A. Complete Results of DirLinkBench

A.1. Results on Cora-ML

Table 1. Benchmark Results on Cora-ML. For all methods, $_F$ indicates the use of original node features as input, while $_D$ indicates the use of in/out degrees as input. Results ranked **first** and **second** are highlighted.

Method	Hits@20	Hits@50	Hits@100	MRR	AUC	AP	ACC
STRAP	67.10±2.55	75.05±1.66	79.09±1.57	**30.91±7.48**	87.38±0.83	90.46±0.70	78.47±0.77
ODIN	27.10±3.69	40.99±3.10	54.85±2.53	10.75±3.51	85.15±0.84	85.41±0.95	77.16±0.84
ELTRA	**70.74±5.47**	**81.93±2.38**	**87.45±1.48**	19.77±5.22	94.83±0.58	95.37±0.52	85.40±0.45
MLP_F	27.16±6.70	44.28±5.72	60.61±6.64	9.02±3.58	89.93±2.09	88.55±2.51	81.32±2.41
MLP_D	29.84±4.83	44.11±4.73	56.74±2.03	11.84±3.40	86.44±0.74	86.58±0.88	77.95±0.95
GCN_F	37.88±5.60	55.31±4.46	70.15±3.01	14.25±3.49	92.01±1.64	91.45±1.47	82.82±0.86
GCN_D	31.36±3.89	45.03±2.92	58.77±2.96	12.56±2.86	86.12±0.87	86.79±1.01	77.81±0.87
GAT_F	33.42±8.93	58.40±6.55	79.72±3.07	9.30±3.39	94.57±0.45	92.77±0.42	88.95±0.71
GAT_D	30.19±4.23	43.53±2.93	55.09±3.34	11.07±3.68	85.52±1.27	86.19±0.96	77.36±1.13
$APPNP_F$	55.47±4.63	75.16±4.09	86.02±2.88	22.49±6.33	95.94±0.57	**95.82±0.59**	**89.90±0.73**
$APPNP_D$	32.21±3.65	45.51±3.76	60.02±3.36	11.89±2.65	88.00±1.08	88.01±1.17	79.28±1.13
$GPRGNN_F$	54.48±7.37	73.72±5.3	86.03±2.73	22.22±4.14	95.76±0.64	95.57±0.69	89.57±0.56
$GPRGNN_D$	26.04±4.14	38.75±2.91	52.82±2.58	10.33±3.13	82.95±1.10	84.04±0.95	75.09±0.80
$DGCN_F$	30.86±4.17	41.82±4.43	54.38±4.97	11.01±4.23	85.55±3.40	85.66±2.35	77.82±3.49
$DGCN_D$	36.30±4.43	50.25±3.42	63.32±2.59	13.98±4.24	87.87±0.96	88.67±0.84	80.26±0.69
$DiGCN_F$	30.05±5.45	48.87±5.25	63.21±5.72	10.16±4.25	89.48±1.83	89.10±1.99	82.47±0.97
$DiGCN_D$	34.39±3.69	49.66±4.14	60.10±4.04	12.49±3.83	85.87±1.22	87.13±1.18	77.88±1.01
$DiGCNIB_F$	45.90±4.97	66.62±3.67	80.57±3.21	17.08±3.90	94.67±0.56	94.21±0.65	87.25±0.58
$DiGCNIB_D$	37.18±4.60	51.64±3.69	64.72±3.43	12.71±4.08	89.23±0.92	89.36±0.85	81.05±1.05
$DirGNN_F$	42.48±7.34	59.41±4.00	76.13±2.85	12.01±3.57	93.05±0.87	92.52±0.79	85.83±0.93
$DirGNN_D$	32.29±2.25	45.53±2.60	58.22±2.50	13.34±5.56	87.06± 0.77	87.35±0.80	77.93±1.14
$MagNet_F$	26.87±3.82	40.58±3.19	53.51±2.00	10.08±3.47	85.21±0.79	85.53±1.00	76.93±0.79
$MagNet_D$	29.38±3.39	43.28±3.76	56.54±2.95	11.19±3.04	85.23±0.84	86.06±0.94	77.51±0.92
$DUPLEX_F$	21.73±3.19	34.98±2.37	69.00±2.52	7.74±1.95	88.02±0.95	86.62±1.43	82.28±0.93
$DUPLEX_D$	17.48±4.69	32.58±8.33	54.50±7.49	5.46±2.10	82.97±4.47	82.97±2.85	75.59±4.87
$DHYPR_F$	59.81±4.79	77.45±2.56	86.81±1.60	20.56±5.10	**96.13±0.28**	95.84±0.39	86.04±0.66
$DHYPR_D$	15.09±4.40	28.96±6.54	42.93±6.63	4.05±1.16	80.83±2.64	79.97±3.02	72.74±3.50
$DiGAE_F$	56.13±3.80	72.23±2.51	82.06±2.51	20.53±4.21	92.56±0.66	93.70±0.54	86.25±0.80
$DiGAE_D$	35.40±4.05	49.12±3.44	61.30±2.70	13.71±4.22	86.82±0.85	87.35±0.84	76.01±1.04
$SDGAE_F$	**70.89±3.35**	**83.63±2.15**	**90.37±1.33**	**28.45±5.82**	**97.24±0.34**	**97.21±0.17**	**91.36±0.70**
$SDGAE_D$	35.53±5.41	49.34±4.60	61.40±3.18	14.21±3.71	87.38±1.06	88.19±1.18	78.99±1.34

A.2. Results on CiteSeer

Table 2. Benchmark Results on CiteSeer. For all methods, $_{F}$ indicates the use of original node features as input, while $_{D}$ indicates the use of in/out degrees as input. Results ranked **first** and **second** are highlighted.

Model	Hits@20	Hits@50	Hits@100	MRR	AUC	AP	ACC
STRAP	63.28±1.46	67.05±1.32	69.32±1.29	**40.70±6.95**	81.82±1.44	84.15±0.84	75.01±1.40
ODIN	30.74±3.78	47.91±2.57	63.95±2.98	11.05±2.74	82.22±1.05	81.74±1.10	73.63±1.19
ELTRA	72.34±1.76	79.44±1.54	84.97±1.90	27.87±9.03	90.98±0.86	92.71±0.81	80.86±1.15
MLP_F	35.55±4.39	52.31±4.60	70.27±3.40	16.08±4.88	85.47±1.35	85.16±1.29	74.26±1.64
MLP_D	40.27±4.48	56.27±3.64	68.78±2.21	15.94±3.04	84.09±1.02	84.86±1.12	74.81±1.32
GCN_F	42.27±7.11	62.65±4.22	80.36±3.07	18.28±6.7	89.94±1.04	88.88±1.38	79.47±1.73
GCN_D	43.96±2.35	56.24±3.62	66.15±2.07	19.36±4.96	81.24±1.55	84.33±0.90	73.92±1.43
GAT_F	48.29±6.04	71.86±4.65	85.88±4.98	16.71±5.56	92.90±0.74	91.12±1.53	85.94±1.21
GAT_D	40.29±3.25	55.62±1.92	65.82±2.87	19.00±4.18	82.72±0.67	83.96±0.60	74.18±1.18
$APPNP_F$	59.86±6.54	77.57±5.68	83.57±4.90	20.91±4.39	93.58±0.71	93.09±0.68	86.23±1.49
$APPNP_D$	45.44±3.38	58.18±1.55	68.47±3.00	20.18±5.50	83.48±1.17	85.72±1.00	74.86±1.19
$GPRGNN_F$	63.66±5.89	82.36±2.72	88.70±2.96	22.88±6.24	94.02±0.43	93.93±0.76	87.78±0.96
$GPRGNN_D$	44.33±4.92	56.68±5.38	69.28±3.85	18.39±5.43	84.41±1.62	85.72±1.92	74.34±2.34
$DGCN_F$	39.64±6.53	50.85±2.91	62.97±4.79	19.15±4.34	80.60±2.90	81.80±1.85	74.12±2.49
$DGCN_D$	45.94±3.01	58.38±2.85	68.97±3.39	19.53±4.83	83.38±1.41	85.44±1.01	74.83±1.46
$DiGCN_F$	38.48±3.50	53.30±5.92	70.95±4.67	15.79±4.05	87.41±2.24	85.02±2.90	80.38±1.17
$DiGCN_D$	40.65±4.23	52.87±3.85	65.46±3.70	17.39±4.82	83.50±1.12	84.75±0.93	74.65±1.36
$DiGCNIB_F$	44.90±7.91	69.86±5.13	85.32±3.70	16.61±5.61	92.50±0.57	90.35±1.43	85.98±1.19
$DiGCNIB_D$	45.68±3.50	58.99±3.92	70.29±2.39	20.22±3.31	85.81±0.69	86.73±0.85	76.54±1.27
$DirGNN_F$	44.95±7.31	64.00±3.19	76.83±4.24	16.19±4.51	88.44±1.28	88.59±1.14	80.34±1.52
$DirGNN_D$	40.16±4.84	53.44±3.38	65.62±2.46	16.95±5.45	83.67±1.08	84.59±1.18	73.75±1.31
$MagNet_F$	32.18±5.04	47.44±3.24	61.55±8.45	12.97±1.73	82.58±1.31	82.70±1.45	73.73±1.30
$MagNet_D$	39.35±5.13	54.50±3.21	65.32±3.26	15.31±2.45	83.05±1.35	84.14±1.31	73.28±1.21
$DUPLEX_F$	30.16±5.06	50.90±10.69	73.39±3.42	17.82±4.47	84.63±2.20	83.01±2.10	79.20±1.79
$DUPLEX_D$	27.98±7.61	50.20±7.36	63.62±3.90	10.95±6.35	80.68±1.15	81.17±1.20	73.75±1.44
$DHYPR_F$	**77.77±4.10**	**89.35±2.59**	**92.32±3.72**	32.39±10.14	**96.61±0.28**	**96.35±0.50**	**87.33±1.39**
$DHYPR_D$	24.32±8.59	41.51±6.55	54.27±5.94	6.17±2.12	77.38±1.79	77.35±2.44	70.27±1.35
$DiGAE_F$	56.12±3.08	71.06±2.49	83.64±3.21	22.88±6.79	91.03±1.14	91.29±1.04	81.85±1.31
$DiGAE_D$	44.32±1.85	59.91±2.08	69.66±2.11	20.89±4.81	85.28±0.96	86.28±0.96	74.54±0.91
$SDGAE_F$	**81.06±4.50**	**91.24±2.55**	**93.69±3.68**	**42.50±9.76**	**97.24±0.60**	**97.13±0.68**	**91.38±0.79**
$SDGAE_D$	45.03±3.19	57.82±2.00	68.97±1.70	21.41±2.85	85.10±0.98	86.24±0.47	74.83±0.86

A.3. Results on Photo

Table 3. Benchmark Results on Photo. For all methods, $_{F}$ indicates the use of original node features as input, while $_{D}$ indicates the use of in/out degrees as input. Results ranked **first** and **second** are highlighted.

Model	Hits@20	Hits@50	Hits@100	MRR	AUC	AP	ACC
STRAP	**38.54±5.20**	**55.21±2.19**	**69.16±1.44**	12.08±3.15	98.54±0.04	98.65±0.05	94.61±0.10
ODIN	5.28±1.36	9.38±1.54	14.13±1.92	1.78±0.66	88.15±0.21	87.34±0.30	80.60±0.20
ELTRA	7.09±1.23	12.86±1.58	20.63±1.93	2.22±0.59	96.89±0.06	95.84±0.13	91.84±0.12
MLP_F	8.83±2.06	14.07±2.87	20.91±4.18	3.18±1.06	95.29±0.37	93.60±1.06	88.31±0.50
MLP_D	7.88±1.56	12.90±0.81	18.04±1.35	2.53±0.40	85.90±0.44	86.44±0.21	77.25±0.51
GCN_F	29.44±3.90	44.12±3.49	57.55±2.54	9.85±2.78	99.04±0.06	98.66±0.10	95.90±0.18
GCN_D	31.47±3.71	44.93±3.34	58.77±2.96	**12.56±2.86**	86.12±0.87	86.79±1.01	77.71±1.01
GAT_F	25.97±4.22	42.85±4.90	58.06±4.03	8.62±3.07	**99.13±0.09**	**98.93±0.11**	**96.17±0.20**
GAT_D	11.96±1.60	21.83±2.98	31.51±2.16	3.61±0.94	94.41±0.19	94.37±0.19	87.00±0.25
$APPNP_F$	22.13±2.60	35.30±2.04	47.51±2.51	6.56±1.14	98.54±0.09	98.26±0.12	94.71±0.29
$APPNP_D$	12.92±1.06	19.42±2.24	26.66±2.14	4.63±1.10	93.29±0.42	92.86±0.40	85.36±0.39
$GPRGNN_F$	23.47±4.25	35.30±4.74	47.60±5.09	7.28±1.42	98.28±0.40	98.01±0.45	94.10±0.91
$GPRGNN_D$	13.03±1.49	19.04±1.37	25.85±1.42	4.83±1.00	92.49±1.74	92.22±1.44	84.44±1.97
$DGCN_F$	22.61±4.58	37.09±5.38	51.61±6.33	6.38±1.49	98.74±0.39	98.49±0.45	95.27±0.94
$DGCN_D$	15.96±3.35	26.88±2.91	35.56±3.52	5.83±1.16	96.26±0.70	95.94±0.76	90.02±1.00
$DiGCN_F$	18.47±1.89	29.63±2.28	40.17±2.38	6.41±2.41	98.10±0.10	97.69±0.14	93.86±0.23
$DiGCN_D$	17.00±1.84	25.51±1.39	33.73±1.95	5.71±1.32	95.21±0.19	95.09±0.21	88.29±0.26
$DiGCNIB_F$	21.42±2.77	34.97±2.67	48.26±3.98	6.82±1.53	98.67±0.14	98.39±0.16	95.05±0.27
$DiGCNIB_D$	16.00±1.67	24.63±1.84	33.20±2.17	6.11±1.50	96.71±0.07	96.38±0.09	91.30±0.17
$DirGNN_F$	22.59±2.77	34.65±3.31	49.15±3.62	8.42±2.90	98.76±0.09	98.47±0.13	95.34±0.17
$DirGNN_D$	21.57±2.11	30.87±2.35	43.21±2.19	8.72±2.08	97.53±0.09	97.26±0.08	92.41±0.20
$MagNet_F$	5.35±0.50	8.52±0.85	12.66±1.03	1.62±0.39	87.92±0.22	87.19±0.32	80.16±0.23
$MagNet_D$	5.14±0.54	9.04±0.52	13.89±0.32	1.61±0.31	88.11±0.21	87.48±0.21	80.31±0.14
$DUPLEX_F$	7.84±1.17	12.64±1.22	17.94±0.66	2.53±0.66	94.22±0.76	93.37±0.91	87.68±0.52
$DUPLEX_D$	6.97±2.14	9.08±4.95	13.28±6.14	2.26±1.17	87.41±7.05	86.40±5.89	79.73±6.87
$DHYPR_F$	10.18±1.21	13.66±1.47	20.93±2.41	3.15±0.57	87.35±1.54	88.83±0.95	76.94±0.63
$DHYPR_D$	0.16±0.14	0.52±0.83	1.63±1.23	0.28±0.06	58.85±1.39	56.65±0.62	53.91±0.66
$DiGAE_F$	27.79±3.85	43.32±3.36	55.05±2.36	9.38±2.47	97.98±0.08	97.99±0.10	91.77±0.18
$DiGAE_D$	16.55±1.20	26.17±2.03	34.60±2.09	5.36±1.66	93.14±0.14	93.76±0.11	83.23±0.34
$SDGAE_F$	**40.89±3.86**	**55.76±4.08**	**68.84±2.35**	**14.82±4.22**	**99.25±0.05**	**99.16±0.06**	**96.16±0.14**
$SDGAE_D$	24.76±3.46	38.5±1.66	50.96±2.32	9.16±1.99	98.07±0.15	97.98±0.12	93.57±0.35

A.4. Results on Computers

Table 4. Benchmark Results on Computers. For all methods, $_{F}$ indicates the use of original node features as input, while $_{D}$ indicates the use of in/out degrees as input. Results ranked **first** and **second** are highlighted.

Model	Hits@20	Hits@50	Hits@100	MRR	AUC	AP	ACC
STRAP	**24.35±3.75**	**38.14±3.77**	**51.87±2.07**	**7.44±1.98**	98.19±0.03	98.32±0.03	93.43±0.07
ODIN	4.42±1.18	8.41±1.27	12.98±1.47	1.46±0.63	89.35±0.09	89.15±0.35	81.73±0.10
ELTRA	4.82±0.75	8.66±1.38	14.74±1.55	1.61±0.52	95.63±0.10	95.11±0.14	89.30±0.15
MLP_F	5.51±0.72	9.31±0.90	14.26±0.88	1.63±0.42	92.83±0.36	91.86±0.39	85.33±0.57
MLP_D	6.97±1.22	12.2±0.88	17.57±0.85	2.76±0.75	87.48±0.16	88.69±0.15	78.75±0.36
GCN_F	19.32±2.69	31.47±1.81	43.77±1.75	7.26±1.64	98.97±0.06	**98.80±0.06**	**95.69±0.13**
GCN_D	10.59±1.40	17.48±1.07	24.59±1.01	4.33±1.26	94.41±0.10	94.25±0.12	87.00±0.13
GAT_F	14.89±3.24	27.53±2.48	40.74±3.22	3.37±0.92	**98.99±0.11**	98.76±0.15	**95.78±0.26**
GAT_D	7.16±1.53	14.49±1.54	21.98±1.04	2.36±0.69	95.20±0.44	94.81±0.47	88.14±0.67
$APPNP_F$	12.40±1.24	21.71±1.13	32.24±1.40	4.86±1.06	98.21±0.08	97.90±0.11	94.01±0.16
$APPNP_D$	9.54±1.53	15.36±1.20	21.92±1.32	3.99±0.83	93.84±0.35	93.49±0.38	85.76±0.52
$GPRGNN_F$	17.08±2.31	26.98±2.82	38.39±2.64	5.66±1.36	98.46±0.20	98.26±0.20	94.48±0.38
$GPRGNN_D$	10.94±1.33	16.33±0.95	21.16±1.53	4.05±1.09	92.78±2.17	92.74±1.78	82.40±4.17
$DGCN_F$	17.74±2.16	27.81±1.84	39.92±1.94	6.51±1.53	98.78±0.10	98.59±0.11	95.22±0.20
$DGCN_D$	11.12±1.50	17.79±1.66	25.20±1.87	4.06±0.70	95.54±0.50	95.30±0.53	88.72±0.74
$DiGCN_F$	11.68±1.84	19.02±2.06	27.51±1.67	4.61±0.71	97.87±0.24	97.47±0.27	93.44±0.54
$DiGCN_D$	10.98±1.53	17.76±1.37	24.46±1.51	4.69±1.09	94.86±0.11	94.75±0.12	87.59±0.17
$DiGCNIB_F$	13.41±2.95	22.54±1.79	32.44±1.85	4.86±0.80	98.46±0.14	98.15±0.17	94.61±0.31
$DiGCNIB_D$	10.70±0.84	16.69±1.41	24.74±1.41	5.10±1.08	96.50±0.09	96.19±0.11	90.77±0.15
$DirGNN_F$	13.95±1.66	23.94±1.26	35.65±1.30	5.02±0.60	98.56±0.05	98.28±0.07	94.68±0.14
$DirGNN_D$	13.09±0.90	21.84±1.54	30.70±0.98	6.14±1.58	96.70±0.08	96.64±0.07	91.08±0.13
$MagNet_F$	5.02±0.60	8.49±0.48	12.66±0.62	1.74±0.66	89.18±0.08	88.99±0.10	81.43±0.08
$MagNet_D$	4.50±0.76	8.15±0.89	12.85±0.59	0.97±0.22	89.37±0.03	89.25±0.05	81.61±0.11
$DUPLEX_F$	7.36±0.85	13.19±0.97	17.90±0.71	2.27±0.63	92.05±0.22	91.45±0.29	85.65±0.27
$DUPLEX_D$	5.92±1.83	9.04±4.80	14.56±5.51	1.48±0.55	87.00±4.97	86.79±4.33	78.90±5.65
$DiGAE_F$	19.65±1.33	31.16±1.62	41.55±1.62	5.34±1.18	97.29±0.13	97.12±0.44	89.52±0.15
$DiGAE_D$	11.94±0.96	19.38±1.60	26.53±1.20	3.58±1.20	92.86±0.28	93.51±0.20	82.11±0.32
$SDGAE_F$	**27.07±2.34**	**41.37±1.61**	**53.79±1.56**	**8.41±1.89**	**99.07±0.04**	**99.00±0.03**	95.66±0.12
$SDGAE_D$	15.18±2.22	24.02±1.53	33.51±1.16	5.73±1.33	97.44±0.12	97.32±0.11	92.26±0.24

A.5. Results on WikiCS

Table 5. Benchmark Results on WikiCS. For all methods, $_{F}$ indicates the use of original node features as input, while $_{D}$ indicates the use of in/out degrees as input. Results ranked **first** and **second** are highlighted.

Model	Hits@20	Hits@50	Hits@100	MRR	AUC	AP	ACC
STRAP	**64.97±1.52**	**71.10±1.13**	**76.27±0.92**	**37.29±9.42**	**98.66±0.03**	**98.91±0.02**	**94.57±0.06**
ODIN	3.41±0.60	6.24±0.63	9.83±0.47	1.17±0.35	92.86±0.04	91.90±0.10	86.39±0.08
ELTRA	3.84±0.49	6.62±0.55	9.88±0.70	1.42±0.33	92.66±0.19	92.19±0.23	85.73±0.28
MLP_F	0.24±0.09	0.71±0.40	1.21±0.25	0.15±0.07	71.90±0.54	70.86±0.68	66.26±0.67
MLP_D	4.04±0.72	7.92±0.61	12.99±0.68	1.63±0.20	92.12±0.10	91.90±0.19	84.65±0.22
GCN_F	6.10±1.85	11.25±1.86	18.05±1.43	2.07±0.49	95.86±0.27	95.41±0.45	89.85±0.35
GCN_D	18.15±2.49	30.21±2.51	38.37±1.51	6.09±2.16	95.97±0.08	96.23±0.08	89.58±0.09
GAT_F	1.83±0.54	3.52±2.21	5.60±1.17	0.83±0.31	73.18±3.59	74.81±4.19	54.16±6.34
GAT_D	24.13±4.10	34.32±4.41	40.47±4.10	7.67±2.07	95.72±0.27	96.06±0.33	88.90±0.36
$APPNP_F$	3.71±0.46	6.66±0.76	11.11±1.09	1.64±0.33	92.76±0.63	92.11±0.63	85.56±0.08
$APPNP_D$	7.60±1.75	12.76±3.01	20.23±1.72	2.75±0.70	94.12±0.09	93.89±0.12	87.51±0.14
$GPRGNN_F$	6.79±0.78	10.80±1.15	14.92±1.19	1.81±0.29	92.00±0.05	91.11±0.08	71.28±0.11
$GPRGNN_D$	5.67±1.67	14.07±2.14	20.87±3.15	2.02±0.41	93.53±0.58	93.47±0.66	86.59±0.56
$DGCN_F$	5.84±1.79	10.12±3.32	15.88±5.12	2.04±0.50	95.98±0.65	95.45±0.80	89.95±0.96
$DGCN_D$	8.35±3.46	16.51±2.99	25.91±4.10	2.88±1.11	96.22±0.32	96.04±0.43	90.13±0.37
$DiGCN_F$	3.63±0.69	6.77±0.98	10.24±0.88	1.58±0.46	92.55±1.53	91.63±1.62	82.60±2.14
$DiGCN_D$	10.08±1.33	16.32±2.16	25.31±1.84	3.85±0.98	95.59±0.12	95.57±0.12	88.89±0.14
$DiGCNIB_F$	5.36±0.58	8.28±1.20	13.61±1.18	1.81±0.48	94.00±0.33	93.31±0.39	84.49±1.62
$DiGCNIB_D$	12.01±2.95	20.99±1.75	28.28±2.44	3.96±1.16	96.36±0.07	96.30±0.08	90.72±0.10
$DirGNN_F$	11.76±3.31	23.90±3.31	33.28±2.84	4.82±1.77	97.09±0.13	97.04±0.16	91.55±0.25
$DirGNN_D$	28.16±2.09	40.94±1.19	50.48±0.85	**12.08±2.05**	97.13±0.09	97.33±0.09	91.28±0.14
$MagNet_F$	3.41±0.35	6.10±0.45	9.25±0.57	1.42±0.22	92.57±0.08	91.54±0.10	86.06±0.11
$MagNet_D$	4.13±0.46	6.57±0.34	10.81±0.46	1.26±0.37	93.06±0.06	92.18±0.07	86.59±0.06
$DUPLEX_F$	2.97±0.52	5.54±0.63	8.52±0.60	0.89±0.22	90.92±0.12	90.06±0.45	83.82±0.23
$DUPLEX_D$	1.09±0.92	1.53±3.12	5.45±0.19	1.03±0.08	90.93±0.04	90.37±0.23	83.81±0.11
$DiGAE_F$	7.01±1.78	11.54±1.11	18.17±1.27	2.18±0.78	93.47±1.04	93.20±1.16	76.38±0.21
$DiGAE_D$	10.6±1.89	19.69±1.98	29.21±1.36	4.59±0.88	93.46±0.22	94.47±0.15	82.53±0.48
$SDGAE_F$	8.54±3.42	19.60±5.04	29.95±5.80	2.35±0.91	96.64±1.23	96.58±1.20	90.98±1.52
$SDGAE_D$	**33.04±3.27**	**47.62±1.74**	**54.67±2.50**	11.78±4.11	**97.23±0.07**	**97.58±0.06**	**92.24±0.12**

A.6. Results on Slashdot

Table 6. Benchmark Results on Slashdot. For all methods, $_{R}$ indicates the use of random node features as input, while $_{D}$ indicates the use of in/out degrees as input. Results ranked **first** and **second** are highlighted.

Model	Hits@20	Hits@50	Hits@100	MRR	AUC	AP	ACC
STRAP	19.10±1.06	25.39±1.43	31.43±1.21	**9.82±1.82**	94.74±0.05	95.13±0.05	88.19±0.08
ODIN	14.97±1.40	24.91±1.19	34.17±1.19	4.44±1.59	96.58±0.07	96.75±0.06	90.39±0.10
ELTRA	18.02±2.11	26.31±0.95	33.44±1.00	5.53±1.77	94.65±0.03	95.23±0.04	88.11±0.11
MLP_R	4.25±0.71	7.26±0.74	11.31±0.70	1.28±0.33	72.86±0.37	76.72±0.21	66.16±0.26
MLP_D	14.16±5.22	24.01±0.79	32.97±0.51	4.14±1.71	95.84±0.07	96.21±0.05	89.62±0.11
GCN_R	12.52±1.30	21.03±1.62	29.04±0.95	3.03±0.73	95.58±0.13	95.69±0.13	89.46±0.12
GCN_D	16.28±1.59	24.51±1.63	33.16±1.22	5.54±2.04	95.90±0.07	96.17±0.06	89.75±0.17
GAT_R	14.82±2.70	22.19±2.78	30.16±3.11	5.11±1.53	96.26±0.18	96.45±0.20	87.14±1.03
GAT_D	12.39±1.47	19.54±1.89	26.65±1.98	4.53±0.78	95.01±0.34	95.25±0.45	88.01±0.49
$APPNP_R$	14.83±1.18	22.75±1.45	31.25±1.14	4.56±1.37	95.36±0.07	95.72±0.06	88.76±0.09
$APPNP_D$	15.00±5.47	24.34±1.47	33.76±1.05	5.86±2.78	96.21±0.06	96.43±0.05	90.07±0.10
$GPRGNN_R$	15.19±1.58	23.41±1.15	32.28±1.27	4.82±1.54	95.64±0.05	95.95±0.05	88.62±0.28
$GPRGNN_D$	12.46±2.17	22.05±1.98	32.61±1.05	4.84±2.37	95.73±0.15	96.00±0.10	89.08±0.18
$DirGNN_R$	18.72±1.93	28.52±1.09	37.41±1.37	6.19±2.04	96.67±0.05	96.89±0.04	90.24±0.12
$DirGNN_D$	20.55±2.85	31.20±1.18	41.74±1.15	7.52±3.24	**96.95±0.05**	**97.14±0.06**	**90.65±0.13**
$MagNet_R$	9.16±1.26	19.58±1.37	28.50±1.78	1.98±0.25	96.31±0.06	96.38±0.06	90.04±0.13
$MagNet_D$	12.55±0.75	22.34±0.42	31.98±1.06	2.83±0.51	96.57±0.09	96.69±0.10	90.45±0.09
$DUPLEX_R$	5.67±1.85	11.49±3.36	18.42±2.59	1.81±0.83	94.36±3.25	94.48±2.76	85.42±3.42
$DUPLEX_D$	2.51±0.64	5.95±1.11	9.39±2.71	0.51±0.01	80.57±3.85	86.52±1.50	77.67±2.24
$DiGAE_R$	18.89±1.71	27.69±1.41	36.57±1.32	5.49±2.96	95.26±0.29	96.13±0.19	84.27±0.26
$DiGAE_D$	**23.68±0.94**	**33.97±1.06**	**41.95±0.93**	5.54±1.51	94.30±0.29	95.80±0.12	85.67±0.28
$SDGAE_R$	18.24±2.05	28.47±1.97	37.34±0.68	5.51±1.65	95.96±0.07	96.31±0.03	90.11±0.11
$SDGAE_D$	**23.57±2.11**	**33.75±1.48**	**42.42±1.15**	**8.41±3.80**	**96.70±0.10**	**97.06±0.08**	**91.05±0.20**

A.7. Results on Epinions

Table 7. Benchmark Results on Epinions. For all methods, $_{R}$ indicates the use of random node features as input, while $_{D}$ indicates the use of in/out degrees as input. Results ranked **first** and **second** are highlighted.

Model	Hits@20	Hits@50	Hits@100	MRR	AUC	AP	ACC
STRAP	**44.66±1.68**	**53.48±0.86**	**58.99±0.82**	**21.18±6.31**	96.62±0.06	97.60±0.04	91.89±0.06
ODIN	11.85±3.33	25.99±1.79	36.91±0.47	3.22±0.80	97.72±0.03	97.91±0.03	92.42±0.07
ELTRA	16.89±1.27	28.37±1.53	41.63±2.53	5.81±1.10	96.19±0.04	97.47±0.03	90.40±0.13
MLP_R	3.84±0.65	7.02±0.40	10.18±0.67	1.18±0.36	78.44±0.25	80.67±0.14	67.83±1.93
MLP_D	15.84±3.61	34.11±2.04	44.59±1.62	4.35±1.64	97.85±0.08	98.02±0.07	92.56±0.45
GCN_R	18.26±2.56	30.18±1.71	40.64±1.53	4.04±1.10	96.90±0.04	97.54±0.03	92.10±0.24
GCN_D	12.40±7.59	30.79±9.24	46.10±1.37	3.12±0.71	97.83±0.09	98.15±0.05	**94.17±0.08**
GAT_R	19.65±3.52	31.90±3.56	43.65±4.88	6.04±2.16	98.35±0.11	**98.50±0.11**	92.05±1.30
GAT_D	18.18±4.11	27.18±3.95	36.76±5.74	7.98±1.92	97.61±0.29	97.81±0.22	92.92±0.37
$APPNP_R$	17.86±2.53	27.89±1.24	39.06±1.26	4.88±4.14	97.70±0.04	97.92±0.02	92.84±0.06
$APPNP_D$	18.46±3.51	30.84±1.84	41.99±1.23	6.41±3.73	**98.36±0.06**	98.48±0.06	94.17±0.16
$GPRGNN_R$	19.05±1.86	29.51±1.60	39.22±1.56	5.44±1.97	97.85±0.02	98.02±0.02	92.53±0.06
$GPRGNN_D$	18.43±5.03	29.62±3.28	41.14±2.10	4.74±1.45	98.02±0.05	98.24±0.05	94.14±0.09
$DirGNN_R$	25.66±3.33	39.28±1.96	50.10±2.06	7.03±2.70	98.25±0.03	98.46±0.03	93.99±0.05
$DirGNN_D$	21.35±2.89	34.06±2.53	46.01±2.07	6.12±2.54	98.03±0.03	98.26±0.02	93.48±0.06
$MagNet_R$	6.41±1.57	12.95±1.51	22.12±1.27	1.62±0.35	97.60±0.03	97.69±0.03	92.79±0.05
$MagNet_D$	7.68±1.00	16.30±2.36	28.01±1.72	2.53±0.57	97.71±0.03	97.86±0.04	92.92±0.05
$DUPLEX_R$	3.76±1.94	8.38±4.39	16.50±4.34	1.85±0.39	92.11±2.25	93.78±3.69	88.20±3.86
$DUPLEX_D$	2.43±0.86	6.74±0.45	12.35±2.64	0.46±0.08	90.61±1.76	88.72±3.26	81.82±3.74
$DiGAE_R$	29.11±3.51	43.25±1.68	53.27±1.17	8.85±2.81	97.11±0.19	97.78±0.11	89.16±0.24
$DiGAE_D$	22.56±9.23	43.19±2.97	55.14±1.96	5.33±1.78	96.47±0.18	97.37±0.10	90.17±0.14
$SDGAE_R$	21.88±2.17	35.28±2.35	45.04±2.18	6.54±1.94	98.11±0.03	98.35±0.03	93.83±0.07
$SDGAE_D$	**32.81±2.67**	**45.61±1.92**	**55.91±1.77**	**11.62±2.86**	**98.43±0.07**	**98.64±0.04**	**94.33±0.11**