

Example demonstrating how to run the
APCluster plugin on the original data provided by
the authors of AP, includes an example of storing
the clustering results in text file

Go to the Affinity Propagation homepage

The screenshot shows a web browser window with the URL <http://www.psi.toronto.edu/affinitypropagation/> in the address bar. The page header features a logo of a Greek letter Psi (Ψ) with a network graph, followed by the text "Probabilistic and Statistical Inference Group" and "University of Toronto". Below the header is a navigation menu with links: Home, People, Publications, Molecular Biology, Computer Vision, Machine Learning, Other Research, Group Resources, and a photograph of a modern building.

AFFINITY PROPAGATION

Brendan J. Frey and Delbert Dueck, University of Toronto
Clustering by Passing Messages Between Data Points. *Science* **315**, 972–976. [[PDF](#)] [[BibTeX](#)]

Interested in a commercial license for the extended software toolkit?
Send email to email to [Brendan Frey](#)

Data sets and software are provided at the bottom of this page

Click here to analyze data using the affinity propagation web application

The web application interface shows a list of data points with their coordinates and labels. A red box highlights the first few entries:

Index	Label	Coordinates
1	0	(128, 128)
2	1	(128, 256)
3	2	(128, 384)
4	3	(128, 512)
5	4	(128, 640)
6	5	(128, 768)
7	6	(128, 904)
8	7	(256, 128)
9	8	(256, 256)
10	9	(256, 384)
11	10	(256, 512)
12	11	(256, 640)
13	12	(256, 768)
14	13	(256, 904)
15	14	(384, 128)
16	15	(384, 256)
17	16	(384, 384)
18	17	(384, 512)
19	18	(384, 640)
20	19	(384, 768)
21	20	(384, 904)
22	21	(512, 128)
23	22	(512, 256)
24	23	(512, 384)
25	24	(512, 512)
26	25	(512, 640)
27	26	(512, 768)
28	27	(512, 904)
29	28	(640, 128)
30	29	(640, 256)
31	30	(640, 384)
32	31	(640, 512)
33	32	(640, 640)
34	33	(640, 768)
35	34	(640, 904)
36	35	(768, 128)
37	36	(768, 256)
38	37	(768, 384)
39	38	(768, 512)
40	39	(768, 640)
41	40	(768, 768)
42	41	(768, 904)
43	42	(904, 128)
44	43	(904, 256)
45	44	(904, 384)
46	45	(904, 512)
47	46	(904, 640)
48	47	(904, 768)
49	48	(904, 904)
50	49	(1032, 128)
51	50	(1032, 256)
52	51	(1032, 384)
53	52	(1032, 512)
54	53	(1032, 640)
55	54	(1032, 768)
56	55	(1032, 904)
57	56	(1160, 128)
58	57	(1160, 256)
59	58	(1160, 384)
60	59	(1160, 512)
61	60	(1160, 640)
62	61	(1160, 768)
63	62	(1160, 904)
64	63	(1280, 128)
65	64	(1280, 256)
66	65	(1280, 384)
67	66	(1280, 512)
68	67	(1280, 640)
69	68	(1280, 768)
70	69	(1280, 904)
71	70	(1408, 128)
72	71	(1408, 256)
73	72	(1408, 384)
74	73	(1408, 512)
75	74	(1408, 640)
76	75	(1408, 768)
77	76	(1408, 904)
78	77	(1536, 128)
79	78	(1536, 256)
80	79	(1536, 384)
81	80	(1536, 512)
82	81	(1536, 640)
83	82	(1536, 768)
84	83	(1536, 904)
85	84	(1664, 128)
86	85	(1664, 256)
87	86	(1664, 384)
88	87	(1664, 512)
89	88	(1664, 640)
90	89	(1664, 768)
91	90	(1664, 904)
92	91	(1792, 128)
93	92	(1792, 256)
94	93	(1792, 384)
95	94	(1792, 512)
96	95	(1792, 640)
97	96	(1792, 768)
98	97	(1792, 904)
99	98	(1920, 128)
100	99	(1920, 256)
101	100	(1920, 384)
102	101	(1920, 512)
103	102	(1920, 640)
104	103	(1920, 768)
105	104	(1920, 904)
106	105	(2048, 128)
107	106	(2048, 256)
108	107	(2048, 384)
109	108	(2048, 512)
110	109	(2048, 640)
111	110	(2048, 768)
112	111	(2048, 904)
113	112	(2176, 128)
114	113	(2176, 256)
115	114	(2176, 384)
116	115	(2176, 512)
117	116	(2176, 640)
118	117	(2176, 768)
119	118	(2176, 904)
120	119	(2304, 128)
121	120	(2304, 256)
122	121	(2304, 384)
123	122	(2304, 512)
124	123	(2304, 640)
125	124	(2304, 768)
126	125	(2304, 904)
127	126	(2432, 128)
128	127	(2432, 256)
129	128	(2432, 384)
130	129	(2432, 512)
131	130	(2432, 640)
132	131	(2432, 768)
133	132	(2432, 904)
134	133	(2560, 128)
135	134	(2560, 256)
136	135	(2560, 384)
137	136	(2560, 512)
138	137	(2560, 640)
139	138	(2560, 768)
140	139	(2560, 904)
141	140	(2688, 128)
142	141	(2688, 256)
143	142	(2688, 384)
144	143	(2688, 512)
145	144	(2688, 640)
146	145	(2688, 768)
147	146	(2688, 904)
148	147	(2816, 128)
149	148	(2816, 256)
150	149	(2816, 384)
151	150	(2816, 512)
152	151	(2816, 640)
153	152	(2816, 768)
154	153	(2816, 904)
155	154	(2944, 128)
156	155	(2944, 256)
157	156	(2944, 384)
158	157	(2944, 512)
159	158	(2944, 640)
160	159	(2944, 768)
161	160	(2944, 904)
162	161	(3072, 128)
163	162	(3072, 256)
164	163	(3072, 384)
165	164	(3072, 512)
166	165	(3072, 640)
167	166	(3072, 768)
168	167	(3072, 904)
169	168	(3200, 128)
170	169	(3200, 256)
171	170	(3200, 384)
172	171	(3200, 512)
173	172	(3200, 640)
174	173	(3200, 768)
175	174	(3200, 904)
176	175	(3328, 128)
177	176	(3328, 256)
178	177	(3328, 384)
179	178	(3328, 512)
180	179	(3328, 640)
181	180	(3328, 768)
182	181	(3328, 904)
183	182	(3456, 128)
184	183	(3456, 256)
185	184	(3456, 384)
186	185	(3456, 512)
187	186	(3456, 640)
188	187	(3456, 768)
189	188	(3456, 904)
190	189	(3584, 128)
191	190	(3584, 256)
192	191	(3584, 384)
193	192	(3584, 512)
194	193	(3584, 640)
195	194	(3584, 768)
196	195	(3584, 904)
197	196	(3712, 128)
198	197	(3712, 256)
199	198	(3712, 384)
200	199	(3712, 512)
201	200	(3712, 640)
202	201	(3712, 768)
203	202	(3712, 904)
204	203	(3840, 128)
205	204	(3840, 256)
206	205	(3840, 384)
207	206	(3840, 512)
208	207	(3840, 640)
209	208	(3840, 768)
210	209	(3840, 904)
211	210	(3968, 128)
212	211	(3968, 256)
213	212	(3968, 384)
214	213	(3968, 512)
215	214	(3968, 640)
216	215	(3968, 768)
217	216	(3968, 904)
218	217	(4104, 128)
219	218	(4104, 256)
220	219	(4104, 384)
221	220	(4104, 512)
222	221	(4104, 640)
223	222	(4104, 768)
224	223	(4104, 904)
225	224	(4232, 128)
226	225	(4232, 256)
227	226	(4232, 384)
228	227	(4232, 512)
229	228	(4232, 640)
230	229	(4232, 768)
231	230	(4232, 904)
232	231	(4360, 128)
233	232	(4360, 256)
234	233	(4360, 384)
235	234	(4360, 512)
236	235	(4360, 640)
237	236	(4360, 768)
238	237	(4360, 904)
239	238	(4488, 128)
240	239	(4488, 256)
241	240	(4488, 384)
242	241	(4488, 512)
243	242	(4488, 640)
244	243	(4488, 768)
245	244	(4488, 904)
246	245	(4616, 128)
247	246	(4616, 256)
248	247	(4616, 384)
249	248	(4616, 512)
250	249	(4616, 640)
251	250	(4616, 768)
252	251	(4616, 904)
253	252	(4744, 128)
254	253	(4744, 256)
255	254	(4744, 384)
256	255	(4744, 512)
257	256	(4744, 640)
258	257	(4744, 768)
259	258	(4744, 904)
260	259	(4872, 128)
261	260	(4872, 256)
262	261	(4872, 384)
263	262	(4872, 512)
264	263	(4872, 640)
265	264	(4872, 768)
266	265	(4872, 904)
267	266	(5000, 128)
268	267	(5000, 256)
269	268	(5000, 384)
270	269	(5000, 512)
271	270	(5000, 640)
272	271	(5000, 768)
273	272	(5000, 904)
274	273	(5128, 128)
275	274	(5128, 256)
276	275	(5128, 384)
277	276	(5128, 512)
278	277	(5128, 640)
279	278	(5128, 768)
280	279	(5128, 904)
281	280	(5256, 128)
282	281	(5256, 256)
283	282	(5256, 384)
284	283	(5256, 512)
285	284	(5256, 640)
286	285	(5256, 768)
287	286	(5256, 904)
288	287	(5384, 128)
289	288	(5384, 256)
290	289	(5384, 384)
291	290	(5384, 512)
292	291	(5384, 640)
293	292	(5384, 768)
294	293	(5384, 904)
295	294	(5512, 128)
296	295	(5512, 256)
297	296	(5512, 384)
298	297	(5512, 512)
299	298	(5512, 640)
300	299	(5512, 768)
301	300	(5512, 904)
302	301	(5640, 128)
303	302	(5640, 256)
304	303	(5640, 384)
305	304	(5640, 512)
306	305	(5640, 640)
307	306	(5640, 768)
308	307	(5640, 904)
309	308	(5768, 128)
310	309	(5768, 256)
311	310	(5768, 384)
312	311	(5768, 512)
313	312	(5768, 640)
314	313	(5768, 768)
315	314	(5768, 904)
316	315	(5896, 128)
317	316	(5896, 256)
318	317	(5896, 384)
319	318	(5896, 512)
320	319	(5896, 640)
321	320	(5896, 768)
322	321	(5896, 904)
323	322	(6024, 128)
324	323	(6024, 256)
325	324	(6024, 384)
326	325	(6024, 512)
327	326	(6024, 640)
328	327	(6024, 768)
329	328	(6024, 904)
330	329	(6152, 128)
331	330	(6152, 256)
332	331	(6152, 384)
333	332	(6152, 512)
334	333	(6152, 640)
335	334	(6152, 768)
336	335	(6152, 904)
337	336	(6280, 128)
338	337	(6280, 256)
339	338	(6280, 384)
340	339	(6280, 512)
341	340	(6280, 640)
342	341	(6280, 768)
343	342	(6280, 904)
344	343	(6408, 128)
345	344	(6408, 256)
346	345	(6408, 384)
347	346	(6408, 512)
348	347	(6408, 640)
349	348	(6408, 768)
350	349	(6408, 904)
351	350	(6536, 128)
352	351	(6536, 256)
353	352	(6536, 384)
354	353	(6536, 512)
355	354	(6536, 640)
356	355	(6536, 768)
357	356	(6536, 904)
358	357	(6664, 128)
359	358	(6664,

Find the section with Data Sets and download the similarities, for example “clustering two-dimensional data points”

median of the other similarities. The MATLAB code executes 100 iterations of affinity propagation. After execution, the combined evidence $r(i,k) + a(i,k)$ is stored in the $N \times N$ matrix Ξ , the number of exemplars is stored in κ , the data instance indices of the exemplars are stored in the K -vector \mathbf{z} , and the exemplar indices of the data instances are stored in the N -vector idx . (Note, instance i is assigned to the data instance with index $\text{idx}(i)$.)

Data Sets

CLUSTERING TWO-DIMENSIONAL DATA POINTS

The similarity between every pair of 2D data points was set to the negative squared distance between the points. To prevent degenerate solutions, where affinity propagation tries to place two points in one cluster, but both data points are equally good as cluster centers, Gaussian noise with $\sigma=10^{-12}$ was added to the similarities, before affinity propagation was applied.

- [Text files containing 2-D data points, similarities, and preferences \(median of S\)](#)
- [MATLAB file containing data, similarities and preferences](#)

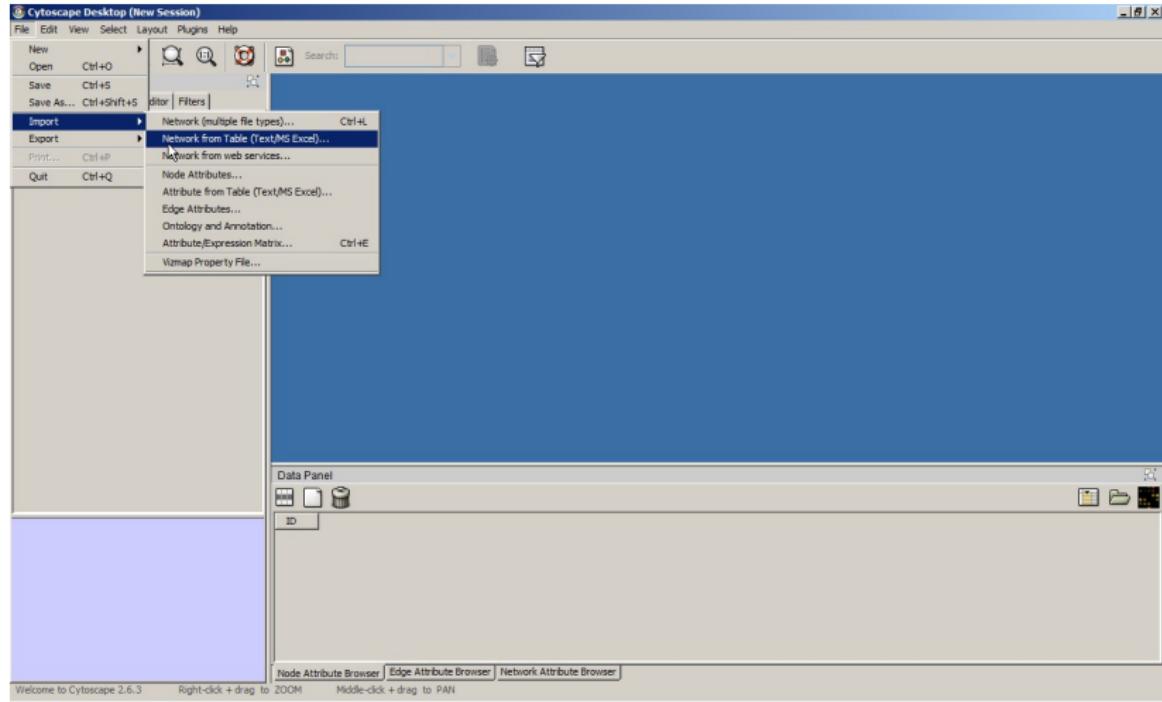
CLUSTERING IMAGES DERIVED FROM OLIVETTI FACE DATABASE

Each 64×64 face image from the first 100 images in the Olivetti database was smoothed using a Gaussian kernel with $\sigma=0.5$ and then rotated by -10° , 0° and 10° and scaled by a factor of 0.9, 1.0 and 1.1 (using nearest-neighbor interpolation), to produce a total of 900 images. To avoid including the background behind each face, a central window of size 50×50 pixels was extracted. Finally, the pixels in each 50×50 image were normalized to have mean 0 and variance 0.1. The similarity between two images was set to the negative sum of squared pixel differences.

- [Image showing all the data instances](#)
- [Text files containing similarities \(5MB\) and preferences](#)
- [MATLAB file containing similarities based on squared error \(19MB\)](#)

FINDING GENES AND EXONS USING PUTATIVE EXON EXPRESSION DATA

Run Cytoscape with the "APCluster" in the plugins directory and open the interface for importing a network



Choose the "ToyProblemSimilarities.txt" network

The screenshot shows the Cytoscape Desktop interface with a "New Session" window open. The main menu bar includes File, Edit, View, Select, Layout, Plugins, and Help. A toolbar with various icons is visible above the dialog. The central dialog is titled "Import Network and Edge Attributes from Table" and "Import Network from Table". It has sections for "Data Sources", "Interaction Definition", "Advanced", and "Preview". The "Input File" field contains the path "file:///C:/Users/misek/Desktop/ToyProblemSimilarities.txt". In the "Interaction Definition" section, "Source Interaction" is set to "Select Source node col...", "Interaction Type" is "Default Interaction", and "Target interaction" is "Select Target node col...". A warning message states: "Columns in BLUE will be loaded as EDGE ATTRIBUTES." The "Preview" section shows a table with columns labeled "Column 1", "Column 2", "Column 3", "Column 4", and "Column 5". The data in the preview table is as follows:

Column 1	Column 2	Column 3	Column 4	Column 5
001		002		-1.860905
001		003		-4.065932
001		004		-9.292907
001		005		-3.581147
001		006		-3.093119
001		007		-27.966812
001		008		-32.147129
001		009		-44.921228
001		010		-47.966678

At the bottom of the dialog are "Import" and "Cancel" buttons. The status bar at the bottom of the Cytoscape window displays "Welcome to Cytoscape 2.6.3", "Right-click + drag to ZOOM", "Middle-click + drag to PAN", and navigation icons.

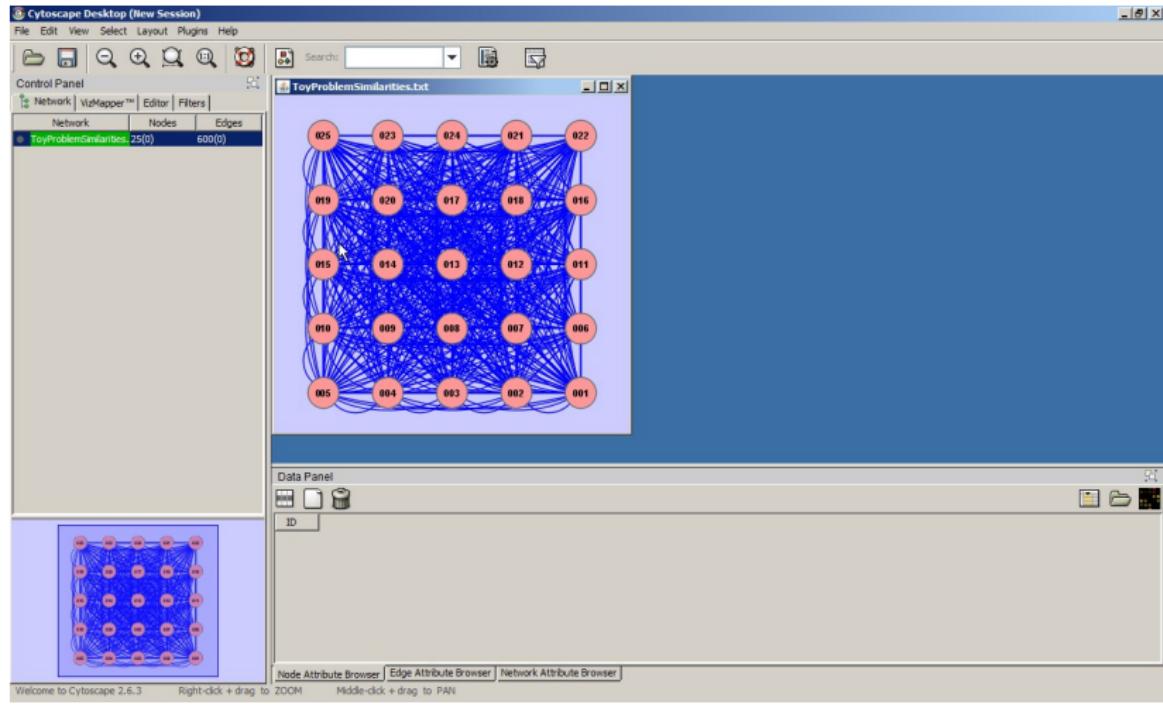
Select appropriate columns as in the picture below and import data

The screenshot shows the Cytoscape desktop interface with a specific dialog box open. The dialog is titled "Import Network and Edge Attributes from Table". It contains several sections: "Data Sources" (Input File: file:///C:/Users/misei/Desktop/ToyProblemSimilarities.txt), "Interaction Definition" (Source Interaction: Column 1, Interaction Type: Column 5, Target Interaction: Column 3), and an "Advanced" section with a checkbox for "Show Text File Import Options". Below these is a "Preview" section for a "Text File" named "ToyProblemSimilarities.txt". The preview shows a grid of data with columns labeled "Column 1" through "Column 5". The first column is highlighted in pink, while the third column is highlighted in blue. The other columns are grey. A red warning message at the top of the preview area says "Left Click: Enable/Disable Column, Right Click: Edit Column". The preview grid contains the following data:

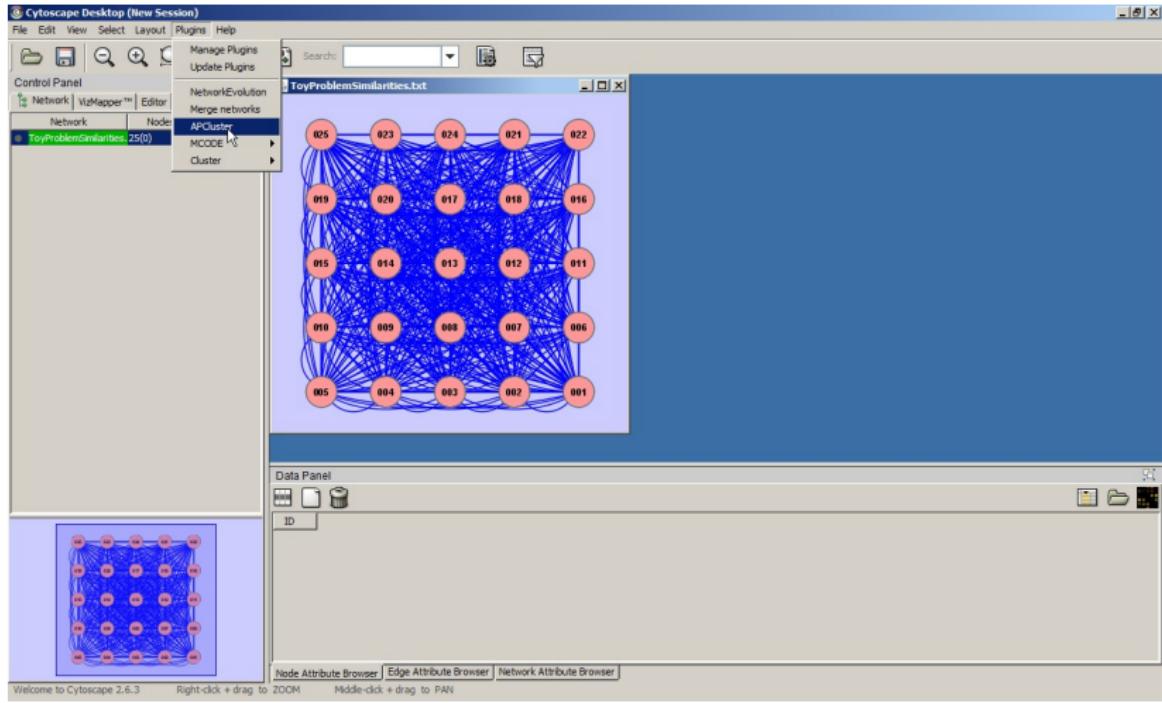
Column 1	Column 2	Column 3	Column 4	Column 5
001		002		-1.860905
001		003		-4.065932
001		004		-9.292907
001		005		-3.581147
001		006		-3.093119
001		007		-27.966812
001		008		-32.147129
001		009		-44.921228
001		010		-47.966678

At the bottom of the dialog are "Import" and "Cancel" buttons.

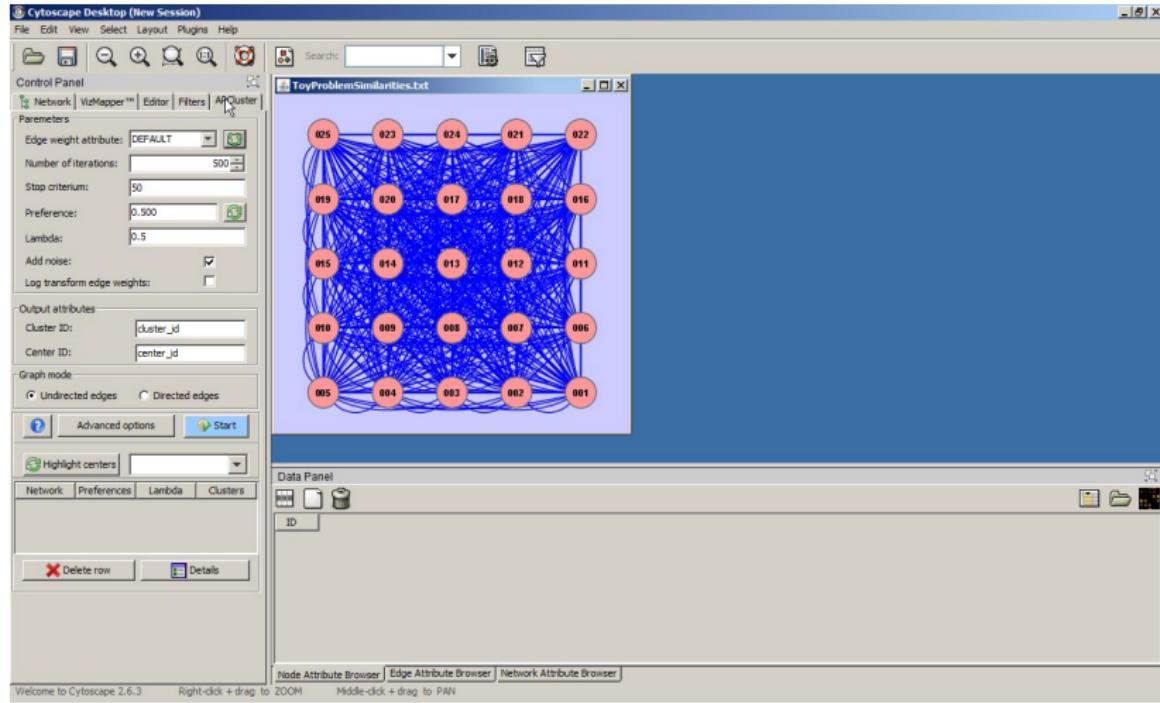
The network that you should obtain



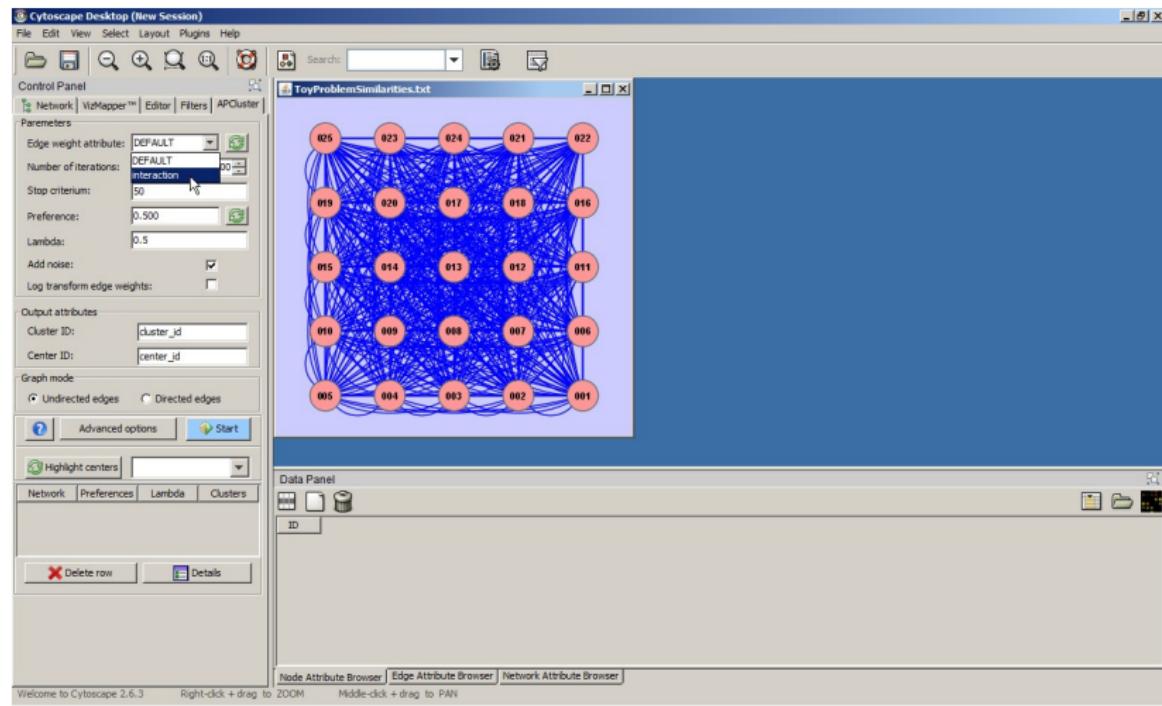
Activate the "APCluster" plugin from the "plugins" menu



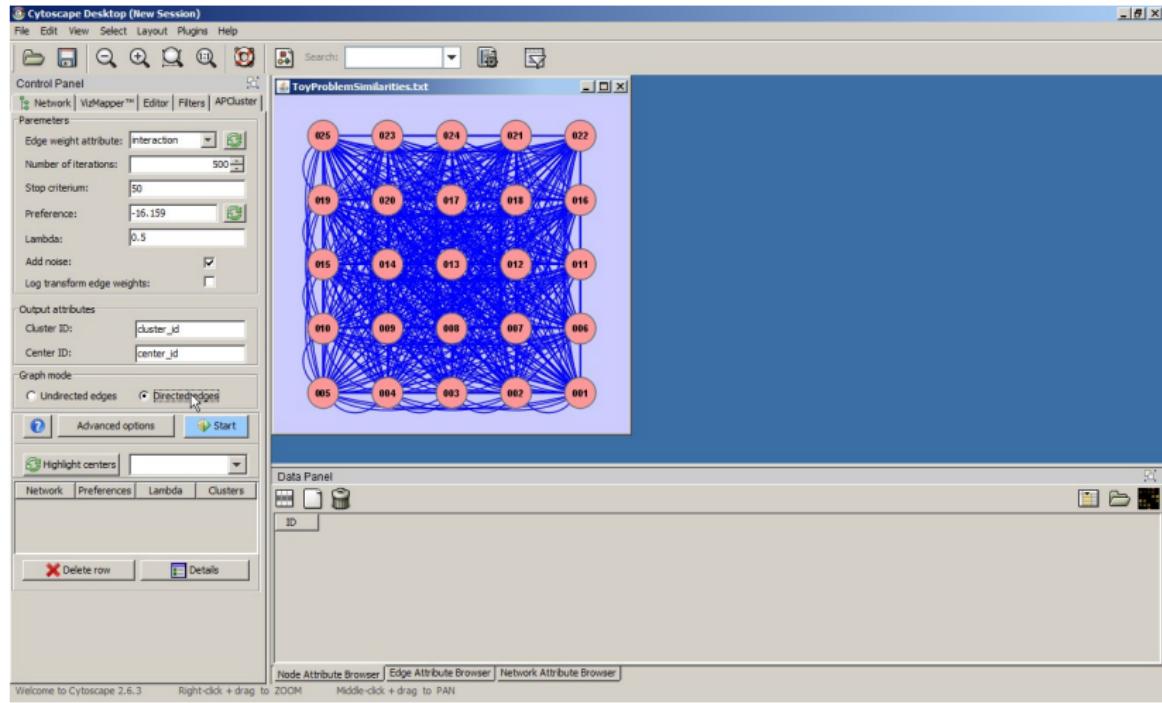
Go to the "APCluster" plugin tab



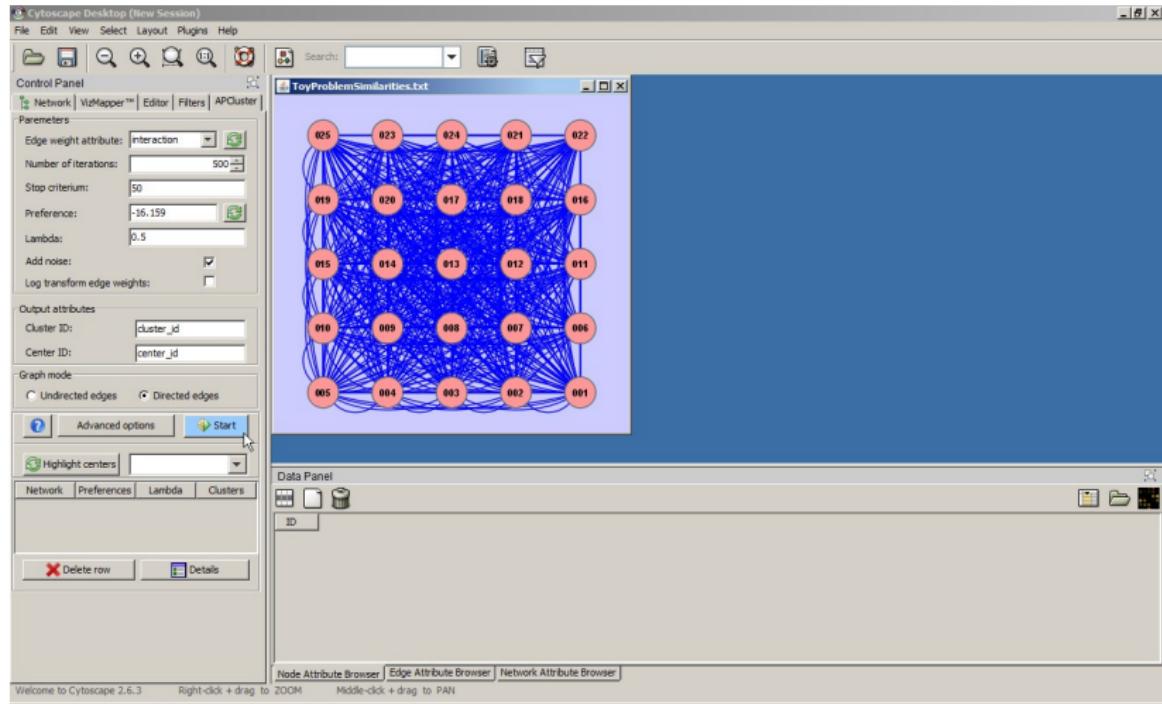
Reload the list of appropriate attributes, and select "interaction"



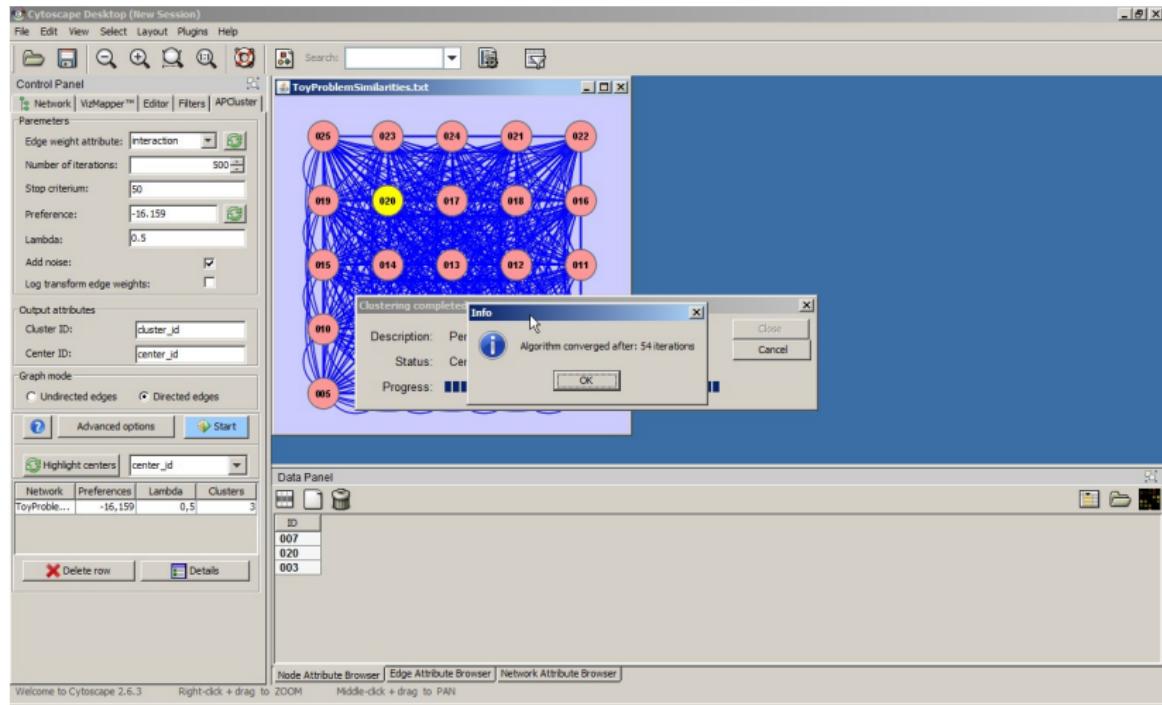
Choose the "Directed edges" option



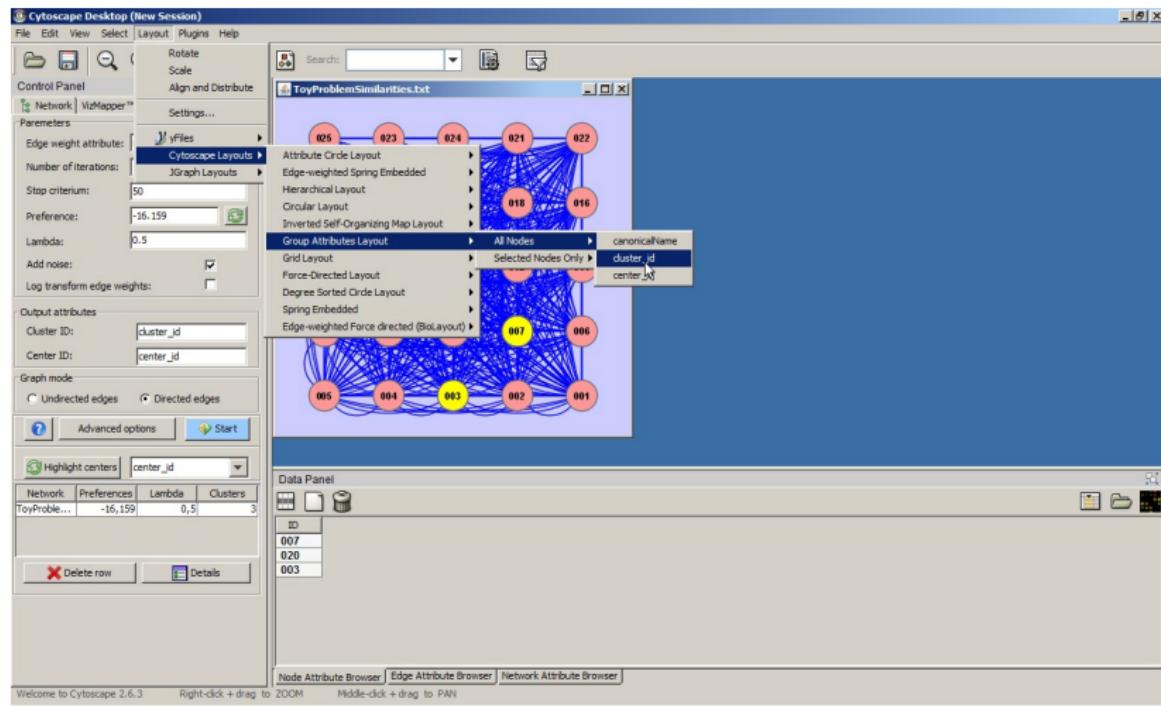
Click "Start" button to run the algorithm



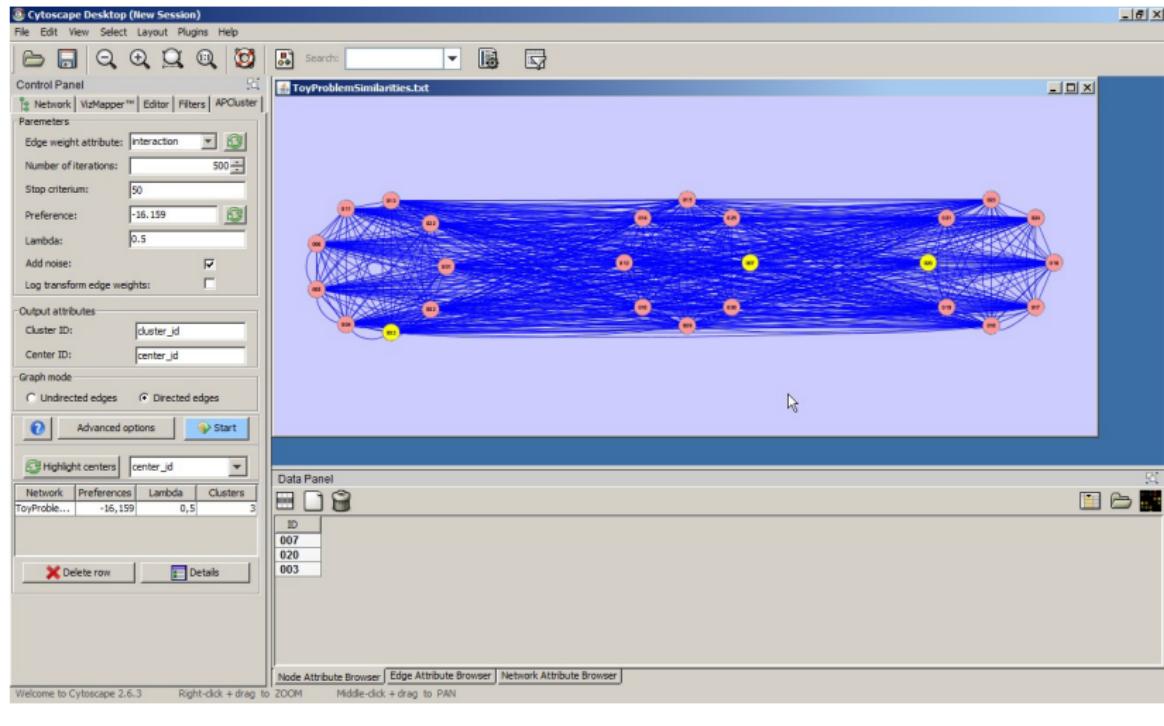
The algorithm will converge.



Choose layout "Group Attributes Layout" and select "cluster_id" as the attribute



You should obtain this layout



Show "cluster_id" and "center_id" attributes in Data panel

Cytoscape Desktop (New Session)

File Edit View Select Layout Plugins Help

Control Panel

Network VizMapper™ Editor Filters APCluster

Parameters

Edge weight attribute: interaction

Number of iterations: 500

Stop criterium: 50

Preference: -16.159

Lambda: 0.5

Add noise:

Log transform edge weights:

Output attributes

Cluster ID: cluster_id

Center ID: center_id

Graph mode

Undirected edges Directed edges

Advanced options Start

Highlight centers center_id

Network Preferences Lambda Clusters

ToyProble... -16.159 0.5 3

Delete row Details

Welcome to Cytoscape 2.6.3 Right-click + drag to ZOOM Middle-click + drag to PAN

canonicalName

center_id

cluster_id

01
01
00
01
00
01
02
00
01
00
01
02
Not

Data Panel

Browser

The screenshot shows the Cytoscape desktop interface. On the left, the 'Control Panel' contains parameters for an 'APCluster' analysis: Edge weight attribute set to 'interaction', Number of iterations at 500, Stop criterium at 50, Preference at -16.159, Lambda at 0.5, and 'Add noise' checked. Below these are 'Output attributes' for 'Cluster ID' and 'Center ID'. Under 'Graph mode', 'Directed edges' is selected. The main window displays a dense network graph with many red edges connecting yellow circular nodes. The bottom section, 'Data Panel', lists attributes for the nodes: 'canonicalName', 'center_id' (which is checked), and 'cluster_id'. The 'center_id' row has three entries: '01', '01', and '00'. The 'cluster_id' row also has three entries: '01', '00', and '01'. The 'Data Panel' also includes a 'Browser' tab.

Select all nodes and choose the option "Export → Entire Table" in Data panel

The screenshot shows the Cytoscape Desktop interface with a network graph titled "ToyProblemSimilarities.txt". The graph consists of green circular nodes connected by numerous red edges, forming several clusters. The Control Panel on the left contains parameters for "Edge weight attribute" (interaction), "Number of iterations" (500), "Stop criterium" (50), "Preference" (-16.159), "Lambda" (0.5), and checkboxes for "Add noise" and "Log transform edge weights". The Output attributes section includes fields for "Cluster ID" (cluster_id) and "Center ID" (center_id). The Graph mode is set to "Directed edges". The Data Panel at the bottom displays a table with columns: ID, center_id, and cluster_id. The table rows are:

ID	center_id	cluster_id
001	003	0
002	003	0
003	0	Select from table
004	0	Copy
005	0	Select All
006	0	Export...
007	0	Selected Cells
008	0	Entire Table
009	0	Search 003 on the web

The status bar at the bottom indicates "Welcome to Cytoscape 2.6.3" and provides keyboard shortcuts for ZOOM and PAN.

Save your clustering in text format

```
clustering.txt
1 ID center_id cluster_id
2 013 003 0
3 012 007 1
4 008 007 1
5 011 003 0
6 022 003 0
7 003 003 0
8 009 007 1
9 025 007 1
10 007 007 1
11 021 020 2
12 005 003 0
13 018 020 2
14 024 020 2
15 014 007 1
16 019 007 1
17 004 003 0
18 020 020 2
19 010 007 1
20 016 020 2
21 023 020 2
22 019 020 2
23 001 003 0
24 017 020 2
25 002 003 0
26 006 003 0
27
```

