

## I. FB15k EVALUATION

- A. *FB15k Average*
- B. *FB15k Best*
- C. *FB15k Worst*

## II. FB15k237 EVALUATION

- A. *FB15k237 Average*
- B. *FB15k237 Best*
- C. *FB15k237 Worst*

## III. WN18 EVALUATION

- A. *WN18 Average*
- B. *WN18 Best*
- C. *WN18 Worst*

## IV. WN18RR EVALUATION

- A. *WN18RR Average*
- B. *WN18RR Best*
- C. *WN18RR Worst*

TABLE I  
REPRODUCTION RESULTS ON FB15K BASED ON AN AVERAGE RANKING

	MR	MRR (%)	AMR (%)	Hits@1 (%)	Hits@3 (%)	Hits@5 (%)	Hits@10 (%)
<b>ComplEx</b>	171.16 $\pm$ 16.05	19.13 $\pm$ 0.45	2.46 $\pm$ 0.28	10.06 $\pm$ 0.42	20.82 $\pm$ 0.67	27.59 $\pm$ 0.94	38.03 $\pm$ 1.02
<b>ConvE</b>	50.76 $\pm$ 0.40	59.56 $\pm$ 0.06	0.73 $\pm$ 0.01	48.28 $\pm$ 0.12	66.99 $\pm$ 0.04	73.27 $\pm$ 0.03	79.76 $\pm$ 0.07
<b>DistMult</b>	134.02 $\pm$ 1.98	26.06 $\pm$ 0.17	1.86 $\pm$ 0.03	16.45 $\pm$ 0.16	29.10 $\pm$ 0.17	35.54 $\pm$ 0.21	45.00 $\pm$ 0.25
<b>HolE</b>	193.03 $\pm$ 7.61	34.15 $\pm$ 0.22	2.71 $\pm$ 0.12	21.79 $\pm$ 0.19	39.69 $\pm$ 0.24	48.06 $\pm$ 0.30	58.84 $\pm$ 0.28
<b>KG2E</b>	5779.07 $\pm$ 51.02	0.58 $\pm$ 0.07	78.40 $\pm$ 0.68	0.11 $\pm$ 0.04	0.36 $\pm$ 0.08	0.56 $\pm$ 0.10	1.01 $\pm$ 0.14
<b>RotatE</b>	42.28 $\pm$ 0.13	55.00 $\pm$ 0.06	0.63 $\pm$ 0.00	41.53 $\pm$ 0.06	64.14 $\pm$ 0.07	71.23 $\pm$ 0.05	78.67 $\pm$ 0.08
<b>SimpleE</b>	7395.75 $\pm$ 2.02	0.04 $\pm$ 0.00	100.02 $\pm$ 0.03	0.01 $\pm$ 0.00	0.03 $\pm$ 0.00	0.04 $\pm$ 0.00	0.06 $\pm$ 0.01
<b>TransD</b>	153.37 $\pm$ 5.35	33.99 $\pm$ 0.03	2.29 $\pm$ 0.09	21.22 $\pm$ 0.03	40.48 $\pm$ 0.10	48.57 $\pm$ 0.09	58.71 $\pm$ 0.14
<b>TransE</b>	127.92 $\pm$ 0.86	26.01 $\pm$ 0.17	1.78 $\pm$ 0.01	15.23 $\pm$ 0.16	29.85 $\pm$ 0.24	37.18 $\pm$ 0.24	47.34 $\pm$ 0.18
<b>TransH</b>	6320.02 $\pm$ 30.37	2.54 $\pm$ 0.20	85.63 $\pm$ 0.40	1.69 $\pm$ 0.25	2.95 $\pm$ 0.20	3.29 $\pm$ 0.22	3.74 $\pm$ 0.18
<b>TransR</b>	6795.95 $\pm$ 16.65	0.65 $\pm$ 0.02	91.99 $\pm$ 0.22	0.37 $\pm$ 0.00	0.63 $\pm$ 0.04	0.78 $\pm$ 0.06	1.03 $\pm$ 0.07
<b>TuckER</b>	7327.77 $\pm$ 29.22	0.07 $\pm$ 0.02	99.11 $\pm$ 0.39	0.01 $\pm$ 0.00	0.02 $\pm$ 0.00	0.03 $\pm$ 0.01	0.15 $\pm$ 0.17

TABLE II  
REPRODUCTION RESULTS ON FB15K BASED ON AN OPTIMISTIC RANKING

	MR	MRR (%)	Hits@1 (%)	Hits@3 (%)	Hits@5 (%)	Hits@10 (%)
<b>ComplEx</b>	171.16 $\pm$ 16.05	19.13 $\pm$ 0.45	10.06 $\pm$ 0.42	20.82 $\pm$ 0.67	27.59 $\pm$ 0.94	38.03 $\pm$ 1.02
<b>ConvE</b>	50.76 $\pm$ 0.40	59.56 $\pm$ 0.06	48.28 $\pm$ 0.12	66.99 $\pm$ 0.04	73.27 $\pm$ 0.03	79.76 $\pm$ 0.07
<b>DistMult</b>	134.02 $\pm$ 1.98	26.06 $\pm$ 0.17	16.45 $\pm$ 0.16	29.10 $\pm$ 0.17	35.54 $\pm$ 0.21	45.00 $\pm$ 0.25
<b>HolE</b>	193.03 $\pm$ 7.61	34.15 $\pm$ 0.22	21.79 $\pm$ 0.19	39.69 $\pm$ 0.24	48.06 $\pm$ 0.30	58.84 $\pm$ 0.28
<b>KG2E</b>	5779.07 $\pm$ 51.02	0.58 $\pm$ 0.07	0.11 $\pm$ 0.04	0.36 $\pm$ 0.08	0.56 $\pm$ 0.10	1.01 $\pm$ 0.14
<b>RotatE</b>	42.28 $\pm$ 0.13	55.00 $\pm$ 0.06	41.53 $\pm$ 0.06	64.14 $\pm$ 0.07	71.23 $\pm$ 0.05	78.67 $\pm$ 0.08
<b>SimpleE</b>	139.34 $\pm$ 49.45	23.90 $\pm$ 8.79	11.58 $\pm$ 6.42	24.16 $\pm$ 10.95	34.73 $\pm$ 13.40	54.28 $\pm$ 15.80
<b>TransD</b>	153.37 $\pm$ 5.35	33.99 $\pm$ 0.03	21.22 $\pm$ 0.03	40.48 $\pm$ 0.10	48.57 $\pm$ 0.09	58.71 $\pm$ 0.14
<b>TransE</b>	127.92 $\pm$ 0.86	26.01 $\pm$ 0.17	15.23 $\pm$ 0.16	29.85 $\pm$ 0.24	37.18 $\pm$ 0.24	47.34 $\pm$ 0.18
<b>TransH</b>	6320.00 $\pm$ 30.37	2.54 $\pm$ 0.20	1.69 $\pm$ 0.25	2.95 $\pm$ 0.20	3.29 $\pm$ 0.22	3.74 $\pm$ 0.18
<b>TransR</b>	6795.94 $\pm$ 16.65	0.65 $\pm$ 0.02	0.37 $\pm$ 0.00	0.63 $\pm$ 0.04	0.78 $\pm$ 0.06	1.03 $\pm$ 0.07
<b>TuckER</b>	7327.77 $\pm$ 29.22	0.07 $\pm$ 0.02	0.01 $\pm$ 0.00	0.02 $\pm$ 0.00	0.03 $\pm$ 0.01	0.15 $\pm$ 0.17

TABLE III  
REPRODUCTION RESULTS ON FB15K BASED ON AN PESSIMISTIC RANKING

	MR	MRR (%)	Hits@1 (%)	Hits@3 (%)	Hits@5 (%)	Hits@10 (%)
<b>ComplEx</b>	171.16 $\pm$ 16.05	19.13 $\pm$ 0.45	10.06 $\pm$ 0.42	20.82 $\pm$ 0.67	27.59 $\pm$ 0.94	38.03 $\pm$ 1.02
<b>ConvE</b>	50.76 $\pm$ 0.40	59.56 $\pm$ 0.06	48.28 $\pm$ 0.12	66.99 $\pm$ 0.04	73.27 $\pm$ 0.03	79.76 $\pm$ 0.07
<b>DistMult</b>	134.02 $\pm$ 1.98	26.06 $\pm$ 0.17	16.45 $\pm$ 0.16	29.10 $\pm$ 0.17	35.54 $\pm$ 0.21	45.00 $\pm$ 0.25
<b>HolE</b>	193.03 $\pm$ 7.61	34.15 $\pm$ 0.22	21.79 $\pm$ 0.19	39.69 $\pm$ 0.24	48.06 $\pm$ 0.30	58.84 $\pm$ 0.28
<b>KG2E</b>	5779.07 $\pm$ 51.02	0.58 $\pm$ 0.07	0.11 $\pm$ 0.04	0.36 $\pm$ 0.08	0.56 $\pm$ 0.10	1.01 $\pm$ 0.14
<b>RotatE</b>	42.28 $\pm$ 0.13	55.00 $\pm$ 0.06	41.53 $\pm$ 0.06	64.14 $\pm$ 0.07	71.23 $\pm$ 0.05	78.67 $\pm$ 0.08
<b>SimpleE</b>	139.34 $\pm$ 49.45	23.90 $\pm$ 8.79	11.58 $\pm$ 6.42	24.16 $\pm$ 10.95	34.73 $\pm$ 13.40	54.28 $\pm$ 15.80
<b>TransD</b>	153.37 $\pm$ 5.35	33.99 $\pm$ 0.03	21.22 $\pm$ 0.03	40.48 $\pm$ 0.10	48.57 $\pm$ 0.09	58.71 $\pm$ 0.14
<b>TransE</b>	127.92 $\pm$ 0.86	26.01 $\pm$ 0.17	15.23 $\pm$ 0.16	29.85 $\pm$ 0.24	37.18 $\pm$ 0.24	47.34 $\pm$ 0.18
<b>TransH</b>	6320.00 $\pm$ 30.37	2.54 $\pm$ 0.20	1.69 $\pm$ 0.25	2.95 $\pm$ 0.20	3.29 $\pm$ 0.22	3.74 $\pm$ 0.18
<b>TransR</b>	6795.94 $\pm$ 16.65	0.65 $\pm$ 0.02	0.37 $\pm$ 0.00	0.63 $\pm$ 0.04	0.78 $\pm$ 0.06	1.03 $\pm$ 0.07
<b>TuckER</b>	7327.77 $\pm$ 29.22	0.07 $\pm$ 0.02	0.01 $\pm$ 0.00	0.02 $\pm$ 0.00	0.03 $\pm$ 0.01	0.15 $\pm$ 0.17

TABLE IV  
REPRODUCTION RESULTS ON FB15K237 BASED ON AN AVERAGE RANKING

	MR	MRR (%)	AMR (%)	Hits@1 (%)	Hits@3 (%)	Hits@5 (%)	Hits@10 (%)
<b>ConvE</b>	255.46 $\pm$ 6.16	26.93 $\pm$ 0.11	3.73 $\pm$ 0.13	18.22 $\pm$ 0.11	29.51 $\pm$ 0.24	35.98 $\pm$ 0.16	44.95 $\pm$ 0.17
<b>ConvKB</b>	4345.27 $\pm$ 46.99	4.71 $\pm$ 0.23	61.36 $\pm$ 0.65	3.31 $\pm$ 0.23	4.04 $\pm$ 0.19	4.57 $\pm$ 0.22	7.76 $\pm$ 0.88
<b>RotatE</b>	191.92 $\pm$ 0.31	26.42 $\pm$ 0.04	2.84 $\pm$ 0.00	17.57 $\pm$ 0.06	28.97 $\pm$ 0.05	35.29 $\pm$ 0.09	44.55 $\pm$ 0.06

TABLE V  
REPRODUCTION RESULTS ON FB15K237 BASED ON AN OPTIMISTIC RANKING

	MR	MRR (%)	Hits@1 (%)	Hits@3 (%)	Hits@5 (%)	Hits@10 (%)
<b>ConvE</b>	255.46 $\pm$ 6.16	26.93 $\pm$ 0.11	18.22 $\pm$ 0.11	29.51 $\pm$ 0.24	35.98 $\pm$ 0.16	44.95 $\pm$ 0.17
<b>ConvKB</b>	4345.27 $\pm$ 46.99	4.71 $\pm$ 0.23	3.31 $\pm$ 0.23	4.04 $\pm$ 0.19	4.57 $\pm$ 0.22	7.76 $\pm$ 0.88
<b>RotatE</b>	191.92 $\pm$ 0.31	26.42 $\pm$ 0.04	17.57 $\pm$ 0.06	28.97 $\pm$ 0.05	35.29 $\pm$ 0.09	44.55 $\pm$ 0.06

TABLE VI  
REPRODUCTION RESULTS ON FB15K237 BASED ON AN PESSIMISTIC RANKING

	MR		MRR (%)	Hits@1 (%)	Hits@3 (%)	Hits@5 (%)	Hits@10 (%)
<b>ConvE</b>	255.46 ±	6.16	26.93 ± 0.11	18.22 ± 0.11	29.51 ± 0.24	35.98 ± 0.16	44.95 ± 0.17
<b>ConvKB</b>	4345.27 ±	46.99	4.71 ± 0.23	3.31 ± 0.23	4.04 ± 0.19	4.57 ± 0.22	7.76 ± 0.88
<b>RotatE</b>	191.92 ±	0.31	26.42 ± 0.04	17.57 ± 0.06	28.97 ± 0.05	35.29 ± 0.09	44.55 ± 0.06

TABLE VII  
REPRODUCTION RESULTS ON WN18 BASED ON AN AVERAGE RANKING

	MR		MRR (%)	AMR (%)	Hits@1 (%)	Hits@3 (%)	Hits@5 (%)	Hits@10 (%)
<b>ComplEx</b>	452.67 ±	63.05	19.49 ± 2.55	2.21 ± 0.31	12.36 ± 1.96	20.66 ± 2.75	25.24 ± 3.33	32.92 ± 4.40
<b>ConvE</b>	444.40 ±	14.82	88.81 ± 0.09	2.17 ± 0.07	85.14 ± 0.10	91.76 ± 0.11	93.29 ± 0.04	94.85 ± 0.06
<b>DistMult</b>	458.64 ±	23.96	77.44 ± 0.22	2.24 ± 0.12	67.45 ± 0.34	85.94 ± 0.21	89.52 ± 0.25	92.72 ± 0.18
<b>HolE</b>	812.64 ±	28.33	70.44 ± 0.45	3.97 ± 0.14	59.29 ± 0.53	79.29 ± 0.47	84.12 ± 0.36	88.61 ± 0.42
<b>KG2E</b>	2708.89 ±	44.57	3.61 ± 0.26	13.25 ± 0.22	1.35 ± 0.22	3.21 ± 0.31	4.57 ± 0.34	7.02 ± 0.43
<b>RotatE</b>	123.68 ±	1.71	87.29 ± 0.12	0.61 ± 0.01	82.17 ± 0.20	91.53 ± 0.12	93.44 ± 0.07	95.28 ± 0.08
<b>SimpleE</b>	20376.43 ±	42.30	0.04 ± 0.01	99.57 ± 0.21	0.01 ± 0.01	0.03 ± 0.00	0.04 ± 0.01	0.07 ± 0.03
<b>TransD</b>	444.39 ±	25.61	36.22 ± 0.12	2.17 ± 0.13	3.94 ± 0.27	65.63 ± 0.55	79.64 ± 0.43	87.27 ± 0.41
<b>TransE</b>	468.24 ±	13.64	39.19 ± 1.21	2.29 ± 0.07	9.99 ± 1.82	64.74 ± 0.91	75.44 ± 0.48	84.25 ± 0.33
<b>TransH</b>	19678.04 ±	18.92	0.18 ± 0.04	96.16 ± 0.09	0.04 ± 0.02	0.19 ± 0.10	0.29 ± 0.14	0.39 ± 0.11
<b>TransR</b>	19686.49 ±	100.97	0.06 ± 0.02	96.20 ± 0.49	0.00 ± 0.00	0.04 ± 0.02	0.05 ± 0.03	0.11 ± 0.06
<b>TuckER</b>	20622.46 ±	153.52	0.03 ± 0.01	100.78 ± 0.75	0.00 ± 0.00	0.02 ± 0.01	0.03 ± 0.03	0.04 ± 0.03

TABLE VIII  
REPRODUCTION RESULTS ON WN18 BASED ON AN OPTIMISTIC RANKING

	MR		MRR (%)	Hits@1 (%)	Hits@3 (%)	Hits@5 (%)	Hits@10 (%)
<b>ComplEx</b>	452.67 ±	63.05	19.49 ± 2.55	12.36 ± 1.96	20.66 ± 2.75	25.24 ± 3.33	32.92 ± 4.40
<b>ConvE</b>	444.40 ±	14.82	88.81 ± 0.09	85.14 ± 0.10	91.76 ± 0.11	93.29 ± 0.04	94.85 ± 0.06
<b>DistMult</b>	458.64 ±	23.96	77.44 ± 0.22	67.45 ± 0.34	85.94 ± 0.21	89.52 ± 0.25	92.72 ± 0.18
<b>HolE</b>	812.63 ±	28.33	70.44 ± 0.45	59.29 ± 0.53	79.29 ± 0.47	84.12 ± 0.36	88.61 ± 0.42
<b>KG2E</b>	2708.88 ±	44.57	3.61 ± 0.26	1.35 ± 0.22	3.21 ± 0.31	4.57 ± 0.34	7.02 ± 0.43
<b>RotatE</b>	123.68 ±	1.71	87.29 ± 0.12	82.17 ± 0.20	91.53 ± 0.12	93.44 ± 0.07	95.28 ± 0.08
<b>SimpleE</b>	384.53 ±	66.45	38.48 ± 4.00	33.93 ± 4.32	39.59 ± 4.67	42.76 ± 3.73	47.01 ± 2.66
<b>TransD</b>	444.39 ±	25.61	36.22 ± 0.12	3.94 ± 0.27	65.63 ± 0.55	79.64 ± 0.43	87.27 ± 0.41
<b>TransE</b>	468.24 ±	13.64	39.19 ± 1.21	9.99 ± 1.82	64.74 ± 0.91	75.44 ± 0.48	84.25 ± 0.33
<b>TransH</b>	19678.02 ±	18.92	0.18 ± 0.04	0.04 ± 0.02	0.19 ± 0.10	0.29 ± 0.14	0.39 ± 0.11
<b>TransR</b>	19686.49 ±	100.97	0.06 ± 0.02	0.00 ± 0.00	0.04 ± 0.02	0.05 ± 0.03	0.11 ± 0.06
<b>TuckER</b>	20622.46 ±	153.52	0.03 ± 0.01	0.00 ± 0.00	0.02 ± 0.01	0.03 ± 0.03	0.04 ± 0.03

TABLE IX  
REPRODUCTION RESULTS ON WN18 BASED ON AN PESSIMISTIC RANKING

	MR		MRR (%)	Hits@1 (%)	Hits@3 (%)	Hits@5 (%)	Hits@10 (%)
<b>ComplEx</b>	452.67 ±	63.05	19.49 ± 2.55	12.36 ± 1.96	20.66 ± 2.75	25.24 ± 3.33	32.92 ± 4.40
<b>ConvE</b>	444.40 ±	14.82	88.81 ± 0.09	85.14 ± 0.10	91.76 ± 0.11	93.29 ± 0.04	94.85 ± 0.06
<b>DistMult</b>	458.64 ±	23.96	77.44 ± 0.22	67.45 ± 0.34	85.94 ± 0.21	89.52 ± 0.25	92.72 ± 0.18
<b>HolE</b>	812.63 ±	28.33	70.44 ± 0.45	59.29 ± 0.53	79.29 ± 0.47	84.12 ± 0.36	88.61 ± 0.42
<b>KG2E</b>	2708.88 ±	44.57	3.61 ± 0.26	1.35 ± 0.22	3.21 ± 0.31	4.57 ± 0.34	7.02 ± 0.43
<b>RotatE</b>	123.68 ±	1.71	87.29 ± 0.12	82.17 ± 0.20	91.53 ± 0.12	93.44 ± 0.07	95.28 ± 0.08
<b>SimpleE</b>	384.53 ±	66.45	38.48 ± 4.00	33.93 ± 4.32	39.59 ± 4.67	42.76 ± 3.73	47.01 ± 2.66
<b>TransD</b>	444.39 ±	25.61	36.22 ± 0.12	3.94 ± 0.27	65.63 ± 0.55	79.64 ± 0.43	87.27 ± 0.41
<b>TransE</b>	468.24 ±	13.64	39.19 ± 1.21	9.99 ± 1.82	64.74 ± 0.91	75.44 ± 0.48	84.25 ± 0.33
<b>TransH</b>	19678.02 ±	18.92	0.18 ± 0.04	0.04 ± 0.02	0.19 ± 0.10	0.29 ± 0.14	0.39 ± 0.11
<b>TransR</b>	19686.49 ±	100.97	0.06 ± 0.02	0.00 ± 0.00	0.04 ± 0.02	0.05 ± 0.03	0.11 ± 0.06
<b>TuckER</b>	20622.46 ±	153.52	0.03 ± 0.01	0.00 ± 0.00	0.02 ± 0.01	0.03 ± 0.03	0.04 ± 0.03

TABLE X  
REPRODUCTION RESULTS ON WN18RR BASED ON AN AVERAGE RANKING

	MR		MRR (%)	AMR (%)	Hits@1 (%)	Hits@3 (%)	Hits@5 (%)	Hits@10 (%)
<b>ConvE</b>	5369.49 ±	50.92	44.69 ± 0.21	26.49 ± 0.25	40.98 ± 0.22	46.49 ± 0.14	48.92 ± 0.23	51.76 ± 0.13
<b>ConvKB</b>	13634.66 ±	714.24	0.30 ± 0.07	67.27 ± 3.52	0.09 ± 0.03	0.21 ± 0.07	0.32 ± 0.10	0.57 ± 0.16
<b>RotatE</b>	4263.32 ±	90.33	48.40 ± 0.09	21.03 ± 0.45	44.02 ± 0.15	50.55 ± 0.12	52.98 ± 0.11	56.51 ± 0.26

TABLE XI  
REPRODUCTION RESULTS ON WN18RR BASED ON AN OPTIMISTIC RANKING

	MR	MRR (%)	Hits@1 (%)	Hits@3 (%)	Hits@5 (%)	Hits@10 (%)
<b>ConvE</b>	5369.49 $\pm$ 50.92	44.69 $\pm$ 0.21	40.98 $\pm$ 0.22	46.49 $\pm$ 0.14	48.92 $\pm$ 0.23	51.76 $\pm$ 0.13
<b>ConvKB</b>	13634.65 $\pm$ 714.24	0.30 $\pm$ 0.07	0.09 $\pm$ 0.03	0.21 $\pm$ 0.07	0.32 $\pm$ 0.10	0.57 $\pm$ 0.16
<b>RotatE</b>	4263.32 $\pm$ 90.33	48.40 $\pm$ 0.09	44.02 $\pm$ 0.15	50.55 $\pm$ 0.12	52.98 $\pm$ 0.11	56.51 $\pm$ 0.26

TABLE XII  
REPRODUCTION RESULTS ON WN18RR BASED ON AN PESSIMISTIC RANKING

	MR	MRR (%)	Hits@1 (%)	Hits@3 (%)	Hits@5 (%)	Hits@10 (%)
<b>ConvE</b>	5369.49 $\pm$ 50.92	44.69 $\pm$ 0.21	40.98 $\pm$ 0.22	46.49 $\pm$ 0.14	48.92 $\pm$ 0.23	51.76 $\pm$ 0.13
<b>ConvKB</b>	13634.65 $\pm$ 714.24	0.30 $\pm$ 0.07	0.09 $\pm$ 0.03	0.21 $\pm$ 0.07	0.32 $\pm$ 0.10	0.57 $\pm$ 0.16
<b>RotatE</b>	4263.32 $\pm$ 90.33	48.40 $\pm$ 0.09	44.02 $\pm$ 0.15	50.55 $\pm$ 0.12	52.98 $\pm$ 0.11	56.51 $\pm$ 0.26