9±1.6	82.9±0.3	92.9±0.5	97.3±0.0	49.3±0.8
CluStream-S - SubKMeans	66.8±1.0	65.5±1.6	82.7±0.2	92.5±0.0	97.4±0.0	49.5±0.6
CluStream-G - SubKMeans	67.3±1.1	65.4±2.5	81.5±0.2	93.2±0.1	97.4±0.0	49.3±0.6
CluStream-C - X-Means	55.8±0.3	33.3±9.2	78.4±0.5	95.8±1.6	97.0±0.0	67.1±0.5
CluStream-W - X-Means	**99.8**±0.1	88.0±0.6	77.7±0.6	99.5±0.0	98.8±0.0	**91.4**±0.0
CluStream-S - X-Means	**99.8**±0.1	88.3±0.3	78.0±0.6	99.5±0.0	**99.1**±0.0	**91.4**±0.0
CluStream-G - X-Means	93.3±6.7	85.1±0.4	83.9±1.0	**99.6**±0.2	**99.1**±0.0	**91.4**±0.0
CluStream-C - P-Dip-M	0.0±0.0	0.0±0.0	3.5±0.0	29.9±10.0	91.8±0.1	36.8±0.9
CluStream-W - P-Dip-M	98.5±0.5	-	89.7±0.1	99.5±0.0	-	-
CluStream-S - P-Dip-M	98.6±0.1	-	89.5±0.1	99.5±0.0	-	-
CluStream-G - P-Dip-M	71.9±1.7	77.1±0.7	72.9±0.5	92.4±0.7	97.6±0.0	89.2±0.4
CluStream-C - SC	62.1±0.5	54.3±0.8	80.9±0.0	92.5±0.0	95.8±0.1	45.2±0.8
CluStream-W - SC	77.5±1.6	68.1±0.5	77.5±0.4	92.5±0.0	95.4±0.0	60.6±0.8
CluStream-S - SC	76.5±0.1	71.2±0.1	77.3±0.3	92.5±0.0	93.5±0.2	61.5±0.7
CluStream-G - SC	76.0±2.7	70.8±0.7	77.6±0.2	93.3±0.2	95.0±0.1	54.1±1.2
CluStream-C - SCAR	71.0±0.3	56.4±2.0	79.8±0.2	80.6±11.6	93.6±0.2	47.5±1.2
CluStream-W - SCAR	70.7±1.5	69.8±0.6	77.0±0.0	53.7±13.1	90.0±0.6	54.3±0.5
CluStream-S - SCAR	74.1±1.4	69.4±0.5	77.1±0.2	39.5±13.2	79.3±0.4	53.3±1.9
CluStream-G - SCAR	75.5±1.9	70.3±0.7	77.1±0.1	53.5±8.2	94.5±0.1	55.9±0.4
CluStream-C - SpectACl	72.7±0.9	73.0±1.1	72.7±1.1	84.2±12.0	92.3±0.1	45.5±1.8
CluStream-W - SpectACl	75.6±1.0	74.3±0.6	36.9±2.3	96.2±0.0	95.7±0.1	51.3±1.1
CluStream-S - SpectACl	74.8±3.2	73.8±1.0	83.5±0.2	96.2±0.0	95.3±0.2	51.4±0.7
CluStream-G - SpectACl	74.5±2.3	72.9±1.1	29.0±1.7	93.1±5.1	95.6±0.3	50.2±1.5
CluStream-C - DBSCAN	76.2±0.0	75.6±0.0	69.7±0.0	99.0±0.0	98.2±0.0	67.5±0.0
CluStream-W - DBSCAN	69.4±0.0	71.6±0.0	70.4±0.0	99.0±0.0	91.5±0.0	65.1±0.0
CluStream-S - DBSCAN	77.1±0.0	71.6±0.0	71.9±0.0	99.0±0.0	91.3±0.0	64.6±0.0
CluStream-G - DBSCAN	77.9±5.4	78.5±0.8	78.9±0.2	79.0±5.4	91.3±0.0	64.6±0.0
CluStream-C - HDBSCAN	78.8±0.0	61.8±0.0	69.6±0.0	98.9±0.0	81.9±0.0	71.6±0.0
CluStream-W - HDBSCAN	74.7±0.0	81.8±0.0	68.0±0.0	98.9±0.0	83.6±0.0	73.7±0.0
CluStream-S - HDBSCAN	75.6±0.0	82.3±0.0	76.8±0.0	98.9±0.0	84.8±0.0	76.3±0.0
CluStream-G - HDBSCAN	71.5±3.0	82.9±0.2	77.8±0.3	94.2±1.4	84.8±0.0	64.9±0.2
CluStream-C - RNN-DBS	81.6±0.0	17.6±0.0	76.2±0.0	74.7±0.0	86.0±0.0	62.4±0.0
CluStream-W - RNN-DBS	71.2±0.0	81.8±0.0	59.8±0.0	90.5±0.0	64.7±0.0	65.3±0.0
CluStream-S - RNN-DBS	69.0±0.0	82.7±0.0	82.7±0.0	97.4±0.0	65.2±0.0	64.4±0.0
CluStream-G - RNN-DBS	77.0±5.6	43.9±1.8	72.3±1.5	78.9±9.3	70.2±0.1	73.2±0.1
CluStream-C - MDBSCAN	69.4±0.0	87.7±0.0	71.0±0.0	97.4±0.0	94.2±0.0	77.4±0.0
CluStream-W - MDBSCAN	79.4±0.0	87.2±0.0	64.9±0.0	98.9±0.0	82.9±0.0	65.4±0.0
CluStream-S - MDBSCAN	76.6±0.0	86.7±0.0	65.2±0.0	98.9±0.0	84.0±0.0	69.4±0.0
CluStream-G - MDBSCAN	78.2±5.2	76.8±0.5	67.3±0.5	93.8±0.6	84.3±0.0	77.4±0.0
CluStream-C - DPC	78.1±0.0	71.3±0.0	73.7±0.0	99.0±0.0	87.4±0.0	52.2±0.0
CluStream-W - DPC	60.4±0.0	81.2±0.0	72.3±0.0	85.9±0.0	98.5±0.0	72.0±0.0
CluStream-S - DPC	59.8±0.0	84.5±0.0	72.5±0.0	83.4±0.0	98.5±0.0	77.5±0.0
CluStream-G - DPC	85.8±1.3	79.4±0.1	79.7±0.4	86.0±11.0	81.3±0.1	76.3±0.0
CluStream-C - SNN-DPC	68.8±0.7	35.9±0.1	68.8±0.1	34.0±0.0	93.2±0.0	46.0±0.6
CluStream-W - SNN-DPC	63.1±0.0	46.7±0.9	47.1±0.0	85.9±0.0	85.8±0.1	40.6±0.0
CluStream-S - SNN-DPC	65.6±0.0	44.1±0.0	50.2±0.0	81.4±0.0	85.1±0.0	34.6±0.0
CluStream-G - SNN-DPC	72.4±2.6	60.5±1.3	72.7±0.7	64.7±7.8	96.4±0.0	46.1±1.1
CluStream-C - DBHD	84.6±0.0	87.1±0.0	81.3±0.0	93.3±0.0	94.3±0.0	69.1±0.0
CluStream-W - DBHD	84.6±0.0	87.1±0.0	81.3±0.0	93.3±0.0	94.3±0.0	69.1±0.0
CluStream-S - DBHD	84.6±0.0	87.1±0.0	81.3±0.0	93.3±0.0	94.3±0.0	69.1±0.0
CluStream-G - DBHD	84.9±1.2	80.1±0.7	82.4±0.3	84.1±10.7	81.3±0.1	75.0±0.5

Table 45: Completeness Scores for evaluated datasets using the default parameters for the online phase, but the best-performing parameters according to the sum of ARI and AMI for the offline phase (×100). Competitors are included with default parameters. The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	Fvl	KDD99	Gas
	Completeness	Completeness	Completeness	Completeness	Completeness	Completeness
STREAMKmeans	59.9±4.7	38.7±4.4	77.7±0.5	85.6±7.5	**99.7**±0.3	**100.0**±0.0
DenStream	39.8±0.0	53.9±0.0	60.4±0.0	26.0±0.0	55.0±0.0	35.8±0.0
DBSTREAM	**100.0**±0.0	87.4±0.0	**100.0**±0.0	**100.0**±0.0	79.7±0.0	48.4±0.0
EMCStream	70.9±2.3	78.2±3.2	82.5±0.4	52.5±8.1	66.7±10.7	68.2±6.5
MCMSTStream	30.2±0.0	47.0±0.0	70.9±0.0	39.1±0.0	60.8±0.0	35.3±0.0
GB-FuzzyStream	89.0±22.0	47.4±0.9	51.9±0.4	-	-	19.6±1.1
CluStream-O - var. k	42.3±0.0	62.3±0.0	39.6±0.0	16.8±0.0	43.5±0.0	35.3±0.0
CluStream-O - fixed k	59.5±0.0	55.1±0.0	74.7±0.0	47.9±0.0	65.1±0.0	41.7±0.0
CluStream-O - k=100	42.3±0.0	62.3±0.0	39.6±0.0	16.8±0.0	43.5±0.0	35.3±0.0
CluStream - Wk-Means	59.6±0.7	73.6±1.0	76.9±0.7	93.5±0.6	61.9±0.3	43.5±0.8
CluStream-C - k-Means	59.7±1.6	68.0±1.5	79.0±0.8	87.9±2.8	66.4±0.1	41.5±2.2
CluStream-W - k-Means	59.6±0.7	73.6±1.0	76.9±0.7	93.5±0.6	61.9±0.3	43.5±0.8
CluStream-S - k-Means	58.7±1.2	73.2±1.2	77.8±0.5	92.3±0.0	62.4±0.2	42.7±0.8
CluStream-G - k-Means	58.8±1.0	73.9±1.2	77.8±0.6	92.9±0.1	62.4±0.2	42.6±0.8
CluStream-C - SubKMeans	58.6±1.0	66.6±1.0	78.1±0.8	88.3±2.5	66.4±0.0	40.6±1.4
CluStream-W - SubKMeans	58.5±1.3	74.7±2.1	74.9±0.9	92.9±0.8	62.1±0.2	44.1±0.5
CluStream-S - SubKMeans	58.6±1.0	75.5±1.7	75.7±0.7	92.3±0.0	62.6±0.2	43.2±0.5
CluStream-G - SubKMeans	58.8±1.0	75.2±1.3	77.2±0.7	92.9±0.1	62.6±0.2	43.3±0.4
CluStream-C - X-Means	77.0±0.3	67.6±2.9	79.2±0.2	36.7±0.6	62.8±0.1	40.3±0.3
CluStream-W - X-Means	42.6±0.1	65.4±0.2	76.5±0.9	29.4±0.0	44.0±0.0	35.4±0.0
CluStream-S - X-Means	42.4±0.0	64.2±0.1	76.6±0.9	28.8±0.5	43.6±0.0	35.3±0.0
CluStream-G - X-Means	51.6±4.4	65.7±0.4	74.5±1.1	27.1±0.3	45.0±0.0	35.3±0.0
CluStream-C - P-Dip-M	**100.0**±0.0	**100.0**±0.0	98.7±0.0	**100.0**±0.0	70.5±0.1	61.5±0.3
CluStream-W - P-Dip-M	46.2±0.1	-	43.7±0.0	20.9±1.1	-	-
CluStream-S - P-Dip-M	45.9±0.1	-	43.4±0.1	21.4±0.1	-	-
CluStream-G - P-Dip-M	62.4±1.1	67.9±0.4	85.9±0.3	43.3±0.3	54.7±0.0	38.0±0.1
CluStream-C - SC	69.3±0.7	75.1±1.3	79.2±0.1	92.3±0.0	69.3±0.0	48.0±0.4
CluStream-W - SC	71.3±1.4	71.0±0.2	77.6±0.5	92.3±0.0	63.0±0.1	55.2±0.8
CluStream-S - SC	70.1±0.4	71.8±0.2	77.0±0.4	92.3±0.0	62.0±0.1	57.0±0.4
CluStream-G - SC	69.3±1.9	71.0±0.7	77.0±0.3	93.0±0.2	61.7±0.1	49.2±1.0
CluStream-C - SCAR	63.7±0.6	71.7±0.9	75.5±0.1	81.8±10.1	69.6±0.1	46.5±0.8
CluStream-W - SCAR	63.4±1.3	71.5±0.3	63.7±0.1	60.8±12.7	60.1±0.2	45.3±0.3
CluStream-S - SCAR	67.0±1.3	71.3±0.2	63.8±0.1	40.9±11.6	57.4±0.2	45.7±1.5
CluStream-G - SCAR	68.6±1.6	70.4±0.9	64.3±0.2	55.4±7.8	51.0±0.1	45.9±0.3
CluStream-C - SpectACl	67.1±1.0	74.9±0.5	81.8±0.4	86.6±10.1	60.8±0.1	43.3±1.1
CluStream-W - SpectACl	69.1±0.9	78.5±0.3	52.0±0.7	96.6±0.0	70.7±0.1	44.4±0.9
CluStream-S - SpectACl	68.9±2.6	76.6±1.0	72.1±0.4	96.6±0.0	72.5±0.1	44.9±0.8
CluStream-G - SpectACl	68.7±2.2	75.0±1.2	46.7±1.0	93.6±5.0	72.6±0.1	43.3±1.4
CluStream-C - DBSCAN	71.5±0.0	65.5±0.0	86.6±0.0	90.5±0.0	68.1±0.0	47.6±0.0
CluStream-W - DBSCAN	75.2±0.0	78.7±0.0	88.7±0.0	89.9±0.0	77.3±0.0	47.6±0.0
CluStream-S - DBSCAN	71.5±0.0	77.5±0.0	88.8±0.0	89.4±0.0	77.9±0.0	47.8±0.0
CluStream-G - DBSCAN	68.1±1.3	74.9±0.3	85.4±0.1	73.5±3.1	77.9±0.0	48.1±0.1
CluStream-C - HDBSCAN	68.4±0.0	77.7±0.0	86.7±0.0	95.1±0.0	74.8±0.0	44.5±0.0
CluStream-W - HDBSCAN	70.3±0.0	76.2±0.0	87.3±0.0	95.1±0.0	81.3±0.0	46.5±0.0
CluStream-S - HDBSCAN	69.9±0.0	74.9±0.0	69.2±0.0	95.1±0.0	79.2±0.0	46.9±0.0
CluStream-G - HDBSCAN	70.9±2.3	74.2±0.1	83.8±0.5	87.0±0.9	79.2±0.0	46.6±0.1
CluStream-C - RNN-DBS	58.7±0.0	59.9±0.0	68.9±0.0	**100.0**±0.0	70.1±0.0	42.6±0.0
CluStream-W - RNN-DBS	64.4±0.0	66.8±0.0	47.6±0.0	50.0±0.0	60.8±0.0	44.2±0.0
CluStream-S - RNN-DBS	64.1±0.0	65.6±0.0	40.2±0.0	53.4±0.0	61.2±0.0	45.9±0.0
CluStream-G - RNN-DBS	64.7±2.5	69.1±5.3	59.7±1.1	60.1±4.2	60.5±0.0	43.3±0.1
CluStream-C - MDBSCAN	75.2±0.0	63.5±0.0	82.1±0.0	95.2±0.0	71.7±0.0	43.9±0.0
CluStream-W - MDBSCAN	74.7±0.0	64.1±0.0	86.8±0.0	99.0±0.0	86.5±0.0	48.3±0.0
CluStream-S - MDBSCAN	74.5±0.0	64.2±0.0	87.0±0.0	99.0±0.0	87.5±0.0	44.5±0.0
CluStream-G - MDBSCAN	69.7±1.7	64.1±0.5	87.2±0.1	92.8±2.9	87.2±0.0	41.0±0.0
CluStream-C - DPC	65.0±0.0	68.7±0.0	81.8±0.0	82.0±0.0	82.4±0.0	47.9±0.0
CluStream-W - DPC	72.4±0.0	67.9±0.0	78.3±0.0	72.5±0.0	63.3±0.0	42.8±0.0
CluStream-S - DPC	74.4±0.0	67.3±0.0	78.8±0.0	74.8±0.0	63.3±0.0	41.8±0.0
CluStream-G - DPC	61.1±0.7	67.1±0.2	80.7±0.1	72.1±6.3	82.2±0.2	42.0±0.0
CluStream-C - SNN-DPC	66.4±0.4	69.2±0.0	71.4±0.1	41.3±0.0	58.7±0.0	50.6±0.5
CluStream-W - SNN-DPC	74.0±0.0	81.2±0.3	70.9±0.0	88.3±0.0	64.3±0.1	57.4±0.0
CluStream-S - SNN-DPC	77.4±0.0	79.7±0.0	72.9±0.0	84.9±0.0	62.5±0.0	51.6±0.0
CluStream-G - SNN-DPC	68.0±2.4	68.3±1.0	82.7±0.3	67.9±7.3	67.2±0.0	53.0±1.3
CluStream-C - DBHD	71.3±0.0	68.4±0.0	75.2±0.0	93.2±0.0	63.7±0.0	51.8±0.0
CluStream-W - DBHD	71.3±0.0	68.4±0.0	75.2±0.0	93.2±0.0	63.7±0.0	51.8±0.0
CluStream-S - DBHD	71.3±0.0	68.4±0.0	75.2±0.0	93.2±0.0	63.7±0.0	51.8±0.0
CluStream-G - DBHD	66.1±1.1	68.4±0.8	81.8±0.5	34.2±5.8	54.8±0.1	45.0±0.1

Table 46: Average reported cluster number per evaluation batch for the evaluated datasets using the default parameters for the online phase, but the best-performing parameters according to the sum of ARI and AMI for the offline phase (×100). Competitors are included with default parameters. The standard deviation across seeds is noted. The best scores are marked as **bold**, and the second-best scores are underlined.

Name	Comp-9	DEN-10	RBF-3	FvI	KDD99	Gas
	Cluster Number	Cluster Number	Cluster Number	Cluster Number	Cluster Number	Cluster Number
STREAMKmeans	6.5±0.5	5.0±1.2	6.7±0.5	1.3±0.2	1.0±0.0	1.0±0.0
DenStream	112.5±0.0	53.6±0.0	25.2±0.0	17.5±0.0	16.1±0.0	11.7±0.0
DBSTREAM	1.0±0.0	1.4±0.0	1.0±0.0	1.0±0.0	5.2±0.0	2.5±0.0
EMCStream	6.5±0.3	7.5±0.2	3.6±0.2	1.8±0.2	3.5±0.4	1.9±0.1
MCMSTStream	12.5±0.0	10.6±0.0	10.6±0.0	13.0±0.0	8.4±0.0	32.6±0.0
GB-FuzzyStream	8.3±14.5	7.2±0.1	6.6±0.2	-	-	6.8±0.5
CluStream-O - var. k	99.3±0.0	99.8±0.0	100.0±0.0	99.7±0.0	99.5±0.0	99.3±0.0
CluStream-O - fixed k	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	23.0±0.0	6.0±0.0
CluStream-O - k=100	99.3±0.0	99.8±0.0	100.0±0.0	99.7±0.0	99.5±0.0	99.3±0.0
CluStream - Wk-Means	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	23.0±0.0	6.0±0.0
CluStream-C - k-Means	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	23.0±0.0	6.0±0.0
CluStream-W - k-Means	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	23.0±0.0	6.0±0.0
CluStream-S - k-Means	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	23.0±0.0	6.0±0.0
CluStream-G - k-Means	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	23.0±0.0	6.0±0.0
CluStream-C - SubKMeans	8.8±0.3	11.6±0.2	8.0±0.0	2.0±0.0	23.0±0.0	6.5±0.0
CluStream-W - SubKMeans	9.0±0.0	12.0±0.0	9.0±0.0	2.0±0.0	23.0±0.0	6.0±0.0
CluStream-S - SubKMeans	9.0±0.0	12.0±0.0	9.0±0.0	2.0±0.0	23.0±0.0	6.9±0.0
CluStream-G - SubKMeans	9.0±0.0	12.0±0.0	8.0±0.0	2.0±0.0	23.0±0.0	6.9±0.0
CluStream-C - X-Means	4.0±0.0	14.7±2.0	12.0±0.3	13.5±0.1	24.1±0.1	20.9±0.6
CluStream-W - X-Means	96.3±0.6	47.3±1.9	18.8±1.7	52.1±0.0	85.5±0.0	94.6±0.4
CluStream-S - X-Means	98.2±0.1	65.3±2.1	19.8±1.4	60.2±6.6	96.7±0.0	96.9±0.5
CluStream-G - X-Means	59.3±9.8	64.3±2.8	23.8±1.9	126.0±10.6	98.3±0.1	97.4±0.3
CluStream-C - P-Dip-M	1.0±0.0	1.0±0.0	1.1±0.0	1.3±0.1	12.0±0.1	8.4±0.5
CluStream-W - P-Dip-M	65.0±0.5	-	42.8±0.3	43.6±3.3	-	-
CluStream-S - P-Dip-M	66.2±0.8	-	44.0±0.7	42.9±1.2	-	-
CluStream-G - P-Dip-M	9.4±0.6	24.6±1.7	4.6±0.1	9.8±0.6	41.8±0.2	55.4±1.1
CluStream-C - SC	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	23.0±0.0	6.0±0.0
CluStream-W - SC	9.0±0.0	11.0±0.0	7.8±0.0	2.0±0.0	19.2±0.0	6.0±0.0
CluStream-S - SC	9.0±0.0	11.0±0.0	7.9±0.0	2.0±0.0	23.0±0.0	6.0±0.0
CluStream-G - SC	9.0±0.0	11.0±0.0	7.9±0.0	2.0±0.0	23.0±0.0	6.0±0.0
CluStream-C - SCAR	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	22.9±0.0	6.0±0.0
CluStream-W - SCAR	9.0±0.0	10.8±0.1	8.0±0.0	2.0±0.1	15.9±0.4	6.0±0.0
CluStream-S - SCAR	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	13.9±0.2	6.0±0.0
CluStream-G - SCAR	9.0±0.0	11.0±0.1	8.0±0.0	2.0±0.0	22.4±0.0	6.0±0.0
CluStream-C - SpectACl	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	23.0±0.0	6.0±0.0
CluStream-W - SpectACl	9.0±0.0	10.6±0.1	8.0±0.0	2.0±0.0	21.6±0.0	6.0±0.0
CluStream-S - SpectACl	9.0±0.0	10.8±0.1	8.0±0.0	2.0±0.0	21.1±0.0	6.0±0.0
CluStream-G - SpectACl	9.0±0.0	10.9±0.1	7.9±0.0	2.0±0.0	21.8±0.0	6.0±0.0
CluStream-C - DBSCAN	12.3±0.0	91.8±0.0	6.0±0.0	2.5±0.0	40.8±0.0	43.4±0.0
CluStream-W - DBSCAN	9.0±0.0	12.0±0.0	4.6±0.0	2.7±0.0	5.9±0.0	24.4±0.0
CluStream-S - DBSCAN	12.0±0.0	17.0±0.0	4.7±0.0	2.7±0.0	5.6±0.0	21.7±0.0
CluStream-G - DBSCAN	13.7±0.6	15.1±0.1	7.5±0.1	2.4±0.2	5.6±0.0	21.4±0.1
CluStream-C - HDBSCAN	10.0±0.0	16.6±0.0	4.7±0.0	2.5±0.0	6.3±0.0	22.5±0.0
CluStream-W - HDBSCAN	8.3±0.0	15.2±0.0	4.7±0.0	2.5±0.0	4.2±0.0	11.7±0.0
CluStream-S - HDBSCAN	8.7±0.0	15.8±0.0	7.1±0.0	2.5±0.0	4.5±0.0	12.4±0.0
CluStream-G - HDBSCAN	7.3±0.2	17.5±0.1	5.3±0.0	2.2±0.0	4.5±0.0	8.4±0.1
CluStream-C - RNN-DBS	17.9±0.0	5.8±0.0	12.2±0.0	1.7±0.0	9.1±0.0	15.4±0.0
CluStream-W - RNN-DBS	12.3±0.0	28.4±0.0	12.6±0.0	4.7±0.0	5.7±0.0	11.8±0.0
CluStream-S - RNN-DBS	11.3±0.0	39.0±0.0	41.8±0.0	5.0±0.0	5.8±0.0	10.8±0.0
CluStream-G - RNN-DBS	16.7±1.5	6.6±0.3	19.2±0.5	7.3±0.3	6.5±0.0	16.9±0.1
CluStream-C - MDBSCAN	9.0±0.0	97.4±0.0	6.9±0.0	2.2±0.0	12.7±0.0	54.2±0.0
CluStream-W - MDBSCAN	11.0±0.0	96.4±0.0	3.9±0.0	2.0±0.0	3.6±0.0	12.3±0.0
CluStream-S - MDBSCAN	10.3±0.0	96.0±0.0	3.9±0.0	2.0±0.0	3.5±0.0	14.3±0.0
CluStream-G - MDBSCAN	12.8±0.6	18.5±0.7	4.0±0.0	2.1±0.1	3.6±0.0	19.7±0.0
CluStream-C - DPC	12.3±0.0	30.8±0.0	8.4±0.0	3.0±0.0	6.1±0.0	23.6±0.0
CluStream-W - DPC	5.3±0.0	91.6±0.0	14.3±0.0	2.5±0.0	46.6±0.0	35.4±0.0
CluStream-S - DPC	5.0±0.0	93.0±0.0	13.3±0.0	2.3±0.0	46.7±0.0	45.2±0.0
CluStream-G - DPC	16.6±0.3	49.5±0.1	16.7±0.3	3.6±0.3	8.5±0.1	37.0±0.1
CluStream-C - SNN-DPC	9.0±0.0	11.0±0.0	8.0±0.0	2.0±0.0	23.0±0.0	6.0±0.0
CluStream-W - SNN-DPC	6.7±0.0	5.0±0.1	4.0±0.0	2.0±0.0	10.4±0.0	3.7±0.0
CluStream-S - SNN-DPC	7.0±0.0	5.8±0.0	4.2±0.0	2.0±0.0	14.6±0.0	3.5±0.0
CluStream-G - SNN-DPC	9.0±0.0	10.9±0.1	8.0±0.0	2.0±0.0	21.5±0.0	6.0±0.0
CluStream-C - DBHD	11.0±0.0	39.8±0.0	9.3±0.0	2.0±0.0	16.4±0.0	11.1±0.0
CluStream-W - DBHD	11.0±0.0	39.8±0.0	9.3±0.0	2.0±0.0	16.4±0.0	11.1±0.0
CluStream-S - DBHD	11.0±0.0	39.8±0.0	9.3±0.0	2.0±0.0	16.4±0.0	11.1±0.0
CluStream-G - DBHD	14.8±0.8	18.1±0.2	6.0±0.1	6.9±0.4	9.7±0.0	12.8±0.1

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