

APPENDIX

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Table 1. Predictive performance on 14 gene-disease associations using network induced by the BIOGPS. We report the AUC-ROC (%) for LEDK and MEDK without using link enrichment (A), (B) respectively and using five different link enrichment methods L1 (LEDK), L2 (MEDK), L3 (MDK), L4 (RLK) and L5 (CDNK).

Disease	A	L1	L2	L3	L4	L5	B	L1	L2	L3	L4	L5
1	61.8	63.8	62.5	63.7	63.9	63.4	57.9	62.8	62.8	62.2	62.6	62.2
2	55.6	67.5	62.3	70.4	69.5	63.5	52.0	62.8	57.3	57.9	60.1	58.3
3	50.3	62.3	61.2	63.6	61.9	60.0	49.5	57.0	55.1	56.1	57.2	55.2
4	61.3	73.9	73.1	73.3	73.7	73.9	62.7	72.7	67.9	72.5	74.7	68.5
5	55.7	62.8	60.6	63.2	62.9	62.9	55.1	61.7	61.0	62.9	62.6	60.5
6	60.1	68.8	66.8	70.4	69.4	67.4	59.7	66.1	62.2	68.2	67.0	63.4
7	68.8	73.6	73.0	73.6	74.2	73.4	67.7	73.5	73.1	74.2	74.8	72.1
8	71.1	77.9	72.3	76.5	77.8	73.2	65.6	71.7	70.8	70.4	71.8	70.9
9	62.4	63.8	63.1	64.4	64.3	63.8	63.7	66.9	65.7	67.2	66.7	66.5
10	69.4	72.9	71.2	74.5	72.6	71.8	62.5	73.6	70.4	72.7	71.9	71.1
11	60.0	63.9	63.1	64.6	63.6	63.3	58.4	61.4	61.9	61.4	61.8	61.7
12	64.4	76.2	73.5	76.1	75.2	73.2	61.9	71.2	70.3	71.7	72.3	70.5
13	57.2	66.1	62.4	65.8	63.0	59.3	55.1	63.7	63.5	62.4	61.8	60.6
14	55.4	61.7	61.7	61.6	63.0	60.1	55.0	63.7	64.8	62.1	63.1	62.5
\overline{AUC}	61.0	68.2	66.2	68.7	68.2	66.4	59.1	66.3	64.8	65.8	66.3	64.6

Table 2. Predictive performance on 14 gene-disease associations using network induced by the BIOGPS. We report the AUC-ROC (%) for MDK and RLK without using link enrichment (A), (B), respectively and using five different link enrichment methods L1 (LEDK), L2 (MEDK), L3 (MDK), L4 (RLK) and L5 (CDNK).

Disease	A	L1	L2	L3	L4	L5	B	L1	L2	L3	L4	L5
1	60.4	65.2	63.6	64.7	65.3	64.6	61.1	63.0	62.2	63.0	63.3	62.5
2	53.0	67.5	64.2	66.8	66.9	65.1	54.4	63.7	59.7	59.8	63.8	61.0
3	50.4	62.7	52.8	61.8	62.3	57.1	50.4	57.4	56.7	56.9	58.6	56.1
4	60.2	74.0	72.4	72.8	74.3	74.9	61.9	72.0	68.2	69.6	71.7	69.9
5	54.8	60.8	61.1	61.4	61.5	61.9	54.8	61.2	60.2	61.9	61.5	61.3
6	62.0	70.6	67.6	70.8	69.5	66.1	61.3	70.0	67.0	69.3	69.5	67.6
7	66.0	73.4	71.7	72.5	72.9	73.2	69.8	73.7	73.3	73.7	74.1	73.4
8	71.4	76.9	73.9	75.3	76.0	74.0	68.7	75.0	73.3	74.4	74.2	72.8
9	59.3	64.2	62.1	63.6	63.3	62.4	62.4	64.4	63.7	65.0	64.7	64.3
10	69.6	75.9	74.4	76.1	76.2	73.9	68.4	72.8	70.2	73.5	71.8	70.5
11	56.0	61.4	58.1	61.7	61.9	60.0	60.6	63.5	63.1	63.5	63.6	62.8
12	65.4	74.2	72.7	73.6	74.2	74.0	64.5	76.2	73.4	74.3	74.6	74.3
13	57.3	67.2	60.5	67.3	67.7	63.5	56.4	63.3	61.7	61.7	63.3	60.5
14	55.5	63.1	60.0	62.3	63.8	63.2	54.9	62.0	61.8	62.0	62.4	61.1
\overline{AUC}	60.1	68.4	65.4	67.9	68.3	66.7	60.7	67.0	65.3	66.3	66.9	65.6

Table 3. Predictive performance on 14 gene-disease associations using network induced by the BIOGRIDphys. We report the AUC-ROC (%) for LEDK and MEDK without using link enrichment (A), (B) respectively and using five different link enrichment methods L1 (LEDK), L2 (MEDK), L3 (MDK), L4 (RLK) and L5 (CDNK).

Disease	A	L1	L2	L3	L4	L5	B	L1	L2	L3	L4	L5
1	76.4	79.2	77.8	77.8	79.6	78.3	73.2	79.7	75.0	73.9	79.5	74.9
2	60.5	66.4	61.6	60.8	67.3	63.4	52.3	63.3	55.5	53.0	61.3	53.8
3	62.2	77.2	67.7	67.4	77.2	69.2	49.1	65.2	53.7	51.8	70.0	54.2
4	69.2	79.7	75.4	75.0	79.1	76.3	63.5	77.5	73.9	71.9	77.9	72.7
5	59.2	66.6	63.3	62.1	67.5	62.7	50.2	59.5	56.2	53.4	58.7	55.0
6	63.1	69.7	66.7	66.7	70.1	67.1	54.4	62.9	60.3	58.7	63.0	59.0
7	60.1	67.2	62.3	61.8	72.2	61.8	53.2	64.1	60.3	59.1	67.8	59.1
8	70.6	75.1	71.0	71.1	75.7	71.8	62.9	73.6	68.0	67.4	74.5	67.6
9	69.1	72.1	70.5	70.5	72.3	73.7	61.3	69.2	63.6	62.1	69.0	64.9
10	61.3	70.4	65.6	66.7	70.4	68.1	57.3	67.4	60.8	60.3	68.6	60.3
11	58.9	64.0	61.4	60.6	64.1	62.1	56.2	61.5	59.3	58.4	61.4	59.6
12	61.0	68.3	70.8	66.3	69.5	67.4	59.6	68.6	67.6	67.1	69.4	66.7
13	55.4	66.3	64.7	57.3	69.1	61.7	57.6	71.5	67.2	66.2	71.9	68.3
14	57.4	68.7	61.4	60.9	72.4	64.3	53.2	64.7	60.0	57.8	64.5	58.9
\overline{AUC}	63.2	70.8	67.2	66.1	71.9	67.7	57.4	67.8	63.0	61.5	68.4	62.5

Table 4. Predictive performance on 14 gene-disease associations using network induced by the BIOGRIDphys. We report the AUC-ROC (%) for MEDK and RLK without using link enrichment (A), (B) respectively and using five different link enrichment methods L1 (LEDK), L2 (MEDK), L3 (MDK), L4 (RLK) and L5 (CDNK).

Disease	A	L1	L2	L3	L4	L5	B	L1	L2	L3	L4	L5
1	66.4	75.6	69.9	72.1	79.2	73.5	76.6	80.0	78.2	78.1	80.2	78.7
2	54.4	63.6	57.5	57.8	65.9	58.7	59.3	66.5	61.8	59.5	65.9	62.8
3	60.0	74.0	60.6	60.3	74.0	65.5	64.4	76.3	68.7	68.4	76.3	71.4
4	60.2	73.3	65.1	67.3	71.8	67.3	70.1	79.5	76.9	75.8	79.7	76.7
5	48.6	61.9	56.5	55.4	62.7	57.4	58.7	66.0	62.6	60.9	64.6	61.1
6	61.7	68.8	65.2	64.5	68.8	65.2	63.2	69.5	67.1	67.1	70.1	67.3
7	56.4	65.5	58.5	58.8	68.7	60.3	61.3	66.8	63.1	62.3	71.1	62.5
8	66.8	74.0	73.1	74.0	74.6	72.5	72.3	75.3	72.3	72.3	75.4	72.7
9	74.0	78.5	75.1	75.6	79.1	75.1	70.4	73.0	71.6	71.7	72.6	74.8
10	54.4	66.9	64.1	61.3	68.2	58.7	62.3	71.0	66.5	67.3	70.8	68.3
11	58.4	64.5	60.0	60.5	63.9	61.4	59.1	62.9	61.0	60.3	63.2	61.8
12	55.9	66.9	56.9	65.4	66.7	64.4	60.8	67.2	70.1	66.1	68.5	67.1
13	54.8	66.2	64.4	58.7	69.4	63.5	55.2	65.5	64.1	57.0	68.1	60.9
14	55.1	66.6	59.7	57.5	67.6	62.6	56.4	67.5	61.7	60.7	68.7	64.1
\overline{AUC}	59.1	69.0	63.3	63.5	70.0	64.7	63.6	70.5	67.6	66.3	71.1	67.9

Table 5. Predictive performance on 14 gene-disease associations using network induced by the HPRD. We report the AUC-ROC (%) for LEDK and MEDK without using link enrichment (A), (B) respectively and using five different link enrichment methods L1 (LEDK), L2 (MEDK), L3 (MDK), L4 (RLK) and L5 (CDNK).

Disease	A	L1	L2	L3	L4	L5	B	L1	L2	L3	L4	L5
1	75.5	77.7	77.8	76.7	77.9	76.1	75.1	77.2	77.0	76.5	76.0	75.9
2	56.6	61.1	58.6	59.6	63.5	58.6	55.9	59.5	56.6	58.0	60.2	58.0
3	61.2	73.0	69.0	71.3	76.1	67.9	56.1	70.0	61.1	67.7	71.1	63.3
4	67.3	74.9	71.0	70.9	74.1	69.7	65.5	72.7	68.6	68.0	71.8	67.5
5	57.6	66.9	65.6	68.6	68.4	68.2	55.1	67.3	62.9	64.5	66.5	62.6
6	67.1	73.7	72.0	72.1	73.5	69.3	64.8	71.8	69.8	69.1	68.6	66.4
7	68.8	73.6	72.4	72.7	73.7	71.9	65.5	71.9	69.4	71.6	72.4	69.8
8	76.2	82.4	76.7	81.9	83.3	77.1	73.4	80.7	73.6	79.5	82.3	74.8
9	68.2	76.2	75.6	71.2	74.5	77.3	64.4	72.2	70.9	68.6	69.4	76.0
10	66.0	76.2	75.9	74.6	76.6	73.8	60.4	74.9	71.8	69.2	71.0	69.4
11	60.5	65.2	63.2	64.4	65.0	63.8	58.3	64.1	60.7	62.7	63.2	61.5
12	61.9	69.8	69.3	68.5	72.1	64.3	60.5	68.8	68.8	67.6	68.0	63.0
13	67.6	72.2	71.9	73.3	72.6	71.4	65.1	71.5	69.4	69.4	69.7	67.1
14	68.4	74.1	72.7	71.8	74.1	71.2	64.6	70.5	66.7	67.8	66.9	67.5
\overline{AUC}	65.9	72.6	70.8	71.3	73.2	70.0	63.2	70.9	67.7	68.6	69.8	67.3

Table 6. Predictive performance on 14 gene-disease associations using network induced by the HPRD. We report the AUC-ROC (%) for MEDK and RLK without using link enrichment (A), (B) respectively and using five different link enrichment methods L1 (LEDK), L2 (MEDK), L3 (MDK), L4 (RLK) and L5 (CDNK).

Disease	A	L1	L2	L3	L4	L5	B	L1	L2	L3	L4	L5
1	75.6	78.2	78.0	78.8	78.6	77.1	75.6	78.2	78.1	77.7	78.8	77.7
2	58.0	62.5	60.6	60.7	63.0	60.7	58.0	60.4	59.2	60.0	63.5	59.2
3	65.5	73.4	70.7	73.5	76.6	69.4	64.4	72.0	70.1	73.7	74.6	70.2
4	68.1	73.9	73.2	72.0	74.3	71.3	68.3	75.1	72.1	71.2	74.0	71.5
5	59.0	68.1	67.1	67.2	68.3	66.9	59.0	68.5	66.7	69.0	68.2	67.8
6	68.3	75.5	72.2	75.3	73.8	71.9	67.1	73.4	72.3	72.1	73.6	70.7
7	71.1	73.5	72.7	72.8	74.2	73.1	70.1	73.3	72.3	72.9	73.5	72.4
8	77.6	82.3	78.8	81.4	83.3	79.2	79.3	82.7	80.0	82.9	83.2	80.3
9	71.0	77.5	77.1	77.2	77.5	81.0	69.8	76.0	75.6	72.5	75.3	78.8
10	67.1	77.0	69.9	73.8	77.5	74.8	69.6	76.3	75.2	76.8	77.1	75.2
11	60.3	65.2	63.4	67.2	65.6	64.4	61.3	65.8	63.5	65.1	65.1	64.5
12	59.2	71.7	70.9	68.6	73.0	64.2	61.7	70.9	69.7	69.7	72.0	64.3
13	65.3	73.3	71.1	73.3	73.3	71.8	67.7	74.1	72.5	74.0	73.2	71.7
14	63.4	72.4	67.1	67.3	73.7	72.1	68.7	74.3	72.5	71.8	74.5	73.9
\overline{AUC}	66.4	73.2	70.9	72.1	73.8	71.3	67.2	72.9	71.4	72.1	73.3	71.3

Table 7. Predictive performance on 14 gene-disease associations using network induced by the OMIM. We report the AUC-ROC (%) for LEDK and MEDK without using link enrichment (A), (B) respectively and using five different link enrichment methods L1 (LEDK), L2 (MEDK), L3 (MDK), L4 (RLK) and L5 (CDNK).

Disease	A	L1	L2	L3	L4	L5	B	L1	L2	L3	L4	L5
1	84.9	86.9	85.6	87.4	86.7	85.8	84.4	86.3	85.3	85.9	85.9	85.4
2	76.6	78.4	78.4	78.8	78.4	78.4	75.7	77.1	77.4	77.3	77.1	77.1
3	78.4	83.3	83.3	83.8	83.2	84.6	74.4	82.1	80.8	82.5	82.4	82.2
4	91.3	93.0	93.0	93.0	93.0	93.1	89.3	93.0	91.5	92.6	93.0	92.1
5	76.1	82.3	79.7	84.1	80.4	80.7	75.6	83.9	79.6	84.3	82.4	79.9
6	81.9	84.7	83.7	83.9	84.6	83.8	79.1	82.7	80.8	83.6	84.1	80.8
7	81.2	85.2	84.5	84.1	84.9	83.2	79.5	84.3	82.8	82.2	84.3	81.9
8	84.3	90.5	91.4	91.0	90.5	92.2	83.9	90.1	89.8	89.7	90.1	90.9
9	78.8	80.6	80.4	80.8	80.4	80.4	78.2	79.9	79.9	80.1	80.3	80.4
10	86.3	87.6	87.6	87.6	87.6	87.6	86.7	88.1	88.1	88.1	88.1	88.1
11	83.3	84.6	84.6	84.6	84.6	84.6	79.8	83.0	81.7	83.1	82.9	82.2
12	82.0	87.3	85.2	87.0	86.8	85.3	79.8	85.3	81.9	87.2	85.4	81.8
13	85.0	88.6	88.9	88.6	89.4	89.2	84.1	88.9	88.6	89.4	89.6	89.1
14	97.4	99.2	98.6	99.2	99.2	99.5	97.2	99.3	98.2	99.1	99.1	99.6
\overline{AUC}	83.4	86.6	86.1	86.7	86.4	86.3	82.0	86.0	84.8	86.1	86.0	85.1

Table 8. Predictive performance on 14 gene-disease associations using network induced by the OMIM. We report the AUC-ROC (%) for MDK and RLK without using link enrichment (A), (B) respectively and using five different link enrichment methods L1 (LEDK), L2 (MEDK), L3 (MDK), L4 (RLK) and L5 (CDNK).

Disease	A	L1	L2	L3	L4	L5	B	L1	L2	L3	L4	L5
1	87.3	89.7	88.7	90.2	89.5	88.4	84.7	86.8	85.5	86.5	86.5	85.7
2	71.2	72.9	72.1	72.1	72.8	72.1	76.4	78.0	78.0	78.2	78.0	78.0
3	78.9	84.2	83.3	84.2	84.0	84.2	77.5	82.7	82.6	83.2	82.9	83.6
4	88.8	90.2	90.0	90.2	90.0	90.0	91.4	92.9	92.8	92.8	92.9	93.1
5	77.7	82.2	80.6	83.5	83.1	82.5	76.3	82.3	80.1	83.8	81.3	80.9
6	76.3	82.4	81.9	82.0	83.7	82.2	82.2	84.9	83.8	83.8	84.6	84.5
7	82.7	85.4	84.1	85.4	85.8	84.1	80.6	84.6	83.9	84.3	83.9	83.3
8	89.3	91.6	91.3	91.8	91.7	92.4	84.3	90.5	90.1	90.5	90.3	93.5
9	78.5	81.5	81.5	81.5	81.5	81.5	78.6	80.4	80.4	80.8	80.4	80.4
10	85.1	88.0	88.0	88.1	88.3	88.0	86.0	87.5	87.5	87.6	87.5	87.5
11	82.0	82.9	82.8	82.7	82.8	82.6	83.0	84.4	84.4	84.4	84.4	84.4
12	84.7	87.8	86.5	88.2	87.7	85.9	81.3	86.5	83.8	86.4	86.3	85.0
13	78.2	83.1	83.1	83.1	83.8	83.1	85.0	88.5	88.5	88.5	89.0	88.5
14	97.5	98.7	98.2	98.4	98.6	98.7	97.4	99.2	98.3	99.2	99.2	99.5
\overline{AUC}	82.7	85.7	85.2	85.8	86.0	85.4	83.2	86.4	85.7	86.4	86.2	86.3