MIS Quarterly

RESEARCH ARTICLE

TOP PERSUADER PREDICTION FOR SOCIAL NETWORKS

Xiao Fang
Lerner College of Business and Economics, University of Delaware,
Newark, DE 19716-3130 U.S.A. {xfang@udel.edu}

Paul Jen-Hwa Hu
David Eccles School of Business, University of Utah,
Salt Lake City, UT 84112 U.S.A. {paul.hu@eccles.utah.edu}

Appendix A

Proof of Theorem 1

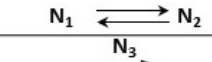
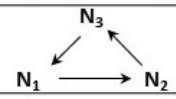
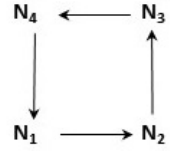
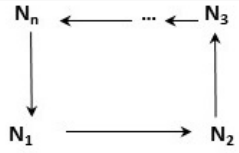
Our proof is built on Perron-Frobenius theorem, a seminal work in matrix theory (Meyer 2000). By Perron-Frobenius theorem, the power iteration algorithm for predicting top K persuaders converges to a unique $\boldsymbol{C}$ and this convergence is independent of the initialization of $\boldsymbol{C}$ if the persuasion probability matrix $\boldsymbol{P}$ is nonnegative, irreducible, and aperiodic (Heath 2002). We first show that $\boldsymbol{P}$ is nonnegative. Each component of the right hand side of Equation (10) is positive except $n_D \geq 0$; thus, persuasion probability p_{ij} estimated with Equation (10) is positive, for all $i, j = 1, 2, \ldots, n$ and $i \neq j$. Because all diagonal elements of $\boldsymbol{P}$ are equal to zero and all non-diagonal elements of $\boldsymbol{P}$ are positive persuasion probabilities, $\boldsymbol{P}$ is nonnegative.

We now prove that $\boldsymbol{P}$ is irreducible and aperiodic. Let $G(\boldsymbol{P})$ be the directed graph associated with $\boldsymbol{P}$. According to Meyer (2000), $G(\boldsymbol{P})$ is defined as a directed graph with n nodes $\{N_1, N_2, \ldots, N_n\}$, and there exists an edge from N_i to N_j if element p_{ij} of $\boldsymbol{P}$ is positive, where $i, j = 1, 2, \ldots, n$ and $i \neq j$. To prove $\boldsymbol{P}$ is irreducible and aperiodic is equivalent to show that $G(\boldsymbol{P})$ is strongly connected and aperiodic (Meyer 2000). We first show $G(\boldsymbol{P})$ is strongly connected. A directed graph is strongly connected if for every ordered pair N_i, N_j of its nodes there exists a path from N_i to N_j (West 2001). Since $p_{ij} > 0$ for all $i, j = 1, 2, \ldots, n$ and $i \neq j$, by the definition of $G(\boldsymbol{P})$, there is an edge from N_i to N_j for any ordered pair N_i, N_j of $G(\boldsymbol{P})$. That is, for any ordered pair N_i, N_j of $G(\boldsymbol{P})$, there is a path of length 1 from N_i to N_j. Therefore, $G(\boldsymbol{P})$ is strongly connected.

The period of a directed graph is the greatest common divisor of the lengths of its cycles and a directed graph is aperiodic if its period is 1 (Denardo 1977; Jarvis and Shier 1999). As discussed above, there exists an edge from N_i to N_j for any ordered pair N_i, N_j of $G(\boldsymbol{P})$. We thus list cycles that start and end at N_1 and their respective lengths in Table A1.

Apparently, the greatest common divisor of the cycle lengths in Table A1 is 1. Table A1 only lists part of the cycles in $G(\boldsymbol{P})$. Hence, the greatest common divisor of the lengths of all the cycles in $G(\boldsymbol{P})$ must be 1, and by definition, $G(\boldsymbol{P})$ is aperiodic. This completes the proof.

Table A1. Some Cycles in *G*(*P*) and Their Lengths

Cycle	Cycle Length
	2
	3
	4
...	...
	n

References

Denardo, E. V. 1977. "Periods of Connected Networks and Powers of Nonnegative Matrices," *Mathematics of Operations Research* (2:1), pp. 20-24.

Heath, M. T. 2002. *Scientific Computing: An Introductory Survey* (2nd ed.), New York: McGraw-Hill.

Jarvis, J. P., and Shier, D. R. 1999. "Graph-Theoretic Analysis of Finite Markov Chains," in *Applied Mathematical Modeling: A Multidisciplinary Approach*, Boca Raton, FL: CRC Press.

Meyer, C. D. 2000. *Matrix Analysis and Applied Linear Algebra*, Philadelphia, PA: Society for Industrial and Applied Mathematics.

West, D. B. 2001. *Introduction to Graph Theory* (2nd ed.), Upper Saddle River, NJ: Prentice Hall.

Appendix B

Additional Evaluation Results

We conducted additional evaluations with γ ranging from 0.1 to 0.9 in increments of 0.1, except for $\gamma = 0.5$. As summarized in Tables B1 to B24, our method substantially outperformed each benchmark method in all three evaluation metrics, across γ and K.

Table B1. Performance Comparison on Top-K Precision ($\gamma = 0.1$)

K	Our Method	Degree	Closeness	Between-ness	Percolation	Eigenvector	Intercentrality ($\beta = 0.1$)	INF-RANK	INF-SIM	Random
50	0.70	0.56	0.58	0.50	0.52	0.60	0.58	0.42	0.36	0.01
100	0.78	0.57	0.58	0.49	0.53	0.58	0.55	0.45	0.41	0.02
150	0.77	0.56	0.57	0.53	0.55	0.59	0.58	0.49	0.42	0.03
200	0.76	0.57	0.56	0.55	0.55	0.57	0.56	0.47	0.46	0.04
250	0.75	0.57	0.55	0.55	0.54	0.53	0.52	0.48	0.49	0.05
300	0.75	0.55	0.55	0.54	0.54	0.54	0.54	0.51	0.49	0.06
350	0.78	0.55	0.54	0.52	0.51	0.55	0.53	0.52	0.48	0.07
400	0.80	0.52	0.54	0.53	0.50	0.53	0.53	0.51	0.48	0.08
450	0.79	0.52	0.52	0.52	0.51	0.52	0.52	0.51	0.48	0.09
500	0.80	0.51	0.51	0.51	0.50	0.52	0.51	0.50	0.48	0.10
AVG	0.77	0.55	0.55	0.52	0.52	0.55	0.54	0.49	0.45	0.06
SD	0.03	0.02	0.02	0.02	0.02	0.03	0.02	0.03	0.04	0.03

Table B2. Performance Comparison on Spearman's Rank Correlation Coefficient ($\gamma = 0.1$)

K	Our Method	Degree	Closeness	Between-ness	Percolation	Eigenvector	Intercentrality ($\beta = 0.1$)	INF-RANK	INF-SIM	Random
50	0.54	0.18	0.15	0.12	0.00	0.01	0.21	0.16	0.18	-0.01
100	0.60	0.19	0.13	0.15	0.04	0.12	0.16	0.12	0.16	0.00
150	0.67	0.18	0.19	0.10	0.14	0.20	0.14	0.18	0.14	0.00
200	0.71	0.12	0.20	0.09	0.11	0.14	0.15	0.19	0.11	0.00
250	0.76	0.08	0.12	0.08	0.08	0.17	0.19	0.14	0.09	0.00
300	0.78	0.14	0.17	0.14	0.15	0.19	0.18	0.16	0.11	0.00
350	0.77	0.17	0.17	0.18	0.23	0.16	0.28	0.16	0.16	0.00
400	0.78	0.25	0.20	0.24	0.26	0.19	0.26	0.20	0.21	0.00
450	0.82	0.25	0.23	0.26	0.24	0.23	0.26	0.23	0.21	0.00
500	0.84	0.26	0.25	0.26	0.24	0.23	0.28	0.24	0.22	0.00
AVG	0.73	0.18	0.18	0.16	0.15	0.16	0.21	0.18	0.16	0.00
SD	0.10	0.06	0.04	0.07	0.09	0.07	0.05	0.04	0.05	0.00

Table B3. Performance Comparison on Total Persuasion Credit ($\gamma = 0.1$)

K	Our Method	Degree	Closeness	Between-ness	Percolation	Eigenvector	Intercentrality ($\beta = 0.1$)	INF-RANK	INF-SIM	Random
50	43.92	31.24	32.05	31.93	33.31	35.05	34.37	29.39	27.45	2.87
100	77.81	54.96	56.55	52.03	55.39	57.62	55.54	51.63	47.11	5.69
150	104.84	74.15	75.30	74.01	73.75	75.99	75.84	70.52	62.78	8.60
200	127.70	92.10	89.93	91.35	91.29	93.11	92.11	83.48	79.64	11.49
250	147.22	107.75	106.42	105.84	105.21	105.02	102.98	97.88	95.19	14.13
300	163.48	119.04	117.42	116.70	117.39	116.85	115.97	111.76	108.96	17.22
350	179.63	130.61	128.23	126.67	124.86	129.27	125.82	125.39	117.92	19.96
400	192.71	136.62	138.02	134.54	133.14	137.40	135.15	134.18	126.94	22.76
450	202.45	146.50	146.56	142.56	142.62	145.85	145.52	142.63	135.41	25.83
500	210.62	155.08	153.40	150.29	151.34	154.46	153.05	150.10	141.22	28.45
AVG	145.04	104.81	104.39	102.59	102.83	105.06	103.64	99.70	94.26	15.70
SD	55.85	41.03	40.32	39.69	38.90	39.46	39.23	40.48	38.92	8.63

Table B4. Performance Comparison on Top-*K* Precision ($\gamma = 0.2$)

K	Our Method	Degree	Closeness	Between-ness	Percolation	Eigenvector	Intercentrality ($\beta = 0.6$)	INF-RANK	INF-SIM	Random
50	0.72	0.54	0.56	0.48	0.50	0.62	0.60	0.40	0.34	0.01
100	0.79	0.57	0.59	0.49	0.53	0.59	0.57	0.44	0.41	0.02
150	0.77	0.55	0.57	0.53	0.55	0.59	0.58	0.49	0.42	0.03
200	0.80	0.57	0.57	0.56	0.55	0.58	0.58	0.47	0.46	0.04
250	0.79	0.57	0.56	0.55	0.55	0.54	0.54	0.48	0.48	0.05
300	0.80	0.56	0.55	0.53	0.53	0.54	0.54	0.51	0.49	0.06
350	0.83	0.55	0.54	0.53	0.51	0.55	0.53	0.52	0.49	0.07
400	0.83	0.51	0.52	0.51	0.49	0.52	0.51	0.50	0.47	0.08
450	0.84	0.50	0.50	0.50	0.49	0.50	0.50	0.49	0.46	0.09
500	0.84	0.50	0.49	0.49	0.49	0.50	0.50	0.50	0.46	0.10
AVG	0.80	0.54	0.55	0.52	0.52	0.55	0.54	0.48	0.45	0.06
SD	0.04	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.05	0.03

Table B5. Performance Comparison on Spearman's Rank Correlation Coefficient ($\gamma = 0.2$)

K	Our Method	Degree	Closeness	Between-ness	Percolation	Eigenvector	Intercentrality ($\beta = 0.1$)	INF-RANK	INF-SIM	Random
50	0.59	0.19	0.16	0.13	0.00	0.01	0.21	0.18	0.18	0.00
100	0.65	0.19	0.13	0.15	0.04	0.12	0.16	0.12	0.16	0.00
150	0.70	0.17	0.19	0.10	0.14	0.20	0.14	0.18	0.14	0.00
200	0.72	0.12	0.20	0.09	0.10	0.14	0.16	0.19	0.11	0.00
250	0.78	0.08	0.12	0.08	0.08	0.17	0.19	0.14	0.09	0.00
300	0.78	0.14	0.17	0.14	0.15	0.19	0.19	0.16	0.11	0.00
350	0.80	0.17	0.17	0.18	0.23	0.16	0.28	0.16	0.16	0.00
400	0.81	0.25	0.20	0.24	0.26	0.19	0.26	0.20	0.21	0.00
450	0.84	0.25	0.23	0.26	0.24	0.23	0.26	0.23	0.21	0.00
500	0.86	0.26	0.25	0.26	0.24	0.23	0.28	0.24	0.22	0.00
AVG	0.75	0.18	0.18	0.16	0.15	0.16	0.21	0.18	0.16	0.00
SD	0.09	0.06	0.04	0.07	0.09	0.06	0.05	0.04	0.05	0.00

Table B6. Performance Comparison on Total Persuasion Credit ($\gamma = 0.2$)

K	Our Method	Degree	Closeness	Between-ness	Percolation	Eigenvector	Intercentrality ($\beta = 0.1$)	INF-RANK	INF-SIM	Random
50	36.02	25.15	25.93	25.74	27.06	28.49	27.97	24.25	22.48	2.84
100	65.59	45.27	46.86	43.17	45.94	47.89	46.29	43.72	39.54	5.74
150	90.76	61.92	63.20	62.00	62.27	63.75	64.09	60.15	53.34	8.43
200	113.39	78.29	76.47	77.92	78.07	79.59	79.10	72.23	68.39	11.38
250	132.90	92.97	91.86	91.39	91.48	90.47	88.96	85.78	82.52	14.27
300	150.89	103.63	102.14	101.73	102.78	101.57	100.86	98.60	95.23	17.08
350	167.05	114.11	112.68	111.14	109.91	113.77	110.58	111.12	103.96	19.87
400	181.46	120.02	122.03	118.73	117.80	121.68	119.70	119.52	111.98	22.88
450	193.51	129.55	130.31	126.35	127.08	129.87	129.64	127.64	120.08	25.82
500	204.28	138.02	137.21	134.02	135.65	138.55	137.19	135.18	126.20	28.45
AVG	133.59	90.89	90.87	89.22	89.81	91.56	90.44	87.82	82.37	15.68
SD	56.46	37.52	37.13	36.39	35.91	36.48	36.16	37.25	35.45	8.65

Table B7. Performance Comparison on Top-*K* Precision ($\gamma = 0.3$)

K	Our Method	Degree	Closeness	Between-ness	Percolation	Eigenvector	Intercentrality ($\beta = 0.6$)	INF-RANK	INF-SIM	Random
50	0.72	0.56	0.58	0.48	0.52	0.64	0.62	0.42	0.34	0.01
100	0.84	0.58	0.61	0.50	0.53	0.61	0.58	0.44	0.42	0.02
150	0.79	0.55	0.57	0.53	0.54	0.58	0.57	0.47	0.42	0.03
200	0.83	0.56	0.56	0.55	0.55	0.58	0.58	0.46	0.46	0.04
250	0.81	0.56	0.56	0.55	0.54	0.54	0.54	0.48	0.48	0.05
300	0.83	0.55	0.54	0.52	0.53	0.54	0.53	0.49	0.48	0.06
350	0.84	0.54	0.53	0.52	0.51	0.54	0.52	0.51	0.48	0.07
400	0.85	0.51	0.52	0.51	0.50	0.52	0.51	0.50	0.47	0.08
450	0.86	0.50	0.50	0.49	0.49	0.50	0.50	0.49	0.46	0.09
500	0.86	0.49	0.48	0.48	0.48	0.49	0.49	0.49	0.45	0.10
AVG	0.82	0.54	0.55	0.51	0.52	0.55	0.54	0.47	0.45	0.06
SD	0.04	0.03	0.04	0.02	0.02	0.05	0.04	0.03	0.04	0.03

Table B8. Performance Comparison on Spearman's Rank Corrrelation Coefficient ($\gamma = 0.3$)

K	Our Method	Degree	Closeness	Between-ness	Percolation	Eigenvector	Intercentrality ($\beta = 0.3$)	INF-RANK	INF-SIM	Random
50	0.57	0.19	0.16	0.13	0.01	0.01	0.21	0.18	0.18	0.00
100	0.64	0.19	0.13	0.15	0.04	0.12	0.16	0.12	0.16	0.00
150	0.75	0.17	0.19	0.10	0.13	0.21	0.14	0.18	0.14	0.00
200	0.75	0.12	0.20	0.09	0.10	0.14	0.16	0.20	0.11	0.00
250	0.78	0.08	0.12	0.08	0.07	0.17	0.19	0.14	0.09	0.00
300	0.81	0.14	0.17	0.14	0.15	0.19	0.19	0.16	0.11	0.00
350	0.85	0.17	0.17	0.18	0.23	0.16	0.28	0.16	0.16	0.00
400	0.86	0.25	0.20	0.24	0.26	0.19	0.26	0.20	0.21	0.00
450	0.88	0.25	0.23	0.26	0.24	0.23	0.26	0.23	0.21	0.00
500	0.89	0.26	0.25	0.26	0.24	0.23	0.28	0.24	0.22	0.00
AVG	0.78	0.18	0.18	0.16	0.15	0.16	0.21	0.18	0.16	0.00
SD	0.10	0.06	0.04	0.07	0.09	0.06	0.05	0.04	0.05	0.00

Table B9. Performance Comparison on Total Persuasion Credit (γ = 0.3)

K	Our Method	Degree	Closeness	Between-ness	Percolation	Eigenvector	Intercentrality (β = 0.1)	INF-RANK	INF-SIM	Random
50	30.93	21.43	22.12	22.01	23.21	24.37	23.92	21.00	19.46	2.86
100	57.84	39.14	40.62	37.60	39.96	41.58	40.21	38.64	34.76	5.72
150	81.23	54.08	55.23	54.35	54.78	55.67	56.20	53.45	47.47	8.57
200	103.27	69.12	67.40	69.04	69.32	70.38	70.11	64.82	61.25	11.31
250	123.06	82.84	81.78	81.73	82.09	80.45	79.21	77.77	74.27	14.30
300	141.13	92.89	91.46	91.59	92.70	90.87	90.26	89.69	86.11	17.15
350	157.21	102.67	101.57	100.52	99.62	102.60	99.63	101.37	94.57	19.94
400	172.49	108.38	110.45	107.81	107.17	110.22	108.41	109.43	102.02	22.78
450	186.30	117.56	118.40	115.06	116.21	118.07	117.93	117.28	109.79	25.53
500	198.69	125.76	125.15	122.62	124.57	126.60	125.29	124.78	116.00	28.36
AVG	125.22	81.39	81.42	80.23	80.96	82.08	81.12	79.82	74.57	15.65
SD	56.27	34.75	34.47	33.85	33.59	33.95	33.61	34.87	32.96	8.59

Table 10. Performance Comparison on Top-*K* Precision (γ = 0.4)

K	Our Method	Degree	Closeness	Between-ness	Percolation	Eigenvector	Intercentrality (β = 0.1)	INF-RANK	INF-SIM	Random
50	0.74	0.54	0.60	0.46	0.50	0.64	0.64	0.40	0.32	0.01
100	0.82	0.57	0.60	0.49	0.52	0.61	0.58	0.43	0.41	0.02
150	0.78	0.55	0.57	0.52	0.53	0.58	0.57	0.47	0.41	0.03
200	0.82	0.56	0.56	0.55	0.55	0.58	0.58	0.46	0.45	0.04
250	0.81	0.56	0.56	0.54	0.54	0.55	0.54	0.48	0.47	0.05
300	0.85	0.55	0.54	0.52	0.53	0.53	0.53	0.49	0.48	0.06
350	0.85	0.54	0.53	0.52	0.51	0.54	0.52	0.50	0.48	0.07
400	0.87	0.50	0.51	0.51	0.49	0.51	0.50	0.49	0.46	0.08
450	0.87	0.50	0.50	0.49	0.48	0.50	0.50	0.50	0.46	0.09
500	0.87	0.49	0.48	0.48	0.48	0.49	0.49	0.49	0.45	0.10
AVG	0.83	0.53	0.54	0.51	0.51	0.55	0.54	0.47	0.44	0.06
SD	0.04	0.03	0.04	0.03	0.02	0.05	0.05	0.03	0.05	0.03

Table B11. Performance Comparison on Spearman's Rank Correlation Coefficient (γ = 0.4)

K	Our Method	Degree	Closeness	Between-ness	Percolation	Eigenvector	Intercentrality (β = 0.6)	INF-RANK	INF-SIM	Random
50	0.61	0.19	0.17	0.14	0.01	0.02	0.21	0.19	0.19	0.00
100	0.63	0.19	0.13	0.15	0.04	0.12	0.17	0.12	0.16	-0.01
150	0.73	0.18	0.19	0.10	0.13	0.21	0.14	0.18	0.14	0.00
200	0.72	0.12	0.20	0.09	0.10	0.14	0.16	0.20	0.11	0.00
250	0.79	0.08	0.12	0.08	0.07	0.17	0.19	0.14	0.09	-0.01
300	0.80	0.14	0.17	0.14	0.15	0.19	0.19	0.16	0.11	0.00
350	0.83	0.17	0.17	0.18	0.23	0.16	0.28	0.16	0.16	0.00
400	0.83	0.25	0.20	0.24	0.26	0.19	0.26	0.20	0.21	0.00
450	0.86	0.25	0.23	0.26	0.24	0.23	0.26	0.23	0.21	0.00
500	0.87	0.25	0.25	0.26	0.24	0.23	0.28	0.24	0.22	0.00
AVG	0.77	0.18	0.18	0.16	0.15	0.17	0.21	0.18	0.16	0.00
SD	0.09	0.06	0.04	0.07	0.09	0.06	0.05	0.04	0.05	0.00

Table B12. Performance Comparison on Total Persuasion Credit (γ = 0.4)

K	Our Method	Degree	Closeness	Between-ness	Percolation	Eigenvector	Intercentrality (β = 0.1)	INF-RANK	INF-SIM	Random
50	27.34	18.80	19.41	19.39	20.48	21.43	21.02	18.70	17.32	2.89
100	51.67	34.73	36.09	33.57	35.64	36.98	35.77	34.90	31.29	5.73
150	73.52	48.36	49.37	48.79	49.27	49.73	50.34	48.50	43.19	8.53
200	94.58	62.32	60.64	62.45	62.81	63.47	63.33	59.29	55.99	11.47
250	113.56	75.20	74.14	74.47	74.98	72.88	71.81	71.74	68.14	14.32
300	132.04	84.69	83.29	83.90	85.02	82.68	82.14	82.90	79.23	17.13
350	148.50	93.92	92.98	92.42	91.77	93.93	91.14	93.91	87.44	19.94
400	164.64	99.42	101.41	99.41	99.02	101.26	99.57	101.68	94.48	22.97
450	178.92	108.26	109.04	106.35	107.83	108.78	108.69	109.30	101.97	25.62
500	192.41	116.17	115.58	113.76	115.95	117.09	115.83	116.71	108.17	28.59
AVG	117.72	74.19	74.19	73.45	74.28	74.82	73.96	73.76	68.72	15.72
SD	55.49	32.48	32.24	31.79	31.69	31.82	31.47	32.95	30.99	8.64

Table B13. Performance Comparison on Top-*K* Precision (γ - 0.6)

K	Our Method	Degree	Closeness	Between-ness	Percolation	Eigenvector	Intercentrality (β = 0.1)	INF-RANK	INF-SIM	Random
50	0.72	0.56	0.60	0.46	0.52	0.66	0.64	0.40	0.32	0.01
100	0.80	0.56	0.60	0.48	0.52	0.61	0.58	0.42	0.40	0.02
150	0.78	0.55	0.57	0.53	0.54	0.58	0.57	0.47	0.41	0.03
200	0.84	0.55	0.56	0.54	0.54	0.58	0.58	0.44	0.44	0.04
250	0.83	0.55	0.54	0.54	0.53	0.54	0.54	0.46	0.46	0.05
300	0.86	0.54	0.53	0.52	0.53	0.52	0.52	0.48	0.48	0.06
350	0.86	0.52	0.51	0.50	0.50	0.52	0.50	0.49	0.46	0.07
400	0.88	0.49	0.50	0.49	0.48	0.50	0.49	0.48	0.46	0.08
450	0.89	0.48	0.48	0.48	0.47	0.48	0.48	0.48	0.45	0.09
500	0.89	0.48	0.47	0.48	0.48	0.48	0.47	0.48	0.45	0.10
AVG	0.83	0.53	0.54	0.50	0.51	0.55	0.54	0.46	0.43	0.06
SD	0.05	0.03	0.04	0.03	0.03	0.06	0.05	0.03	0.05	0.03

Table B14. Performance Comparison on Spearman's Rank Correlation Coeffiient (γ = 0.6)

K	Our Method	Degree	Closeness	Between-ness	Percolation	Eigenvector	Intercentrality (β = 0.6)	INF-RANK	INF-SIM	Random
50	0.59	0.19	0.17	0.15	0.01	0.02	0.21	0.20	0.19	0.00
100	0.63	0.19	0.13	0.15	0.05	0.12	0.17	0.13	0.16	0.01
150	0.71	0.20	0.20	0.10	0.13	0.21	0.15	0.18	0.14	-0.01
200	0.73	0.12	0.20	0.09	0.10	0.14	0.16	0.20	0.11	0.00
250	0.78	0.08	0.12	0.08	0.08	0.18	0.19	0.14	0.09	0.00
300	0.79	0.14	0.17	0.14	0.15	0.20	0.19	0.16	0.11	0.00
350	0.81	0.17	0.18	0.18	0.23	0.17	0.28	0.16	0.16	0.00
400	0.83	0.25	0.20	0.24	0.26	0.19	0.26	0.20	0.21	0.00
450	0.85	0.25	0.23	0.26	0.24	0.23	0.26	0.23	0.21	0.00
500	0.86	0.25	0.25	0.26	0.24	0.23	0.28	0.24	0.22	0.00
AVG	0.76	0.19	0.19	0.16	0.15	0.17	0.22	0.18	0.16	0.00
SD	0.09	0.06	0.04	0.07	0.09	0.06	0.05	0.04	0.05	0.00

Table B15. Performance Comparison on Total Persuasion Credit (γ = 0.6)

K	Our Method	Degree	Closeness	Between-ness	Percolation	Eigenvector	Intercentrality (β = 0.1)	INF-RANK	INF-SIM	Random
50	22.29	15.22	15.70	15.82	16.73	17.39	17.03	15.47	14.36	2.84
100	43.20	28.59	29.75	27.95	29.58	30.52	29.51	29.58	26.39	5.74
150	62.92	39.90	41.06	40.93	41.42	41.31	41.98	41.41	37.09	8.61
200	82.07	52.56	50.93	52.97	53.45	53.50	53.48	51.25	48.43	11.40
250	100.29	64.07	62.99	63.92	64.61	61.84	61.00	62.88	59.22	14.23
300	117.73	72.62	71.27	72.60	73.71	70.64	70.17	72.86	69.13	17.09
350	134.63	80.98	80.18	80.42	80.16	80.99	78.49	82.81	76.88	20.05
400	150.94	86.10	87.84	86.90	86.95	87.77	86.27	90.08	83.34	22.72
450	166.56	94.30	94.89	93.27	95.31	94.70	94.69	97.28	90.34	25.61
500	181.40	101.65	101.01	100.38	102.99	102.54	101.36	104.51	96.43	28.66
AVG	106.20	63.60	63.56	63.52	64.49	64.12	63.40	64.81	60.16	15.70
SD	53.48	28.92	28.69	28.52	28.71	28.38	28.04	29.94	27.95	8.64

Table B16. Performance Comparison on Top-*K* Precision (γ - 0.7)

K	Our Method	Degree	Closeness	Between-ness	Percolation	Eigenvector	Intercentrality (β = 0.1)	INF-RANK	INF-SIM	Random
50	0.70	0.54	0.60	0.44	0.50	0.64	0.64	0.38	0.30	0.01
100	0.78	0.56	0.61	0.48	0.53	0.61	0.59	0.42	0.40	0.02
150	0.78	0.55	0.57	0.53	0.54	0.58	0.57	0.47	0.41	0.03
200	0.84	0.55	0.56	0.54	0.54	0.58	0.58	0.44	0.44	0.04
250	0.84	0.55	0.54	0.54	0.54	0.54	0.54	0.46	0.46	0.05
300	0.86	0.53	0.52	0.51	0.52	0.51	0.51	0.47	0.47	0.06
350	0.88	0.51	0.51	0.49	0.49	0.51	0.49	0.48	0.45	0.07
400	0.88	0.48	0.49	0.49	0.47	0.49	0.48	0.48	0.45	0.08
450	0.89	0.48	0.48	0.47	0.47	0.48	0.48	0.48	0.45	0.09
500	0.90	0.47	0.46	0.47	0.47	0.47	0.46	0.47	0.44	0.10
AVG	0.84	0.52	0.53	0.50	0.51	0.54	0.53	0.46	0.43	0.06
SD	0.06	0.03	0.05	0.03	0.03	0.06	0.06	0.03	0.05	0.03

Table B17. Performance Comparison on Spearman's Rank Correlation Coefficient (γ = 0.7)

K	Our Method	Degree	Closeness	Between-ness	Percolation	Eigenvector	Intercentrality (β = 0.6)	INF-RANK	INF-SIM	Random
50	0.60	0.19	0.17	0.15	0.01	0.02	0.21	0.20	0.19	-0.01
100	0.67	0.20	0.13	0.15	0.05	0.13	0.17	0.13	0.16	0.00
150	0.69	0.20	0.20	0.10	0.13	0.21	0.15	0.18	0.14	0.00
200	0.71	0.12	0.20	0.09	0.10	0.14	0.16	0.20	0.11	0.00
250	0.77	0.08	0.13	0.08	0.08	0.18	0.19	0.14	0.09	0.00
300	0.81	0.14	0.17	0.14	0.15	0.20	0.19	0.16	0.11	0.00
350	0.80	0.17	0.18	0.18	0.23	0.17	0.28	0.16	0.16	0.00
400	0.82	0.25	0.20	0.24	0.26	0.19	0.26	0.20	0.21	0.00
450	0.83	0.25	0.23	0.26	0.24	0.23	0.26	0.23	0.21	0.00
500	0.85	0.25	0.25	0.26	0.24	0.23	0.28	0.23	0.22	0.00
AVG	0.76	0.19	0.19	0.16	0.15	0.17	0.22	0.18	0.16	0.00
SD	0.08	0.06	0.04	0.07	0.09	0.06	0.05	0.04	0.05	0.00

Table B18. Performance Companion on Total Persuasion Credit ($\gamma = 0.7$)

K	Our Method	Degree	Closeness	Between-ness	Percolation	Eigenvector	Intercentrality ($\beta = 0.1$)	INF-RANK	INF-SIM	Random
50	20.47	13.92	14.34	14.52	15.36	15.91	15.58	14.27	13.26	2.91
100	39.93	26.32	27.40	25.85	27.33	28.12	27.18	27.57	24.55	5.73
150	58.80	36.90	37.94	37.98	38.46	38.15	38.83	38.71	34.77	8.63
200	77.19	48.86	47.25	49.37	49.88	49.70	49.72	48.16	45.53	11.43
250	94.98	59.81	58.72	59.86	60.61	57.61	56.85	59.44	55.78	14.23
300	112.05	67.95	66.63	68.22	69.33	65.99	65.55	68.93	65.20	17.01
350	129.04	75.95	75.18	75.75	75.64	75.94	73.55	78.45	72.74	19.94
400	145.35	80.89	82.51	81.99	82.24	82.47	81.04	85.50	78.98	22.84
450	161.39	88.80	89.31	88.12	90.41	89.13	89.15	92.52	85.78	25.61
500	176.74	95.90	95.22	95.08	97.87	96.75	95.60	99.65	91.79	28.43
AVG	101.59	59.53	59.45	59.67	60.71	59.98	59.30	61.32	56.84	15.67
SD	52.55	27.46	27.23	27.19	65.25	26.96	63.68	28.71	26.73	8.59

Table B19. Performance Comparison on Top-*K* Precision ($\gamma = 0.8$)

K	Our Method	Degree	Closeness	Betweenness	Percolation	Eigenvector	Intercentrality ($\beta = 0.1$)	INF-RANK	INF-SIM	Random
50	0.72	0.54	0.60	0.44	0.50	0.64	0.64	0.40	0.30	0.01
100	0.79	0.56	0.60	0.48	0.52	0.61	0.58	0.43	0.40	0.02
150	0.78	0.54	0.57	0.53	0.53	0.58	0.57	0.47	0.40	0.03
200	0.84	0.55	0.56	0.54	0.54	0.58	0.58	0.44	0.44	0.04
250	0.84	0.55	0.54	0.54	0.53	0.54	0.54	0.46	0.46	0.05
300	0.87	0.53	0.52	0.51	0.52	0.51	0.51	0.47	0.47	0.06
350	0.88	0.51	0.50	0.49	0.49	0.51	0.49	0.47	0.45	0.07
400	0.90	0.48	0.49	0.48	0.47	0.48	0.47	0.47	0.45	0.08
450	0.91	0.46	0.47	0.46	0.46	0.47	0.46	0.47	0.44	0.09
500	0.92	0.46	0.45	0.46	0.46	0.46	0.45	0.47	0.43	0.10
AVG	0.84	0.52	0.53	0.49	0.50	0.54	0.53	0.45	0.42	0.06
SD	0.06	0.04	0.05	0.04	0.03	0.06	0.06	0.02	0.05	0.03

Table B20. Performance Comparison on Spearman's Rank Corellation Coefficient ($\gamma = 0.8$)

K	Our Method	Degree	Closeness	Between-ness	Percolation	Eigenvector	Intercentrality ($\beta = 0.6$)	INF-RANK	INF-SIM	Random
50	0.60	0.19	0.17	0.15	0.01	0.02	0.21	0.20	0.19	0.00
100	0.65	0.20	0.13	0.15	0.06	0.13	0.17	0.13	0.16	0.00
150	0.69	0.21	0.20	0.10	0.13	0.21	0.15	0.18	0.14	0.00
200	0.72	0.13	0.20	0.09	0.10	0.14	0.16	0.20	0.11	0.00
250	0.77	0.09	0.13	0.08	0.07	0.18	0.19	0.14	0.09	0.00
300	0.80	0.15	0.17	0.14	0.15	0.20	0.19	0.16	0.11	0.00
350	0.82	0.17	0.18	0.18	0.23	0.17	0.28	0.15	0.16	0.00
400	0.83	0.25	0.20	0.24	0.26	0.19	0.27	0.20	0.21	0.00
450	0.85	0.25	0.23	0.26	0.24	0.23	0.26	0.23	0.21	0.00
500	0.86	0.25	0.25	0.26	0.24	0.23	0.28	0.23	0.22	0.00
AVG	0.76	0.19	0.19	0.17	0.15	0.17	0.22	0.18	0.16	0.00
SD	0.09	0.06	0.04	0.07	0.09	0.06	0.05	0.04	0.05	0.00

Table B21. Performance Comparison on Total Persuasion Credit ($\gamma = 0.8$)

K	Our Method	Degree	Closeness	Between-ness	Percolation	Eigenvector	Intercentrality ($\beta = 0.1$)	INF-RANK	INF-SIM	Random
50	18.92	12.83	13.21	13.42	14.20	14.66	14.35	13.25	12.33	2.90
100	37.29	24.39	25.40	24.07	25.41	26.07	25.20	25.84	22.98	5.73
150	55.24	34.35	35.28	35.46	35.92	35.46	36.13	36.38	32.76	8.57
200	72.92	45.68	44.09	46.26	46.81	46.44	46.47	45.47	43.02	11.46
250	90.26	56.12	55.02	56.34	57.15	53.96	53.26	56.43	52.79	14.27
300	107.16	63.89	62.59	64.40	65.53	61.95	61.54	65.48	61.77	17.16
350	123.93	71.57	70.82	71.66	71.71	71.53	69.25	74.63	69.12	19.88
400	140.40	76.34	77.85	77.69	78.13	77.84	76.47	81.47	75.17	22.78
450	156.53	83.99	84.41	83.59	86.11	84.25	84.29	88.32	81.76	25.77
500	172.34	90.84	90.13	90.40	93.37	91.64	90.53	95.35	87.70	28.50
AVG	97.50	56.00	55.88	56.33	57.43	56.38	55.75	58.26	53.94	15.70
SD	51.60	26.15	25.93	25.99	26.42	25.69	25.37	27.61	25.64	8.62

Table B22. Performance Comparison on Top-*K* Precision ($\gamma = 0.9$)

K	Our Method	Degree	Closeness	Between-ness	Percolation	Eigenvector	Intercentrality ($\beta = 0.1$)	INF-RANK	INF-SIM	Random
50	0.72	0.54	0.60	0.44	0.50	0.64	0.64	0.40	0.30	0.01
100	0.79	0.56	0.61	0.48	0.53	0.61	0.59	0.43	0.40	0.02
150	0.78	0.53	0.57	0.52	0.53	0.58	0.58	0.47	0.40	0.03
200	0.83	0.55	0.56	0.54	0.54	0.58	0.58	0.44	0.44	0.04
250	0.84	0.55	0.54	0.54	0.53	0.54	0.54	0.46	0.46	0.05
300	0.87	0.53	0.52	0.51	0.52	0.51	0.51	0.47	0.47	0.06
350	0.88	0.51	0.50	0.49	0.49	0.51	0.49	0.47	0.45	0.07
400	0.89	0.48	0.49	0.48	0.47	0.48	0.47	0.47	0.44	0.08
450	0.91	0.46	0.47	0.45	0.46	0.47	0.46	0.46	0.44	0.09
500	0.92	0.45	0.45	0.45	0.46	0.46	0.45	0.46	0.43	0.10
AVG	0.84	0.52	0.53	0.49	0.50	0.54	0.53	0.45	0.42	0.06
SD	0.06	0.04	0.06	0.04	0.03	0.06	0.06	0.02	0.05	0.03

Table B23. Performance Comparison on Spearman's Rank Correlation Coefficient ($\gamma = 0.9$)

K	Our Method	Degree	Closeness	Between-ness	Percolation	Eigenvector	Intercentrality ($\beta = 0.6$)	INF-RANK	INF-SIM	Random
50	0.59	0.19	0.17	0.15	0.01	0.02	0.22	0.21	0.19	0.01
100	0.63	0.20	0.14	0.15	0.06	0.13	0.17	0.14	0.16	0.00
150	0.68	0.21	0.21	0.10	0.13	0.22	0.15	0.18	0.15	0.00
200	0.72	0.13	0.21	0.09	0.10	0.14	0.16	0.20	0.11	0.00
250	0.76	0.09	0.13	0.08	0.07	0.18	0.19	0.14	0.09	0.00
300	0.80	0.15	0.17	0.14	0.15	0.20	0.19	0.16	0.11	0.00
350	0.81	0.18	0.18	0.18	0.23	0.17	0.28	0.15	0.16	0.00
400	0.82	0.25	0.20	0.24	0.26	0.19	0.27	0.19	0.21	0.00
450	0.84	0.25	0.23	0.26	0.24	0.23	0.26	0.23	0.20	0.00
500	0.86	0.26	0.25	0.26	0.24	0.23	0.28	0.23	0.22	0.00
AVG	0.75	0.19	0.19	0.17	0.15	0.17	0.22	0.18	0.16	0.00
SD	0.09	0.06	0.04	0.07	0.09	0.06	0.05	0.04	0.05	0.00

Table B24. Performance Comparison on Total Persuasion Credit (γ = 0.9)

K	Our Method	Degree	Closeness	Between-ness	Percolation	Eigenvector	Intercentrality (β = 0.1)	INF-RANK	INF-SIM	Random
50	17.59	11.89	12.24	12.48	13.20	13.59	13.30	12.37	11.53	2.85
100	34.93	22.73	23.68	22.52	23.75	24.31	23.48	24.33	21.60	5.73
150	52.10	32.13	32.97	33.27	33.71	33.12	33.79	34.33	31.00	8.51
200	69.11	42.91	41.33	43.55	44.12	43.58	43.64	43.10	40.81	11.40
250	86.00	52.87	51.78	53.24	54.10	50.76	50.10	53.76	50.15	14.33
300	102.67	60.32	59.04	61.03	62.17	58.40	58.01	62.42	58.74	16.94
350	119.29	67.69	66.97	68.04	68.23	67.62	65.45	71.22	65.90	19.99
400	135.75	72.32	73.72	73.87	74.48	73.72	72.41	77.87	71.77	22.73
450	152.06	79.71	80.05	79.56	82.30	79.90	79.96	84.56	78.18	25.60
500	168.22	86.33	85.59	86.22	89.37	87.08	86.00	91.49	84.04	28.56
AVG	93.77	52.89	52.74	53.38	54.54	53.21	52.61	55.55	51.37	15.67
SD	50.67	24.97	24.75	24.91	25.44	24.54	24.23	26.61	24.65	8.62

Appendix C

Analysis of Three Versus Two Forces for Top Persuader Prediction

Our method integrates three important forces (i.e., social influence, entity similarity, and structural equivalence) to predict top persuaders. To demonstrate the importance and value of considering three forces for top persuader prediction, we conducted additional analyses using the data and evaluation design detailed in the "Empirical Evaluation and Results" section. Specifically, we removed structural equivalence from our method and persuasion probability originally defined in Equation (8) became

$$p_{ij} = P\left(D_j = 1 | I_{ij}, \gamma^{d_{ij}-1} M_{ij}\right) \tag{C1}$$

We labeled this new method without structural equivalence as R-removed. Similarly, we removed entity similarity only and labeled the method without entity similarity as M-removed; we dropped social influence only and labeled the method without social influence as I-removed. The performance differences between our method and these new methods, each of which considers only two forces, reveal the need to consider three forces for top persuader prediction; they also shed light on the contribution of each removed force to the performance of our method.

In Tables C1–C3, we report the performance comparisons between our method and each method that only considers two forces, with γ = 0.5. Our method substantially outperforms R-removed, M-removed, and I-removed in each evaluation metric, across the *K* values we investigated. Averaged across *K*, our method outperforms R-removed, M-removed, and I-removed by 20.28%, 17.66%, and 68.85%, respectively, in terms of top-*K* precision and by 76.60%, 99.68%, and 483.31%, respectively, in terms of Spearman coefficient. On average, our method is 22.72% higher in total persuasion credit than R-removed, 20.21% higher than M-removed and 32.34% higher than I-removed. We further analyzed different values ranging from 0.1 to 0.9, in increments of 0.1, except for γ = 0.5, and observed results largely similar to those reported in Tables C1–C3. Across , our method outperforms R-removed by 11.95% to 27.20% in top-*K* precision, 71.14% to 258.14% in Spearman coefficient, and 13.60% to 27.25% in total persuasion credit. Similarly, our method outperforms M-removed by 11.80% to 19.88% in top-*K* precision, 66.38% to 204.92% in Spearman coefficient, and 13.41% to 23.54% in total persuasion credit; it also outperforms I-removed by 66.22% to 80.35% in top-*K* precision, 128.09% to 537.94% in Spearman coefficient, and 31.82% to 40.31% in total persuasion credit. Overall, our method significantly outperforms the methods that consider only two forces, suggesting the necessity of considering three forces for top persuader prediction. Our results also indicate that each of the three forces contributes to the performance of our method; in particular, social influence seems to contribute the most among the three forces.

Table C1. Performance Comparison on Top=*K* Precision ($\gamma = 0.5$)

K	Our Method	R-removed	M-removed	I-removed
50	0.72	0.60	0.64	0.30
100	0.81	0.69	0.69	0.43
150	0.78	0.71	0.72	0.50
200	0.82	0.71	0.73	0.52
250	0.83	0.72	0.73	0.47
300	0.85	0.71	0.73	0.55
350	0.85	0.70	0.72	0.56
400	0.87	0.70	0.71	0.58
450	0.88	0.68	0.69	0.58
500	0.89	0.68	0.69	0.55
AVG	0.83	0.69	0.71	0.50
SD	0.05	0.03	0.03	0.09

Table C2. Performance Comparison on Spearman's Rank Correlation Coefficient ($\gamma = 0.5$)

K	Our Method	R-removed	M-removed	I-removed
50	0.68	0.26	0.19	0.02
100	0.65	0.24	0.25	0.19
150	0.73	0.38	0.37	0.20
200	0.73	0.41	0.41	0.17
250	0.79	0.45	0.46	0.37
300	0.80	0.50	0.43	0.29
350	0.82	0.56	0.48	0.35
400	0.83	0.63	0.53	0.39
450	0.85	0.68	0.53	0.38
500	0.86	0.70	0.55	0.42
AVG	0.77	0.48	0.42	0.28
SD	0.07	0.16	0.12	0.13

Table C3. Performance Comparison on Total Persuasion Credit ($\gamma = 0.5$)

K	Our Method	R-removed	M-removed	I-removed
50	24.55	21.61	23.56	21.24
100	47.00	41.44	41.48	38.50
150	67.80	58.51	59.81	54.96
200	87.78	74.02	76.10	70.19
250	106.42	87.99	88.60	78.13
300	124.16	99.70	101.28	94.01
350	140.97	109.73	112.48	104.24
400	157.30	122.08	122.90	112.39
450	172.30	131.72	132.96	120.10
500	186.62	141.30	143.28	124.08
AVG	111.49	88.81	90.25	81.78
SD	54.45	39.66	39.82	35.36

Appendix D

Empirical Evaluation with Another Data Set

We conducted an additional evaluation with another data set. The data set contains 6.01 million records of phone communications among 28,440 mobile phone users over 20 weeks. Each record corresponds to a phone communication and consists of the timestamp and duration of the communication as well as the respective identities of the two users participating in the communication. We can construct a social network from these data. A social entity of the network represents a mobile phone user, a relationship between two entities exists if there are phone communications between their corresponding users, and the strength of social interactions between two entities is measured as the communication time between their corresponding users. The data set also contains adoption information: whether a user adopted a particular mobile phone service during the study period (i.e., initial purchase of the service) and, if adopted, in which week. Over the study period, a total of 3,129 users adopted the service. We also have data about each user's profile, including gender, age, and membership levels in the two most recent years.

Following the same procedure described in the "Evaluation Design" subsection, we used the data over the first 10 weeks of the study period to train our method and each benchmark method for predicting top-K persuaders, where K varies from 280 (i.e., approximately 1% of the total number of users) to 2,800 (i.e., approximately 10% of the total number of users), in increments of 280. We then employed data over the second 10 weeks of the study period to evaluate the prediction performance of each method. In Tables D1–D3, we report the performance of our method and each benchmark method in terms of top-K precision, Spearman's rank correlation coefficient, and total persuasion credit respectively, with attenuation factor $\gamma = 0.5$. As shown, our method substantially outperforms all the benchmark methods in each performance metric, across the investigated K values. Across K, our method, on average, is 312.01% higher in top-K precision than eigenvector centrality (the best performing benchmark method in terms of average top-K precision), 82.04% higher in the Spearman coefficient than eigenvector centrality (the best performing benchmark method according to average Spearman coefficient), and 207.68% higher in total persuasion credit than intercentrality (the best performing benchmark method in terms of average total persuasion credit). In addition, we applied the Wilcoxon signed-ranks test to the performance data in these tables and noted that our method significantly outperformed each benchmark method in any performance metric ($p < 0.001$). To ensure the robustness of our evaluation results, we conducted more evaluations with different γ, ranging from 0.1 to 0.9, in increments of 0.1, except for $\gamma = 0.5$. We obtained evaluation results largely similar to those in Tables D1–D3. Overall, across the values we investigated, our method outperforms the best performing benchmark method by a range of 208.59% to 379.07% in top-K precision, 57.48% to 110.65% in Spearman coefficient, and 115.01% to 263.26% in total persuasion credit.

Table D1. Performance Comparison on Top-K Precision ($\gamma = 0.5$)

K	Our Method	Degree	Closeness	Between-ness	Percolation	Eigenvector	Intercentrality ($\beta = 0.1$)	INF-RANK	INF-SIM	Random
280	0.80	0.16	0.05	0.14	0.16	0.21	0.17	0.09	0.06	0.01
560	0.80	0.17	0.08	0.14	0.14	0.19	0.18	0.12	0.09	0.02
840	0.78	0.15	0.10	0.14	0.14	0.16	0.17	0.12	0.09	0.03
1120	0.76	0.15	0.10	0.14	0.14	0.15	0.16	0.13	0.11	0.04
1400	0.73	0.15	0.11	0.13	0.14	0.15	0.15	0.12	0.11	0.05
1680	0.70	0.16	0.12	0.14	0.15	0.15	0.16	0.13	0.12	0.06
1960	0.66	0.17	0.13	0.14	0.16	0.17	0.17	0.13	0.12	0.07
2240	0.63	0.16	0.13	0.14	0.16	0.17	0.17	0.14	0.13	0.08
2520	0.59	0.16	0.14	0.15	0.16	0.17	0.18	0.15	0.13	0.09
2800	0.58	0.18	0.16	0.16	0.17	0.20	0.20	0.16	0.14	0.10
AVG	0.70	0.16	0.11	0.14	0.15	0.17	0.17	0.13	0.11	0.05
SD	0.08	0.01	0.03	0.01	0.01	0.02	0.01	0.02	0.03	0.03

Table D2. Performance Comparison on Spearman's Rank Correlation Coefficient ($\gamma = 0.5$)

K	Our Method	Degree	Closeness	Between-ness	Percolation	Eigenvector	Intercentrality ($\beta = 0.9$)	INF-RANK	INF-SIM	Random
280	0.52	0.10	0.04	0.15	0.01	0.22	0.36	0.13	0.12	0.00
560	0.52	0.23	-0.06	0.04	0.09	0.48	0.40	0.03	0.08	0.00
840	0.55	0.22	-0.03	0.06	0.07	0.49	0.35	0.08	0.01	0.00
1120	0.55	0.19	0.04	0.06	0.12	0.43	0.32	0.07	-0.03	0.00
1400	0.58	0.16	-0.02	0.09	0.09	0.37	0.31	0.10	0.00	0.00
1680	0.59	0.18	0.11	0.07	0.11	0.35	0.28	0.08	0.03	0.00
1960	0.61	0.19	0.01	0.10	0.11	0.31	0.27	0.09	0.05	0.00
2240	0.63	0.21	-0.02	0.09	0.09	0.30	0.24	0.07	0.03	0.00
2520	0.63	0.20	0.00	0.08	0.10	0.28	0.22	0.05	0.04	0.00
2800	0.63	0.20	-0.01	0.09	0.14	0.24	0.22	0.07	0.04	0.00
AVG	0.58	0.19	0.01	0.08	0.09	0.35	0.30	0.08	0.04	0.00
SD	0.04	0.04	0.05	0.03	0.04	0.10	0.06	0.03	0.04	0.00

Table D3. Performance Comparison on Total Persuasion Credit ($\gamma = 0.5$)

K	Our Method	Degree	Closeness	Between-ness	Percolation	Eigenvector	Intercentrality ($\beta = 0.1$)	INF-RANK	INF-SIM	Random
280	195.17	58.00	20.30	37.24	43.30	84.94	67.65	35.38	25.29	11.56
560	341.35	94.54	43.79	71.46	74.63	115.48	110.64	66.81	46.14	22.99
840	458.04	121.89	69.19	100.37	101.51	134.01	140.84	88.65	68.43	34.27
1120	550.64	150.69	92.49	124.65	128.15	157.92	165.08	111.75	95.96	46.11
1400	617.37	183.13	112.53	141.36	155.97	180.09	185.52	129.74	116.02	56.80
1680	677.77	202.90	140.09	165.47	181.58	199.38	207.60	150.31	131.69	67.07
1960	715.98	220.63	166.56	185.38	206.50	223.65	230.23	168.08	147.83	79.90
2240	750.42	234.20	184.71	205.66	227.57	241.07	250.54	191.25	171.27	91.15
2520	780.36	250.02	207.77	229.83	252.31	258.07	276.12	215.75	188.05	101.87
2800	804.90	269.20	232.11	253.92	262.54	282.53	299.61	229.00	204.89	113.87
AVG	589.20	178.52	126.95	151.53	163.41	187.71	193.38	138.67	119.56	62.56
SD	202.53	70.23	71.25	69.76	75.62	64.83	73.96	64.12	60.60	34.30