

ไฟล์ netscience.gml ที่ให้ไว้ใน zip file เป็นข้อมูล co-authorship network หรือเครือข่ายของผู้เขียนที่บทความวิชาการร่วมกัน จงใช้โปรแกรม Gephi เพื่อตอบคำถามต่อไปนี้ โดยให้ capture หน้าจอแสดงผลการทำงานของ Gephi และเขียนคำอธิบายประกอบว่าได้พิจารณาอะไรบ้าง และคำตอบคืออะไร

1. เน็ตเวิร์คนี้เป็นเน็ตเวิร์คแบบใด (random, small-world, scale-free)

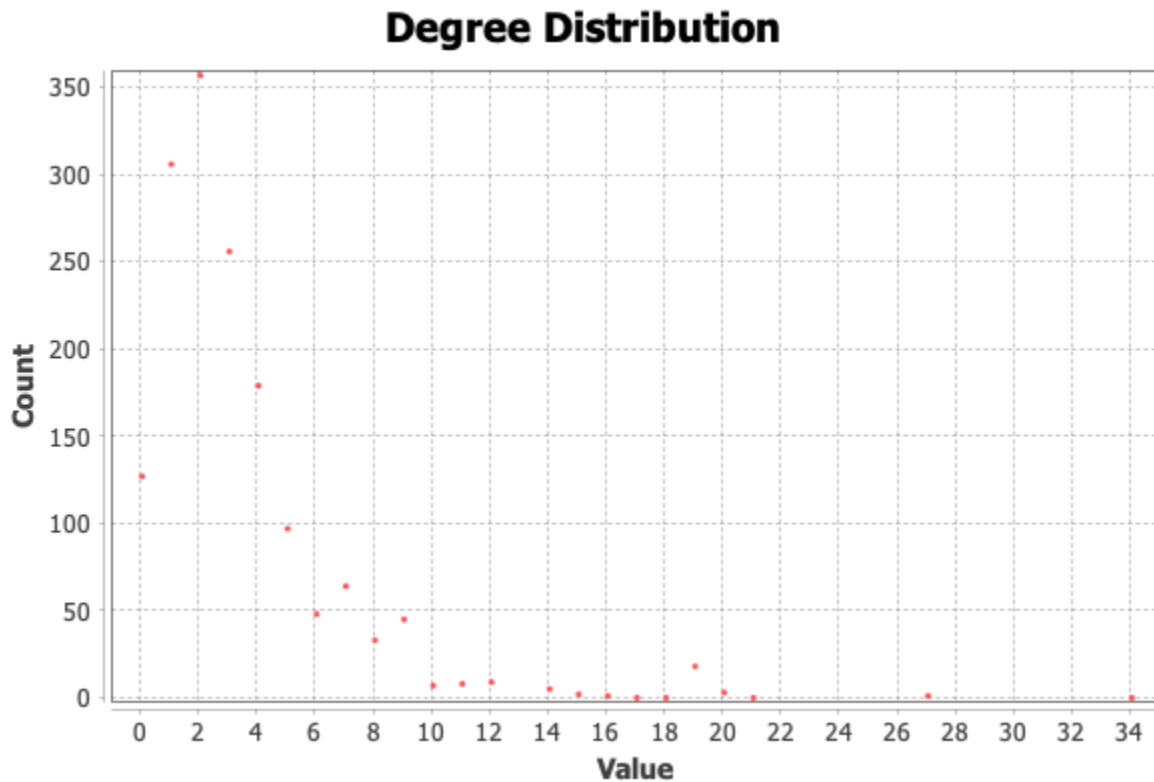


Figure 1.

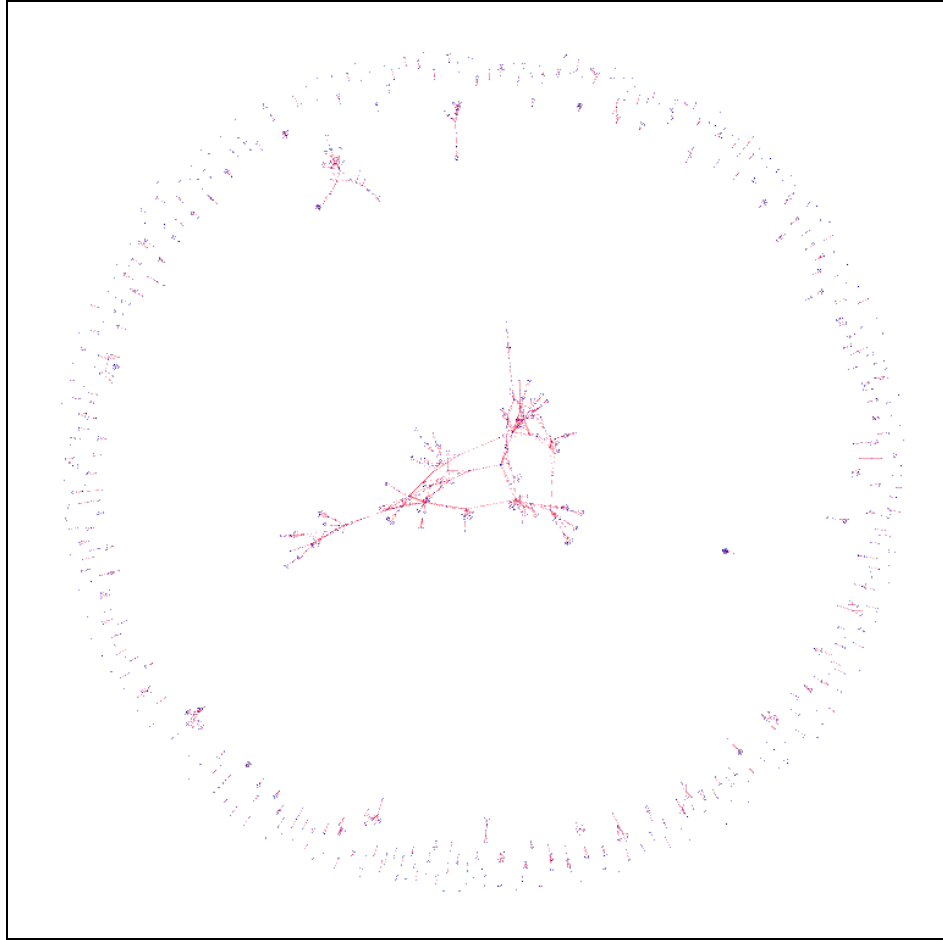


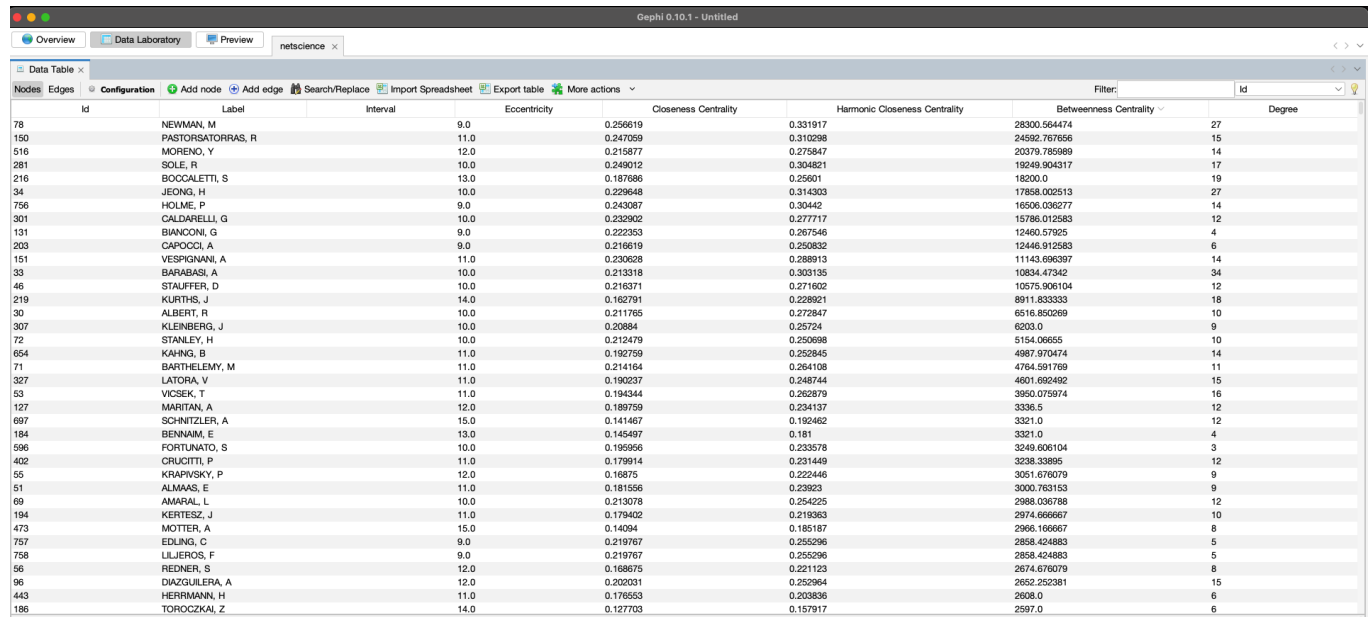
Figure 2.

The network is a scale-free network. Figure 2 shows network visualization in YifanHu layout. The degree distribution statistics shown in Figure 1 demonstrates that there are many nodes in the network with low degrees, while nodes with higher degrees are fewer in number. This is similar to the degree distribution of a scale-free network, which follows the power law function  $P(k) \sim k^{-\gamma}$ .

The degree distribution of this network is not in normal distribution form. Also, the degree distribution of this network is not in Small-world network distribution form (skewness).

Actually, this network is a mixed model because of the presence of both disconnected nodes and small-world characteristics. However, the choice of network structure is based on the degree distribution that closely matches the degree distribution of netscience.

## 2. ใครเป็นผู้ที่มีความสำคัญในเน็ตเวิร์กนี้ 3 อันดับแรก



Id	Label	Interval	Eccentricity	Closeness Centrality	Harmonic Closeness Centrality	Betweenness Centrality	Degree
78	NEWMAN, M		9.0	0.256619	0.331917	28300.564474	27
150	PASTORSATORRAS, R		11.0	0.247059	0.310298	24532.767656	15
516	MORENO, Y		12.0	0.215877	0.275847	20379.765989	14
281	SOLE, R		10.0	0.249012	0.304821	19249.904317	17
216	BOCCALETTI, S		13.0	0.187686	0.25601	18200.0	19
34	JEONG, H		10.0	0.229648	0.314303	17858.002513	27
756	HOLME, P		9.0	0.243087	0.30442	16506.036277	14
301	CALDARELLI, G		10.0	0.232902	0.277717	15786.012583	12
131	BIANCONI, G		9.0	0.222353	0.267546	12460.57625	4
203	CAPOCCI, A		9.0	0.216619	0.250832	12446.912583	6
151	VESPIGNANI, A		11.0	0.230628	0.288913	11143.696397	14
33	BARABASI, A		10.0	0.213318	0.303135	10834.47342	34
46	STAUFFER, D		10.0	0.216371	0.271602	10575.906104	12
219	KURTHS, J		14.0	0.162791	0.228921	8911.833333	18
30	ALBERT, R		10.0	0.211765	0.272947	6516.360269	10
307	KLEINBERG, J		10.0	0.20884	0.25724	6203.0	9
72	STANLEY, H		10.0	0.212479	0.250698	5154.06655	10
654	KAHNG, B		11.0	0.192759	0.252845	4987.970474	14
71	BARTHELEMY, M		11.0	0.214164	0.264108	4764.591769	11
327	LATORA, V		11.0	0.190237	0.248744	4601.692492	15
53	VICSEK, T		11.0	0.194344	0.262879	3950.075974	16
127	MARITAN, A		12.0	0.189759	0.234137	3336.5	12
697	SCHNITZLER, A		15.0	0.141467	0.192462	3321.0	12
184	BENNAIM, E		13.0	0.145497	0.181	3321.0	4
596	FORTUNATO, S		10.0	0.195956	0.233578	3249.606104	3
402	CRUCITTI, P		11.0	0.179914	0.231449	3238.33895	12
55	KRAPIVSKY, P		12.0	0.16875	0.222446	3051.676079	9
51	ALMAAS, E		11.0	0.181656	0.228923	3000.763153	9
69	AMARAL, L		10.0	0.213078	0.254225	2988.036788	12
194	KERTESZ, J		11.0	0.179402	0.219363	2974.666667	10
473	MOTTER, A		15.0	0.14094	0.185187	2966.166667	8
757	EDLUNG, C		9.0	0.219767	0.255296	2858.424883	5
758	LILJEROS, F		9.0	0.219767	0.255296	2858.424883	5
96	REDNER, S		12.0	0.168675	0.221123	2674.676079	8
96	DIAZGUILERA, A		12.0	0.202031	0.252964	2652.252381	15
443	HERRMANN, H		11.0	0.176553	0.203836	2608.0	6
186	TOROCZKAI, Z		14.0	0.127703	0.157917	2597.0	6

I determine the importance of each node using betweenness centrality, because this scale-free network has many nodes that serve as important pathways in the shortest path of each node. After computing the betweenness centrality, the top 3 most important nodes are

1. NEWMAN, M
2. PASTORSATORRAS, R
3. MORENO, Y.

Degree centrality could also be used to determine node importance, but I think betweenness centrality is more appropriate.

I didn't use closeness centrality in this case because the actual network contains many connected components or disconnected nodes that cannot be reached by most nodes. Additionally, I didn't use the eigenvector centrality because it has an assumption of equal weighting of neighbors, which eigenvector centrality assumes that all neighbors of a node contribute equally to its centrality. However, in this network, certain neighbors may be more important than others.