Supplementary Material for SGDP

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Abstract. This document is the **Supplementary Material** for *SGDP: A Stream-Graph Neural Network Based Data Prefetcher*. We would like to thank the Program Committee members and the anonymous Reviewers for their great efforts in handling the review of our manuscript.

Appendix A: All Results of Rolling Prediction Based Multi-Step Prefetching

We summarize the detailed results of multi-step prefetching in **Table** 1. As reported in the **Table** 1, SGDP and its variants achieve the best results in 80 cases and 52 cases in terms of HR@100 and EPR@100, respectively. We also visualize the results of the averaged results of all datasets and two representative datasets as shown in Fig. 1. On hw_1 dataset, SGDP stably performs the best with both the highest HR@100 and EPR@100. On src1_2, $SGDP_p$ maintains highest HR@100 while SGDP have highest EPR@100.

Appendix B: Inference Efficiency

To verify the practicality of SGDP compared to the SOTA methods, we collect statistics of inference time and report the detailed results of the number of LBA delta predictions that can be inferred per second by learning-based methods in **Table** 2. SGDP and its variants process 469 to 670 LBA deltas per second, while Delta-LSTM and DeepPrefetcher are only able to process 91.2 and 197.7 on average respectively. $SGDP_l$ speed up inference time up to 3.13 times than DeepPrefetcher. Overall, SGDP and its variants show much higher efficiency and practicality.

Appendix C: All Results of Single-step Prefetching Based on Different Cache Sizes

We summarize the results of single-step prefetching about all eight datasets based on 20 different cache sizes ($\{5, 10, 20, \cdots, 90, 100, 200, \cdots, 900, 1000\}$) from **Table** 3 to **Table**10. As reported in the Tables, SGDP and its variants ($SGDP_l$ and $SGDP_p$) achieve the best results in all 160 cases and 83 cases in terms of HR and EPR, respectively. As for EPR, our models are not far from the maximum (mostly within 1%) in the non-first case.
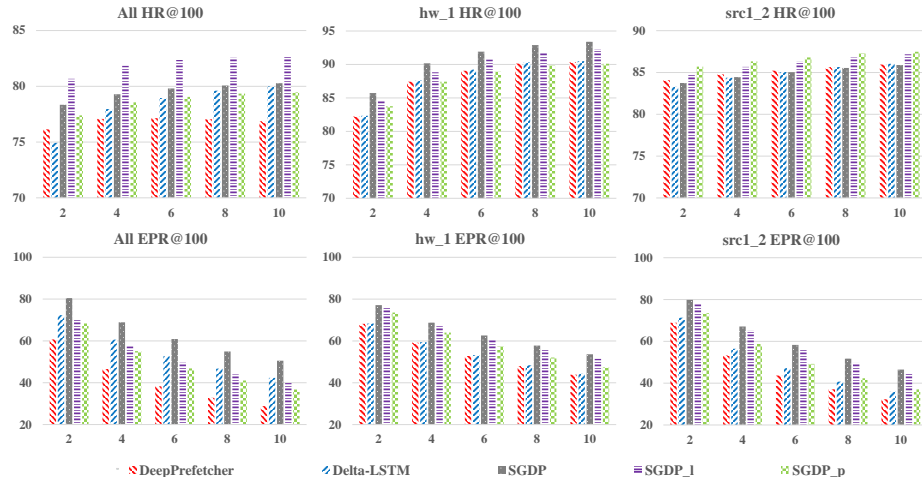
Fig. 1. Visualized Results of Multi-step Prefetching

Appendix D: Results and Algorithm Reproducing

In data prefetch, researchers rarely open-source their code. We have contacted most authors for their baseline codes and benchmarks, but the response is almost non-existent, which makes it difficult for us to compare baselines. We could not find the related source code for graph-based methods. However, we can guarantee that the two learning-based methods we compared are the best methods available. They achieve better results than all graph-based ones using the same datasets, so we choose them as the baselines. Although the authors of the two methods did not give us the code directly, we received confirmation and positive feedback from them on our reproduction. So, we are confident that our results are now SOTA and definitely better than all the previous graph-based methods.

As for the discussed time-series-based methods in our paper, i.e., ARIMA and Informer, they are often discussed as baselines described in our Related Work section, it is reasonable to use ARIMA and Informer as baselines. As the other researchers said in their paper, those time-series-based methods perform well in datasets which have more sequence access patterns.

Researchers in this field hardly fully open-source their code, which not only makes it difficult for us to reproduce their methods but also hinders the development of the field. Therefore, we sincerely hope to promote the openness and development of the storage field and help more developers and researchers enter the community more efficiently by making our source code, datasets, and our reproduced and validated baselines available[1].

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[1] Our codes are available at https://anonymous.4open.science/r/D2F2/.

Table 1. Results of Multi-step Prefetching. The results are in percentage, and the best results are highlighted in **bold**.

Dataset	Methods	HR@100										EPR@100									
	Steps	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
hw_1	DeepPrefetcher	74.6	82.2	85.3	87.4	88.4	89.1	89.7	90.1	90.2	90.3	75.9	68.2	63.0	59.2	55.8	52.8	50.3	48.0	45.8	43.9
	Delta-LSTM	74.8	82.3	85.4	87.6	88.6	89.2	89.9	90.3	90.4	90.5	76.0	68.4	63.2	59.5	56.1	53.2	50.6	48.4	46.2	44.3
	SGDP	**79.5**	**85.7**	**88.3**	**90.2**	**91.2**	**91.9**	**92.5**	**92.9**	**93.2**	**93.4**	**83.5**	**77.1**	**72.4**	**68.8**	**65.5**	**62.6**	**60.1**	**57.8**	**55.6**	**53.6**
	$SGDP_l$	78.8	84.7	87.1	88.8	89.9	90.8	91.3	91.8	92.1	92.3	82.7	76.1	71.0	67.1	63.7	60.8	58.1	55.8	53.6	51.5
	$SGDP_p$	78.2	83.8	86.0	87.4	88.3	88.9	89.5	89.9	90.1	90.1	80.4	73.6	68.1	64.0	60.5	57.4	54.7	52.1	49.6	47.3
hw_2	DeepPrefetcher	92.5	93.4	93.7	93.9	94.0	94.1	94.1	94.1	94.2	94.2	94.0	89.6	85.7	82.2	79.0	76.0	73.3	70.7	68.3	66.0
	Delta-LSTM	92.8	93.6	94.0	94.3	94.4	94.5	94.5	94.6	94.6	94.6	94.2	89.9	86.2	83.0	80.0	77.2	74.7	72.4	70.2	68.1
	SGDP	93.0	94.1	94.5	94.8	94.9	95.0	95.1	95.1	95.2	95.2	**97.7**	**96.0**	**94.7**	**93.4**	**92.3**	**91.3**	**90.4**	**89.4**	**88.5**	**87.7**
	$SGDP_l$	93.1	94.1	94.6	94.8	95.0	95.1	95.2	95.2	95.3	95.3	97.2	95.2	93.3	91.7	90.1	88.7	87.3	85.9	84.6	83.4
	$SGDP_p$	**94.0**	**95.1**	**95.5**	**95.7**	**95.9**	**96.0**	**96.0**	**96.0**	**96.1**	**96.1**	95.0	91.2	88.0	85.0	82.3	79.7	77.4	75.0	72.9	70.8
hw_3	DeepPrefetcher	50.7	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8	50.7	34.9	26.3	21.1	17.7	15.2	13.3	11.8	10.6	9.7
	Delta-LSTM	56.8	60.7	67.8	68.3	68.4	68.5	68.4	68.4	68.4	68.4	66.8	52.4	46.9	41.1	36.5	32.8	29.7	27.1	25.3	23.5
	SGDP	76.6	77.7	78.0	78.0	78.0	78.0	78.0	78.0	78.1	78.0	**89.5**	**81.6**	**74.4**	**68.9**	**63.8**	**59.9**	**56.1**	**53.1**	**50.8**	**48.2**
	$SGDP_l$	**79.0**	**80.2**	**80.5**	**80.6**	**80.8**	**80.8**	**80.8**	**80.8**	**80.9**	**80.8**	84.2	73.8	65.3	58.9	53.5	49.2	45.3	42.2	39.5	37.0
	$SGDP_p$	48.3	48.5	48.5	48.6	48.6	48.7	48.7	48.9	49.2	49.3	73.1	61.6	53.4	47.5	42.9	39.2	36.2	34.1	32.8	31.5
hm_1	DeepPrefetcher	59.1	60.0	59.2	58.2	57.1	56.1	55.2	54.4	53.6	53.0	56.0	39.6	29.8	23.5	19.1	16.0	13.7	11.9	10.5	9.4
	Delta-LSTM	50.6	55.5	56.7	57.8	58.7	59.3	59.9	60.2	60.4	60.6	72.8	63.5	54.9	48.6	43.6	39.6	36.3	33.5	31.5	29.5
	SGDP	55.7	55.8	55.5	55.3	55.1	54.9	54.6	54.3	54.1	54.0	**90.1**	**80.5**	**72.0**	**64.9**	**59.2**	**54.2**	**50.0**	**46.6**	**44.8**	**42.3**
	$SGDP_l$	61.4	63.1	63.6	63.7	63.4	63.1	62.8	62.4	62.1	61.8	60.8	45.1	35.8	29.7	25.2	21.9	19.3	17.2	15.5	14.1
	$SGDP_p$	**62.9**	**65.0**	**65.7**	**65.8**	**65.8**	**65.4**	**65.1**	**64.8**	**64.5**	**64.1**	63.8	48.6	39.2	32.7	28.0	24.3	21.5	19.2	17.4	15.8
mds_0	DeepPrefetcher	73.7	81.3	81.7	81.8	81.6	81.2	80.9	80.6	80.3	79.9	77.5	61.3	50.5	42.6	36.3	31.2	27.4	24.4	21.9	19.9
	Delta-LSTM	69.6	75.6	77.2	78.2	79.0	79.7	80.3	80.9	81.4	81.8	**87.8**	**80.7**	**74.6**	**69.4**	**65.2**	**61.4**	**58.1**	**55.2**	**52.7**	**50.4**
	SGDP	76.3	76.9	77.4	77.8	78.1	78.5	78.9	79.1	79.4	79.5	87.0	78.1	71.1	65.4	60.7	56.6	53.2	50.3	47.7	45.3
	$SGDP_l$	77.5	78.9	79.5	79.8	80.0	80.1	80.2	80.3	80.3	80.3	73.9	59.7	49.8	43.0	37.8	33.6	30.4	27.8	25.5	23.5
	$SGDP_p$	**79.8**	**82.0**	**82.9**	**83.6**	**84.0**	**84.3**	**84.6**	**84.8**	**85.0**	**85.0**	81.9	71.3	63.2	56.9	51.5	47.1	43.3	40.2	37.3	34.7
proj_0	DeepPrefetcher	79.1	81.3	81.7	82.0	82.2	82.2	82.3	82.2	82.3	82.2	78.6	64.6	55.1	47.9	42.4	37.8	34.2	31.1	28.5	26.4
	Delta-LSTM	69.1	76.9	78.4	79.1	79.5	79.9	80.2	80.5	80.7	80.9	86.2	**79.6**	**72.7**	67.1	62.3	58.2	54.6	51.5	48.8	46.3
	SGDP	78.5	78.9	79.1	79.3	79.5	79.7	79.8	79.9	80.1	80.1	**87.6**	78.2	70.7	64.5	59.5	55.1	51.4	48.1	45.4	42.9
	$SGDP_l$	81.1	81.9	82.3	82.6	82.9	**83.1**	**83.2**	83.3	**83.5**	83.5	83.6	72.4	64.0	57.4	52.1	47.8	44.1	41.0	38.3	36.0
	$SGDP_p$	**81.3**	**82.1**	**82.4**	**82.7**	**82.9**	83.1	83.1	**83.3**	83.5	83.5	80.2	67.7	58.7	51.9	46.5	42.1	38.5	35.5	32.9	30.6
prxy_0	DeepPrefetcher	70.2	75.0	76.2	76.8	77.2	77.5	77.6	77.5	77.6	77.6	70.4	58.4	49.3	42.6	37.5	33.5	30.1	27.3	25.0	23.1
	Delta-LSTM	64.2	71.5	73.2	74.1	74.8	75.4	76.1	76.4	76.7	77.0	79.3	**72.8**	**65.6**	**59.9**	**55.4**	**51.4**	**48.3**	**45.3**	**42.9**	**40.7**
	SGDP	73.2	73.9	74.4	74.6	75.3	75.5	75.6	75.7	76.1	76.1	**83.3**	72.3	64.3	58.0	53.2	49.0	45.5	42.5	40.1	37.6
	$SGDP_l$	**76.5**	**77.7**	**78.3**	**78.7**	**79.4**	**79.6**	**79.8**	**79.9**	**80.2**	**80.2**	74.3	61.4	53.1	47.0	42.5	38.6	35.5	32.8	30.7	28.6
	$SGDP_p$	76.2	77.2	77.8	78.2	79.0	79.3	79.6	79.8	80.1	80.1	72.6	59.1	50.4	44.0	39.5	35.8	32.7	30.1	28.0	26.0
src1_2	DeepPrefetcher	82.9	84.1	84.5	84.8	85.0	85.2	85.5	85.6	85.9	86.0	80.9	68.9	60.0	53.3	48.0	43.7	40.1	37.1	34.5	32.3
	Delta-LSTM	79.6	83.3	84.0	84.4	84.7	85.1	85.4	85.7	85.9	86.0	81.3	71.3	63.0	56.4	51.3	47.2	43.7	40.7	38.1	35.9
	SGDP	83.1	83.7	84.1	84.5	84.8	85.0	85.5	85.8	85.9	86.0	**88.5**	**79.8**	**72.8**	**67.1**	**62.4**	**58.3**	**54.9**	**51.7**	**49.0**	**46.5**
	$SGDP_l$	83.9	84.8	85.3	85.7	86.0	86.3	86.7	86.8	87.1	87.2	87.4	78.3	71.0	65.1	60.4	56.3	52.8	49.7	47.0	44.5
	$SGDP_p$	**84.8**	**85.7**	**86.0**	**86.3**	**86.6**	**86.8**	**87.0**	**87.3**	**87.5**	**87.5**	84.0	73.4	65.2	58.7	53.6	49.2	45.5	42.3	39.5	37.0

Table 2. The number of LBA delta predictions that can be inferred per second by learning-based methods.

Method \ dataset	hw_1	hw_2	hw_3	hm_1	mds_0	proj_0	prxy_0	src1_2	avg
Delta-LSTM	89.4	87.4	94.5	92.4	90.7	91.5	88.4	95.1	91.2
DeepPrefetcher	208.2	154.5	194.2	160.1	248.4	178.4	187.9	249.6	197.7
SGDP	644.5	692.4	666.1	515.2	543.5	553.3	470.0	550.7	579.5
$SGDP_l$	634.7	686.9	614.7	500.1	651.4	663.9	526.3	670.7	618.6
$SGDP_p$	599.5	645.6	593.9	567.0	491.7	529.3	574.8	558.7	570.1

Table 3. Results of single-step prefetching based on different cache sizes about dataset **hw_1**.

HR@N

Methods \ Cache sizes	5	10	20	30	40	50	60	70	80	90	100	200	300	400	500	600	700	800	900	1000
No_pre	0	0	0	0	0	0	0	0.3	0.3	0.3	0.3	0.4	1.7	2.6	2.7	3.1	7.6	15.6	38.9	54.2
Naive	56.9	57.5	57.8	57.9	57.9	57.9	57.9	57.9	58.0	58.0	58.0	58.1	58.2	58.9	59.2	59.5	59.7	59.9	61.6	63.2
Stride	43.6	43.7	43.8	43.9	43.9	43.9	43.9	44.0	44.0	44.0	44.0	44.0	44.6	45.4	45.7	46.0	46.2	50.2	53.8	65.8
ARIMA	1.5	1.9	2.3	2.6	3.0	3.1	3.1	3.4	3.8	3.9	4.0	4.3	4.5	5.0	6.0	6.7	7.6	8.0	8.3	8.8
Informer	0.2	0.2	0.4	0.5	0.5	0.6	0.7	0.7	0.8	0.8	0.9	1.3	1.6	2.0	2.4	3.9	4.4	5.2	5.5	5.8
DeepPrefetcher	73.9	74.3	74.5	74.6	74.6	74.6	74.6	74.6	74.6	74.6	74.6	74.7	74.8	75.3	75.7	75.7	75.9	76.5	77.8	79.2
Delta-LSTM	74.0	74.4	74.6	74.7	74.7	74.7	74.7	74.7	74.8	74.8	74.8	74.8	74.9	75.4	75.8	75.8	76.0	76.6	77.9	79.3
SGDP	**78.7**	**79.2**	**79.4**	**79.4**	**79.4**	**79.5**	**79.5**	**79.5**	**79.5**	**79.5**	**79.5**	**79.5**	**79.6**	**79.9**	**80.2**	**80.3**	**80.4**	**81.3**	**82.4**	**85.8**
SGDP$_l$	77.9	78.5	78.7	78.8	78.8	78.8	78.8	78.8	78.8	78.8	78.8	78.9	79.0	79.3	79.6	79.6	79.8	80.7	81.7	84.9
SGDP$_p$	74.9	75.7	76.7	77.1	77.4	77.6	77.7	77.9	78.0	78.1	78.2	78.5	78.6	79.0	79.3	79.4	79.5	80.2	81.1	83.6

EPR@N

Methods \ Cache sizes	5	10	20	30	40	50	60	70	80	90	100	200	300	400	500	600	700	800	900	1000
Naive	61.1	63.3	64.3	64.4	64.4	64.4	64.5	64.5	64.5	64.5	64.5	64.6	64.8	64.9	65.0	65.1	65.1	65.2	64.7	64.5
Stride	80.2	80.5	81.0	81.0	81.0	81.1	81.1	81.1	81.1	81.1	81.1	81.1	81.2	81.3	81.4	81.4	81.5	81.3	81.1	80.6
ARIMA	1.5	1.9	2.5	2.8	3.2	3.3	3.3	3.6	4.1	4.2	4.3	4.4	4.7	5.1	5.3	5.6	5.7	6.0	6.2	6.2
Informer	0.2	0.3	0.4	0.5	0.6	0.6	0.7	0.7	0.8	0.8	0.9	1.1	1.4	1.7	2.1	2.3	2.6	2.8	2.8	2.9
DeepPrefetcher	74.6	75.4	75.8	75.8	75.8	75.8	75.9	75.9	75.9	75.9	75.9	75.9	76.0	76.2	76.4	76.5	76.5	76.5	76.5	76.5
Delta-LSTM	74.7	75.5	75.9	75.9	75.9	76.0	76.0	76.0	76.0	76.0	76.0	76.0	76.1	76.3	76.5	76.6	76.6	76.6	76.6	76.6
SGDP	**81.9**	**82.9**	**83.4**	**83.4**	**83.4**	**83.5**	**83.5**	**83.5**	**83.5**	**83.5**	**83.5**	**83.5**	**83.6**	**83.6**	**83.7**	**83.7**	**83.7**	**83.4**	**83.0**	**81.6**
SGDP$_l$	80.9	82.1	82.6	82.6	82.6	82.7	82.7	82.7	82.7	82.7	82.7	82.8	82.9	82.9	83.0	83.0	83.1	82.7	82.3	80.6
SGDP$_p$	76.4	77.6	78.8	79.2	79.6	79.8	80.0	80.1	80.2	80.3	80.4	80.8	80.9	81.0	81.1	81.2	81.2	80.9	80.7	79.6

Table 4. Results of single-step prefetching based on different cache sizes about dataset **hw_2**.

HR@N

Methods \ Cache sizes	5	10	20	30	40	50	60	70	80	90	100	200	300	400	500	600	700	800	900	1000
No_pre	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Naive	92.3	92.5	92.5	92.5	92.6	92.6	92.6	92.6	92.6	92.6	92.6	92.7	92.7	92.7	92.7	92.7	92.7	92.7	92.7	92.7
Stride	91.0	91.0	91.0	91.0	91.1	91.1	91.1	91.1	91.1	91.1	91.1	91.1	91.1	91.1	91.1	91.1	91.1	91.1	91.1	91.1
ARIMA	82.6	82.8	82.8	82.8	82.8	82.9	82.9	82.9	82.9	82.9	82.9	82.9	83.0	83.0	83.0	83.0	83.0	83.0	83.0	83.0
Informer	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
DeepPrefetcher	92.2	92.2	92.3	92.4	92.4	92.5	92.5	92.5	92.5	92.5	92.5	92.6	92.7	92.7	92.7	92.7	92.8	92.8	92.8	92.8
Delta-LSTM	92.4	92.5	92.6	92.6	92.7	92.7	92.7	92.8	92.8	92.8	92.8	92.9	92.9	92.9	92.9	93.0	93.0	93.0	93.0	93.1
SGDP	92.9	93.0	93.0	93.0	93.0	93.0	93.0	93.0	93.0	93.0	93.0	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1
SGDP$_l$	92.9	92.9	93.0	93.0	93.0	93.0	93.0	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.1	93.2	93.2	93.2	93.2
SGDP$_p$	**93.6**	**93.7**	**93.8**	**93.9**	**94.0**	**94.0**	**94.0**	**94.0**	**94.0**	**94.0**	**94.0**	**94.1**	**94.1**	**94.1**	**94.1**	**94.2**	**94.2**	**94.2**	**94.2**	**94.2**

EPR@N

Methods \ Cache sizes	5	10	20	30	40	50	60	70	80	90	100	200	300	400	500	600	700	800	900	1000
Naive	93.0	93.3	93.4	93.5	93.5	93.6	93.6	93.7	93.7	93.7	93.7	93.9	93.9	93.9	93.9	94.0	94.0	94.0	94.0	94.0
Stride	**99.1**	**99.1**	**99.1**	**99.1**	**99.2**	**99.2**	**99.2**	**99.2**	**99.2**	**99.2**	**99.2**	**99.2**	**99.2**	**99.2**	**99.2**	**99.2**	**99.2**	**99.2**	**99.2**	**99.2**
ARIMA	85.5	85.9	86.0	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.2	86.2	86.3	86.3	86.3	86.4	86.4	86.4	86.4	86.4
Informer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DeepPrefetcher	93.3	93.4	93.6	93.6	93.7	93.8	93.9	94.0	94.0	94.0	94.0	94.2	94.3	94.3	94.3	94.4	94.5	94.5	94.5	94.5
Delta-LSTM	93.6	93.7	93.8	93.9	94.0	94.1	94.1	94.1	94.2	94.2	94.2	94.4	94.4	94.5	94.5	94.6	94.7	94.7	94.7	94.7
SGDP	97.5	97.5	97.6	97.6	97.6	97.7	97.7	97.7	97.7	97.7	97.7	97.7	97.8	97.8	97.8	97.8	97.8	97.8	97.8	97.8
SGDP$_l$	96.8	97.0	97.0	97.1	97.1	97.2	97.2	97.2	97.2	97.2	97.2	97.3	97.3	97.3	97.3	97.4	97.4	97.4	97.4	97.4
SGDP$_p$	94.2	94.4	94.6	94.7	94.8	94.9	94.9	95.0	95.0	95.0	95.0	95.1	95.2	95.2	95.2	95.3	95.4	95.4	95.4	95.4

Table 5. Results of single-step prefetching based on different cache sizes about dataset **hw_3**.

												HR@N								
Methods \ Cache sizes	5	10	20	30	40	50	60	70	80	90	100	200	300	400	500	600	700	800	900	1000
No_pre	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.3	0.9	0.9	1.0	1.1	1.1	1.2	1.3
Naive	47.6	47.7	47.8	47.8	47.8	47.8	47.8	47.8	47.9	47.9	47.9	48.2	48.2	48.2	48.2	48.2	48.7	48.8	48.8	48.8
Stride	38.4	38.4	38.5	38.5	38.5	38.5	38.5	38.5	38.6	38.6	38.6	38.8	38.8	39.3	39.4	39.5	39.5	39.5	39.6	39.6
ARIMA	0.1	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.5	0.5	0.6	0.6	1.2	1.2	1.3
Informer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.3	0.3	0.9	0.9	0.9
DeepPrefetcher	50.4	50.4	50.5	50.5	50.5	50.5	50.5	50.6	50.6	50.6	50.7	50.8	51.0	51.0	51.1	51.1	51.1	51.7	51.7	51.7
Delta-LSTM	56.3	56.4	56.4	56.4	56.4	56.5	56.5	56.5	56.6	56.6	56.8	57.1	57.1	57.1	57.2	57.3	57.8	57.8	57.8	57.9
SGDP	76.0	76.0	76.1	76.1	76.1	76.1	76.2	76.4	76.5	76.5	76.6	76.8	76.8	76.9	77.3	77.3	77.4	77.4	77.4	77.5
$SGDP_l$	**78.5**	**78.5**	**78.5**	**78.6**	**78.6**	**78.6**	**78.6**	**78.9**	**79.0**	**79.0**	**79.0**	**79.2**	**79.3**	**79.3**	**79.3**	**79.7**	**79.7**	**79.7**	**79.7**	**79.8**
$SGDP_p$	48.0	48.1	48.1	48.1	48.1	48.1	48.2	48.2	48.2	48.3	48.3	48.6	48.9	48.9	49.0	49.3	49.6	49.6	49.6	49.6
												EPR@N								
Methods \ Cache sizes	5	10	20	30	40	50	60	70	80	90	100	200	300	400	500	600	700	800	900	1000
Naive	47.9	48.0	48.1	48.1	48.1	48.2	48.2	48.2	48.2	48.2	48.3	48.5	48.5	48.4	48.4	48.4	48.7	48.7	48.7	48.7
Stride	81.6	81.6	81.7	81.7	81.7	81.8	81.8	81.8	81.9	82.0	82.0	82.1	82.1	82.2	82.2	82.2	82.3	82.3	82.3	82.3
ARIMA	0.1	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Informer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DeepPrefetcher	50.4	50.4	50.5	50.5	50.5	50.5	50.5	50.6	50.6	50.7	50.7	50.8	51.0	51.0	51.0	51.0	51.2	51.2	51.2	51.2
Delta-LSTM	65.3	66.2	66.3	66.3	66.3	66.4	66.4	66.4	66.5	66.5	66.8	67.0	67.0	67.0	67.0	67.1	67.2	67.2	67.2	67.2
SGDP	**88.8**	**88.9**	**88.9**	**88.9**	**89.0**	**89.0**	**89.0**	**89.3**	**89.4**	**89.5**	**89.5**	**89.7**	**89.7**	**89.8**	**90.0**	**90.0**	**90.1**	**90.1**	**90.1**	**90.1**
$SGDP_l$	83.6	83.6	83.6	83.6	83.7	83.7	83.7	84.0	84.1	84.1	84.2	84.4	84.4	84.5	84.5	84.7	84.7	84.7	84.7	84.7
$SGDP_p$	70.6	72.1	72.5	72.6	72.6	72.6	72.7	72.8	72.9	73.0	73.1	73.7	74.4	74.5	74.6	74.7	74.9	75.1	75.1	75.1

Table 6. Results of single-step prefetching based on different cache sizes about dataset **hm_1**.

												HR@N								
Methods \ Cache sizes	5	10	20	30	40	50	60	70	80	90	100	200	300	400	500	600	700	800	900	1000
No_pre	1.0	2.7	5.5	8.5	11.9	14.3	16.6	19.4	21.5	23.5	25.3	42.2	68.7	91.9	95.4	96.2	96.8	97.3	97.9	98.3
Naive	30.8	31.7	33.2	34.6	36.0	37.4	38.8	40.2	41.5	42.7	43.8	53.4	60.5	68.2	78.2	88.0	94.2	96.4	97.1	97.4
Stride	25.7	27.1	29.6	32.1	34.9	37.1	39.3	41.8	43.7	45.3	47.0	59.8	75.6	95.3	97.3	98.0	98.4	98.6	98.9	99.1
ARIMA	2.4	3.5	5.6	7.5	9.4	11.3	13.1	14.7	16.3	17.7	19.0	30.4	38.7	48.5	60.9	74.9	86.3	91.7	93.8	95.2
Informer	0.5	1.1	2.8	4.1	5.7	7.2	8.5	10.0	11.5	12.7	14.0	24.1	31.4	38.6	48.1	59.3	71.1	81.1	86.8	90.4
DeepPrefetcher	36.7	38.5	41.7	44.6	47.1	49.6	52.0	54.1	55.9	57.5	59.1	71.2	80.5	94.3	97.2	98.0	98.6	99.0	99.1	99.3
Delta-LSTM	28.3	30.0	32.9	35.6	38.3	40.9	43.1	45.0	47.0	49.0	50.6	63.6	78.3	95.9	97.8	98.4	98.8	99.0	99.1	99.3
SGDP	36.7	38.1	40.4	42.7	45.0	47.1	48.8	50.9	52.8	54.3	55.7	67.4	**81.2**	**96.8**	**98.4**	**98.8**	**99.1**	**99.2**	**99.3**	**99.4**
$SGDP_l$	40.6	43.1	46.5	49.1	51.4	53.5	55.4	57.1	58.6	60.1	61.4	70.3	78.5	90.2	97.4	98.2	98.6	98.8	98.9	99.1
$SGDP_p$	**41.4**	**43.9**	**47.5**	**50.3**	**52.7**	**54.9**	**56.8**	**58.5**	**59.9**	**61.4**	**62.9**	**71.8**	80.3	92.8	97.5	98.3	98.6	98.9	99.2	99.4
												EPR@N								
Methods \ Cache sizes	5	10	20	30	40	50	60	70	80	90	100	200	300	400	500	600	700	800	900	1000
Naive	30.5	30.5	30.8	30.9	31.0	31.0	31.1	31.1	31.2	31.2	31.2	31.2	30.0	26.9	21.8	16.6	11.8	7.5	6.2	5.6
Stride	82.0	82.3	82.7	83.0	83.3	83.5	83.8	84.0	84.1	84.2	84.4	84.3	79.0	83.6	86.1	87.7	88.0	87.8	**87.4**	**88.4**
ARIMA	2.3	2.7	3.2	3.6	4.0	4.2	4.5	4.6	4.8	5.0	5.2	6.3	6.9	6.5	5.6	4.0	3.0	2.5	2.3	2.5
Informer	0.1	0.1	0.2	0.3	0.4	0.4	0.5	0.6	0.6	0.7	0.7	1.1	1.4	1.5	1.4	1.2	1.0	0.9	0.8	0.7
DeepPrefetcher	37.0	38.5	41.5	44.0	46.2	48.3	50.1	51.9	53.5	54.8	56.0	65.3	67.1	53.5	48.4	41.5	42.1	45.2	47.4	46.1
Delta-LSTM	55.9	57.7	60.9	63.4	65.4	67.1	68.6	69.8	70.8	71.9	72.8	79.0	79.6	78.1	81.8	83.4	85.7	87.0	86.6	87.6
SGDP	**86.5**	**87.8**	**88.7**	**89.1**	**89.2**	**89.5**	**89.7**	**89.8**	**89.9**	**90.0**	**90.1**	**90.9**	**87.8**	**86.7**	**88.1**	**89.1**	**88.9**	**88.7**	87.3	86.2
$SGDP_l$	43.3	46.3	50.3	53.0	54.8	56.3	57.6	58.7	59.6	60.2	60.8	63.7	61.5	49.0	33.9	27.1	26.3	26.6	26.7	24.4
$SGDP_p$	43.4	46.8	51.2	54.3	56.5	58.3	59.9	61.1	62.1	63.0	63.8	67.7	65.9	51.4	41.6	35.5	35.1	35.5	36.3	34.8

Table 7. Results of single-step prefetching based on different cache sizes about dataset **mds_0**.

Methods \ Cache sizes	5	10	20	30	40	50	60	70	80	90	100	200	300	400	500	600	700	800	900	1000
HR@N																				
No_pre	10.1	13.2	18.1	21.0	24.2	26.7	30.0	32.4	33.4	34.2	35.0	45.8	49.6	51.3	52.6	55.0	57.9	58.5	59.3	61.0
Naive	50.0	54.3	58.4	61.2	63.1	64.6	65.8	66.8	67.5	67.9	68.2	71.1	75.0	78.9	81.1	82.9	83.9	84.5	84.9	85.2
Stride	44.0	47.3	51.8	54.2	55.8	57.5	59.0	60.3	60.9	61.5	62.2	72.0	75.6	76.9	77.4	77.8	78.5	78.9	79.2	79.8
ARIMA	13.2	16.6	20.7	24.0	27.4	30.2	32.6	35.0	36.1	36.9	37.4	41.2	46.1	50.3	52.8	54.3	55.2	56.1	57.6	58.3
Informer	6.2	9.6	13.1	16.0	18.6	20.4	22.1	23.7	25.4	26.9	28.3	35.9	40.2	44.1	47.2	49.0	50.9	52.3	53.5	54.5
DeepPrefetcher	55.7	60.7	65.3	68.1	69.8	71.1	71.9	72.5	73.0	73.4	73.7	78.9	84.4	86.2	87.1	87.4	87.7	87.9	88.1	88.5
Delta-LSTM	53.8	57.3	61.5	63.6	65.0	66.1	67.1	67.9	68.5	69.0	69.6	78.6	82.4	83.9	84.3	84.7	85.0	85.3	85.7	86.2
SGDP	62.5	66.0	69.7	71.7	72.8	73.7	74.4	74.9	75.4	75.8	76.3	84.5	88.4	89.9	90.3	90.5	90.7	91.0	91.3	91.6
SGDP$_l$	62.3	66.1	70.1	72.4	73.9	75.1	76.0	76.5	76.9	77.2	77.5	82.0	87.5	89.7	90.6	91.1	91.4	91.6	91.8	92.1
SGDP$_p$	**63.5**	**67.4**	**71.8**	**74.4**	**76.0**	**77.2**	**78.0**	**78.6**	**79.1**	**79.4**	**79.8**	**86.1**	**89.9**	**91.2**	**91.6**	**91.8**	**92.0**	**92.2**	**92.4**	**92.6**
EPR@N																				
Naive	45.8	47.8	50.4	51.8	52.6	52.5	51.9	51.0	50.9	51.0	51.1	52.1	52.8	53.1	52.9	52.8	50.8	51.2	51.8	52.2
Stride	**79.2**	**82.3**	**86.9**	**89.1**	**90.1**	**90.5**	**90.5**	**90.5**	**90.6**	**90.6**	**90.6**	**90.7**	**90.8**	**90.9**	**90.7**	**90.6**	**89.9**	**89.8**	**89.8**	**89.8**
ARIMA	8.1	8.6	9.5	9.9	10.0	10.1	9.9	9.3	9.3	9.2	9.2	9.6	9.8	10.2	10.4	10.7	11.0	11.3	11.7	12.0
Informer	0.2	0.3	0.5	0.8	1.0	1.0	1.1	1.1	1.1	1.1	1.2	2.1	3.0	3.7	4.2	4.5	4.7	4.8	5.0	5.2
DeepPrefetcher	63.1	66.9	71.3	73.9	75.4	76.1	76.2	76.3	76.7	77.2	77.5	80.2	82.3	83.1	83.5	83.7	83.2	83.2	83.2	83.3
Delta-LSTM	77.0	80.2	84.2	86.1	87.0	87.3	87.4	87.4	87.6	87.6	87.8	89.1	90.0	90.4	90.4	90.1	89.7	89.6	89.8	89.8
SGDP	77.2	80.2	83.9	85.7	86.5	86.8	86.8	86.6	86.9	87.0	87.0	87.9	88.5	88.8	88.9	88.9	88.4	88.4	88.5	88.4
SGDP$_l$	62.4	65.4	69.2	71.3	72.4	72.7	72.8	72.7	73.2	73.5	73.9	76.5	78.3	79.2	79.8	80.0	79.2	79.4	79.6	79.6
SGDP$_p$	64.9	68.7	73.8	77.0	78.9	79.6	80.0	80.4	81.0	81.4	81.9	85.3	87.5	88.1	88.4	88.4	87.8	87.8	88.0	87.9

Table 8. Results of single-step prefetching based on different cache sizes about dataset **proj_0**.

Methods \ Cache sizes	5	10	20	30	40	50	60	70	80	90	100	200	300	400	500	600	700	800	900	1000
HR@N																				
No_pre	4.1	6.1	8.9	11.0	14.1	17.4	23.1	26.3	27.3	28.2	28.7	30.8	32.3	32.8	33.2	33.5	34.0	34.8	35.0	35.2
Naive	59.0	61.1	63.6	65.1	66.3	67.2	68.2	69.2	69.6	69.9	70.1	71.1	71.8	72.5	73.0	73.4	73.7	73.9	74.2	74.3
Stride	48.7	51.0	53.1	54.5	55.7	57.0	58.9	60.1	60.5	60.8	61.1	62.5	63.8	64.1	64.3	64.7	64.9	65.2	65.3	65.4
ARIMA	10.7	12.9	15.6	18.1	20.8	23.6	27.5	30.8	32.1	33.0	33.5	35.2	36.1	37.0	37.7	38.3	38.7	38.9	39.0	39.3
Informer	2.3	3.9	6.0	7.7	9.2	10.6	12.1	13.7	15.4	17.3	19.8	29.6	30.8	31.9	32.6	33.4	33.8	34.2	34.5	34.7
DeepPrefetcher	70.4	72.6	74.7	75.9	76.8	77.4	78.1	78.5	78.7	78.9	79.1	80.2	81.1	81.8	81.9	82.1	82.2	82.5	82.7	82.8
Delta-LSTM	60.5	62.3	64.0	65.0	65.9	66.7	67.7	68.4	68.7	68.9	69.1	70.5	71.7	72.1	72.3	72.6	72.8	73.1	73.3	73.3
SGDP	71.5	73.4	75.0	75.9	76.5	77.1	77.6	78.0	78.2	78.4	78.5	79.7	80.7	81.1	81.2	81.5	81.7	81.9	82.1	82.1
SGDP$_l$	**73.5**	**75.5**	**77.3**	**78.3**	**79.0**	**79.6**	**80.2**	**80.6**	**80.8**	81.0	81.1	82.0	82.9	83.6	83.8	84.0	84.2	84.3	84.5	84.6
SGDP$_p$	71.5	73.7	76.2	77.5	78.4	79.2	80.0	80.5	80.8	**81.0**	**81.3**	**82.6**	**83.6**	**84.2**	**84.4**	**84.5**	**84.7**	**84.9**	**85.1**	**85.2**
EPR@N																				
Naive	57.6	58.7	61.0	62.3	62.9	62.7	61.9	60.1	59.8	59.8	59.7	60.2	60.4	60.6	60.7	60.9	60.9	60.9	60.8	60.8
Stride	80.3	82.5	85.6	87.3	88.4	**88.7**	**88.4**	**88.0**	**88.1**	**88.1**	**88.1**	**88.3**	**88.3**	**88.3**	**88.3**	**88.4**	**88.4**	**88.3**	**88.3**	**88.3**
ARIMA	11.6	12.0	12.6	13.0	13.1	12.6	11.7	10.8	10.4	10.2	10.1	10.0	10.1	10.1	10.2	10.2	10.3	10.3	10.3	10.4
Informer	0.0	0.1	0.1	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.5	1.0	1.4	1.8	2.0	2.2	2.2	2.3	2.3	2.3
DeepPrefetcher	73.0	75.0	77.5	78.9	79.7	79.6	78.9	78.3	78.4	78.5	78.6	79.7	80.3	80.8	81.0	81.1	81.2	81.3	81.4	81.5
Delta-LSTM	**82.8**	**84.3**	86.1	87.1	87.5	87.4	86.7	86.2	86.1	86.1	86.2	86.6	86.9	87.1	87.2	87.3	87.3	87.4	87.3	87.4
SGDP	82.2	84.0	**86.3**	**87.6**	**88.4**	88.4	88.0	87.6	87.6	87.6	87.6	87.9	88.0	88.1	88.1	88.2	88.2	88.2	88.2	88.2
SGDP$_l$	77.8	79.8	82.2	83.5	84.3	84.3	83.8	83.4	83.4	83.5	83.6	84.5	84.9	85.3	85.4	85.5	85.6	85.6	85.6	85.6
SGDP$_p$	72.3	74.5	77.5	79.2	80.3	80.5	80.0	79.6	79.8	79.9	80.2	81.6	82.5	83.0	83.3	83.5	83.6	83.7	83.8	83.9

Table 9. Results of single-step prefetching based on different cache sizes about dataset **prxy_0**.

	5	10	20	30	40	50	60	70	80	90	100	200	300	400	500	600	700	800	900	1000
HR@N																				
No_pre	14.9	20.1	25.1	27.5	30.0	32.4	35.7	38.0	39.2	40.1	40.7	45.9	47.5	47.8	48.0	48.4	48.5	48.6	48.7	48.8
Naive	40.4	46.4	52.4	56.0	58.2	59.9	61.3	62.5	63.3	63.9	64.3	66.5	67.9	69.5	70.5	71.3	71.9	72.3	72.5	72.7
Stride	34.5	40.3	45.1	47.6	49.4	51.3	53.2	54.6	55.3	55.9	56.5	61.1	62.6	62.9	63.2	63.5	63.6	63.7	63.8	63.8
ARIMA	14.6	19.9	25.7	29.2	32.0	34.7	37.3	39.7	40.8	41.7	42.2	45.5	47.4	49.4	50.4	51.0	51.7	52.0	52.2	52.3
Informer	8.4	13.7	18.6	21.8	24.0	25.7	26.9	28.2	29.7	30.8	32.1	39.8	41.9	43.1	44.0	44.9	45.5	46.1	46.6	46.9
DeepPrefetcher	50.9	57.0	62.3	64.7	66.2	67.4	68.3	69.0	69.4	69.9	70.2	73.6	75.6	76.5	76.7	76.9	77.1	77.2	77.3	77.4
Delta-LSTM	46.8	52.2	56.5	58.5	59.7	60.9	62.0	62.8	63.3	63.7	64.2	68.5	70.1	70.4	70.7	71.0	71.0	71.1	71.2	71.3
SGDP	56.7	62.2	66.4	68.3	69.5	70.6	71.3	71.9	72.4	72.8	73.2	77.2	78.7	79.0	79.3	79.6	79.6	79.7	79.8	79.9
$SGDP_l$	**58.7**	**64.1**	**68.9**	**71.2**	**72.7**	**73.9**	**74.7**	**75.3**	**75.8**	**76.2**	**76.5**	79.4	81.4	82.2	82.5	**82.7**	**82.8**	**82.9**	**82.9**	**83.0**
$SGDP_p$	58.2	63.9	68.8	71.0	72.5	73.6	74.4	75.0	75.4	75.8	76.2	**80.0**	**81.8**	**82.2**	**82.5**	82.6	82.8	82.9	83.0	83.0
EPR@N																				
Naive	33.5	35.1	37.6	39.1	40.1	40.4	39.9	39.0	38.6	38.6	38.5	38.8	39.2	39.6	39.8	40.1	40.3	40.5	40.7	40.9
Stride	65.2	69.6	75.3	78.9	81.2	81.9	81.7	81.4	81.3	81.2	81.1	81.1	81.2	81.3	81.3	81.3	81.4	81.4	81.4	81.4
ARIMA	6.1	6.5	7.1	7.4	7.8	7.9	7.7	7.4	7.3	7.2	7.2	7.4	7.5	7.7	7.7	7.8	8.0	8.0	8.1	8.2
Informer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2
DeepPrefetcher	59.6	63.5	67.7	70.0	71.2	71.3	70.9	70.3	70.3	70.3	70.4	71.5	72.5	72.9	73.1	73.3	73.4	73.7	73.8	73.9
Delta-LSTM	72.9	75.7	78.7	80.4	81.1	81.0	80.3	79.7	79.5	79.4	79.3	79.8	80.1	80.3	80.5	80.6	80.7	80.8	80.8	80.9
SGDP	**73.0**	**76.3**	**80.2**	**82.4**	**83.6**	**84.0**	**83.7**	**83.4**	**83.4**	**83.4**	**83.3**	**83.5**	**83.6**	**83.7**	**83.8**	**83.9**	**83.9**	**84.0**	**84.0**	**84.1**
$SGDP_l$	62.4	65.7	69.5	71.9	73.3	73.7	73.6	73.5	73.8	74.0	74.3	75.9	77.0	77.5	77.7	77.9	78.1	78.3	78.4	78.4
$SGDP_p$	61.2	64.9	69.1	71.4	72.7	73.0	72.6	72.3	72.3	72.4	72.6	73.5	74.4	74.8	75.1	75.4	75.7	75.8	76.0	76.1

Table 10. Results of single-step prefetching based on different cache sizes about dataset **src1_2**.

	5	10	20	30	40	50	60	70	80	90	100	200	300	400	500	600	700	800	900	1000
HR@N																				
No_pre	1.6	3.9	7.6	11.3	15.6	20.5	27.6	31.5	32.8	33.9	34.8	39.5	42.6	44.6	45.7	46.3	47.0	47.4	47.9	48.2
Naive	58.5	60.5	63.1	65.2	66.8	68.3	69.9	71.4	72.1	72.6	73.0	74.7	75.9	77.3	78.5	79.4	79.9	80.3	80.6	80.8
Stride	45.9	48.3	51.0	53.2	55.3	57.6	60.3	62.0	62.7	63.3	63.8	66.2	69.2	70.9	71.7	72.1	72.6	72.9	73.2	73.4
ARIMA	12.5	14.6	18.1	21.6	25.1	29.2	34.5	38.2	39.9	41.1	42.0	45.3	46.2	48.9	50.2	51.9	53.0	53.8	54.4	54.8
Informer	0.7	1.7	4.1	6.2	8.0	10.1	12.3	14.4	16.5	19.3	22.5	34.8	36.7	39.3	40.8	42.4	43.5	44.0	44.7	45.3
DeepPrefetcher	72.5	74.5	76.5	78.0	79.1	80.2	81.3	82.0	82.3	82.6	82.9	84.0	85.3	86.3	87.4	88.0	88.3	88.5	88.8	89.0
Delta-LSTM	66.9	68.7	70.8	72.4	73.7	75.1	76.6	77.5	78.0	78.3	78.7	79.8	81.5	82.6	83.7	84.3	84.6	84.9	85.2	85.4
SGDP	73.5	75.4	77.4	78.7	79.8	80.8	81.7	82.2	82.6	82.8	83.1	84.3	85.9	86.9	87.6	87.9	88.1	88.4	88.6	88.8
$SGDP_l$	**74.3**	**76.3**	**78.3**	**79.6**	**80.7**	81.6	82.6	83.1	83.4	83.7	83.9	85.0	86.5	87.4	88.2	88.5	88.7	89.0	89.2	89.4
$SGDP_p$	72.7	74.9	77.3	79.2	80.6	**81.9**	**83.1**	**83.8**	**84.2**	**84.5**	**84.8**	**85.9**	**87.1**	**87.9**	**88.6**	**88.9**	**89.2**	**89.3**	**89.6**	**89.8**
EPR@N																				
Naive	58.3	59.9	63.3	65.2	65.9	65.8	64.9	63.2	63.0	63.0	63.1	63.8	64.3	64.8	65.1	65.3	65.6	65.8	66.1	66.3
Stride	78.0	81.0	**86.1**	**88.6**	**89.7**	**90.1**	**89.8**	**89.6**	**89.6**	**89.6**	**89.6**	**90.0**	**91.1**	**91.6**	**91.7**	**91.8**	**91.9**	**91.9**	**92.0**	**92.0**
ARIMA	18.9	19.5	20.3	20.8	21.0	20.6	19.2	18.2	18.0	17.8	17.7	17.7	18.0	18.4	18.6	18.8	19.0	18.9	19.1	19.2
Informer	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.4	0.5	0.5	0.5	0.6
DeepPrefetcher	74.0	76.2	79.8	81.4	82.1	82.1	81.4	80.8	80.9	80.9	80.9	81.4	82.8	83.9	84.9	85.6	86.2	86.5	86.8	87.0
Delta-LSTM	75.9	77.9	81.1	82.5	83.0	82.9	82.1	81.5	81.4	81.4	81.4	81.9	83.1	84.3	85.2	85.9	86.5	86.8	87.1	87.3
SGDP	**80.0**	**82.5**	85.9	87.7	88.5	88.8	88.5	88.3	88.4	88.5	88.5	89.0	89.7	90.1	90.3	90.4	90.5	90.6	90.7	90.8
$SGDP_l$	79.0	81.5	84.9	86.7	87.5	87.7	87.4	87.2	87.3	87.4	87.4	87.8	88.3	88.6	88.7	88.9	89.0	89.1	89.3	89.3
$SGDP_p$	73.6	76.1	80.2	82.4	83.7	84.1	83.7	83.5	83.7	83.9	84.0	84.6	85.3	85.7	86.1	86.4	86.8	86.9	87.2	87.3