



소셜 네트워크 분석

김 기훈

SNS (= online social network)
≠ SNA



1979년

The Community Question: The Intimate Networks of East Yorkers¹

Barry Wellman
University of Toronto and the Netherlands Institute for Advanced Study

The Community Question has set the agenda for much of sociology. It is the question of how large-scale social systemic divisions of labor affect the organization and content of primary ties. Network analysis is proposed as a useful approach to the Community Question, because, by focusing on linkages, it avoids the a priori confinement of analysis to solidary groupings and territorial units. Three contentions about the Question are evaluated: arguments that Community is Lost, Saved, or Liberated. Data are presented about the structure and use of the "intimate" networks of 845 adult residents of East York, Toronto. Intimate networks are found to be prevalent, composed of both kin and nonkin, nonlocal, asymmetric, and of sparse density. Help in dealing with both emergencies and everyday matters is available from almost all intimate networks, but from only a minority of intimate ties. The data provide broad support for the Liberated argument, in conjunction with some portions of the Saved argument.

COMMUNITY AS NETWORK

The Community Question has set the agenda for much of sociology. It is the question of how large-scale social systemic divisions of labor affect the organization and content of primary ties. The Question thus has formed a crucial sociological nexus between macroscopic and microscopic analysis. It has posed the problem of the structural integration of a social system and the interpersonal means by which its members have access to scarce resources.

In considering the Community Question, sociologists have been especially This paper has been revised a number of times, and I am grateful to the following people who have commented extensively on some form of it: S. D. Berkowitz, Y. Michal Bodemann, L. S. Bourne, Ronald Burt, Bonnie Erickson, Linton Freeman, Harriet Friedmann, Joseph Galambos, Leslie Howard, Nancy Hirsch, Edward Lee, Barry Lightfoot, J. Clyde Mitchell, Livianna Montecchi, Walter Phillips, Chris Pickvance, Norman Shalansky, Charles Tilly, Jack Wayne, Beverly Wellman, Harriet White, and anonymous *AJS* referees. The following agencies have supported portions of the research: Canada Council, Canada Ministry of Manpower and Immigration, Clarke Institute of Psychiatry, Ladlaw Foundation, Netherlands Institute for Advanced Study, Ontario Ministry of Health, Social Science and Humanities Research Council of Canada, and Urban Housing Markets Program (Centre for Urban and Community Studies, University of Toronto).

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AJS Volume 84 Number 5 1201

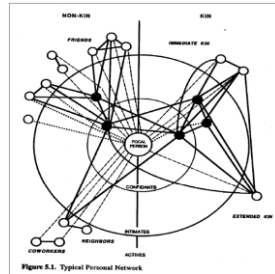
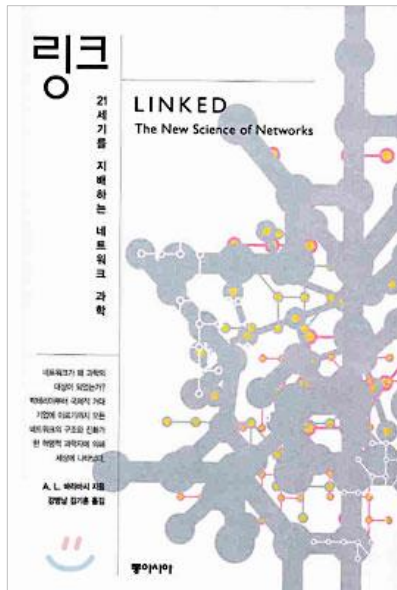
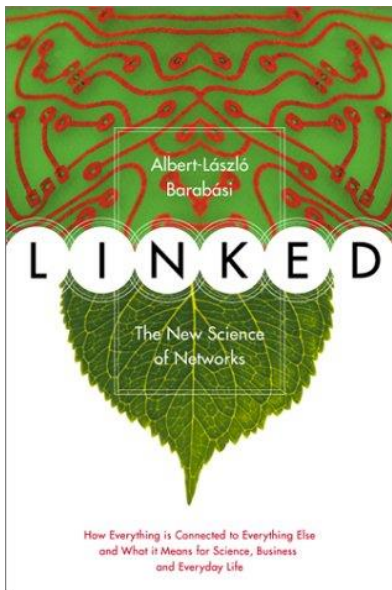
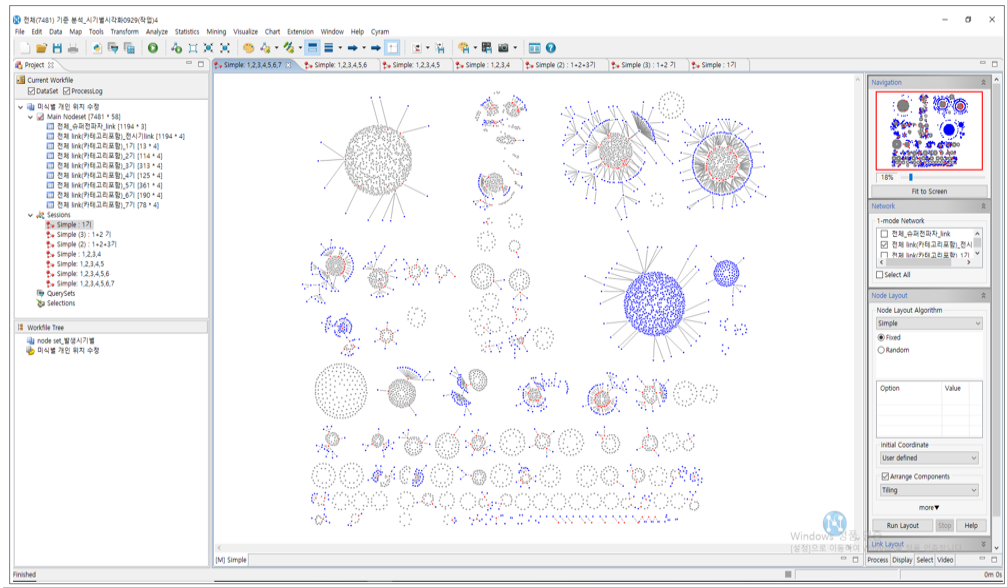


Figure 5.1. Typical Personal Network

2002년



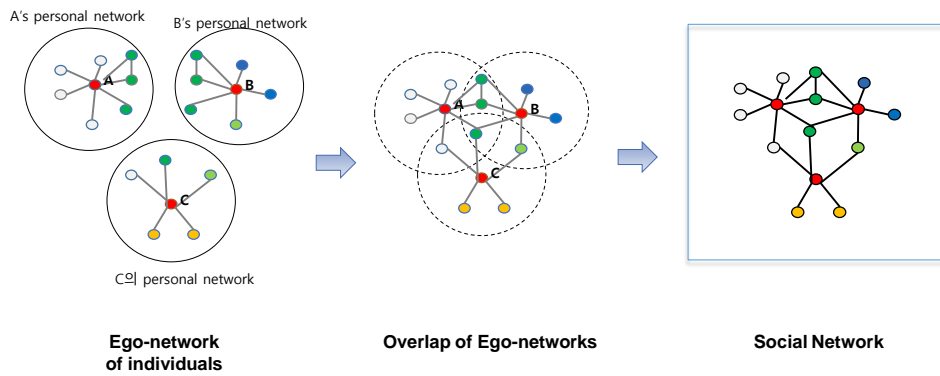
코로나19 전염 네트워크

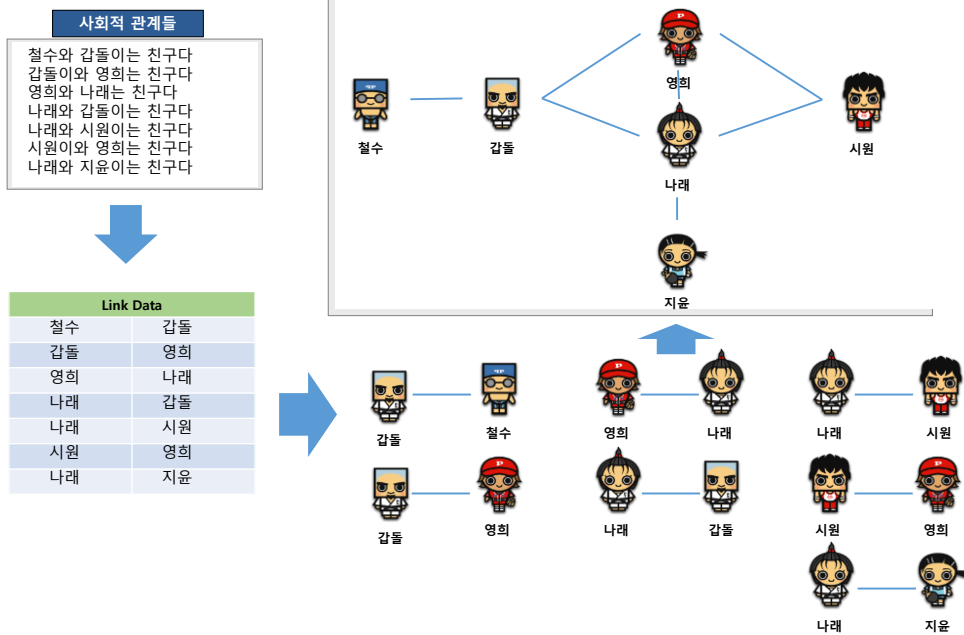


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사이람





Social Network Analysis

Social network analysis is an interdisciplinary behavioral science specialty.

It is grounded in the observation that social actors are interdependent and that the links among them have important consequences for every individual.

For example, links among actors permit the flow of material goods, information, affect, power, influence, social support, and social control. They provide individuals with opportunities and, at the same time, potential constraints on their behavior.

Social network analysis involves theorizing, model building and empirical research focused on uncovering the patterning of links among actors. It is concerned also with uncovering the antecedents and consequences of recurrent patterns.

Linton C. Freeman

소셜 네트워크 분석

소셜 네트워크 분석은 학제적 행동과학의 한 분야다.

그것은 사회적 행위자가 상호의존적이며, 그들 간의 링크들이 모든 개인에게 중대한 영향을 미친다는 관찰에 근거하고 있다.

예컨대, 행위자들 간의 링크는 물질적 재화, 정보, 감정, 권력, 영향력, 사회적 지원, 사회적 통제 등의 흐름을 여닫는다.

링크는 개인에게 기회를 주는 동시에 그들의 행동에 잠재적 제약을 가한다.

소셜 네트워크 분석은 행위자들 간의 링크들의 패턴(형성)을 드러내는 데에 초점을 둔 이론화, 모델 구성, 그리고 경험적 연구를 포괄한다.

그것은 반복적 링크 패턴의 선행 요인과 후속 결과를 드러내는 것을 포함한다.

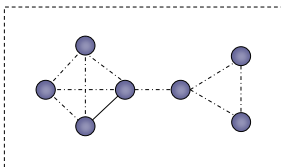
Linton C. Freeman

the "Social"

Max Weber
(1864-1920)



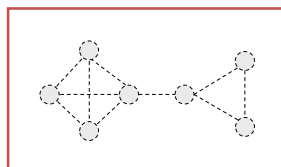
Social Action



Emile Durkheim
(1858-1917)



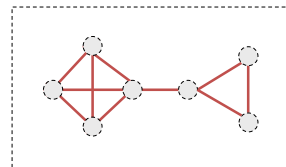
Social Fact

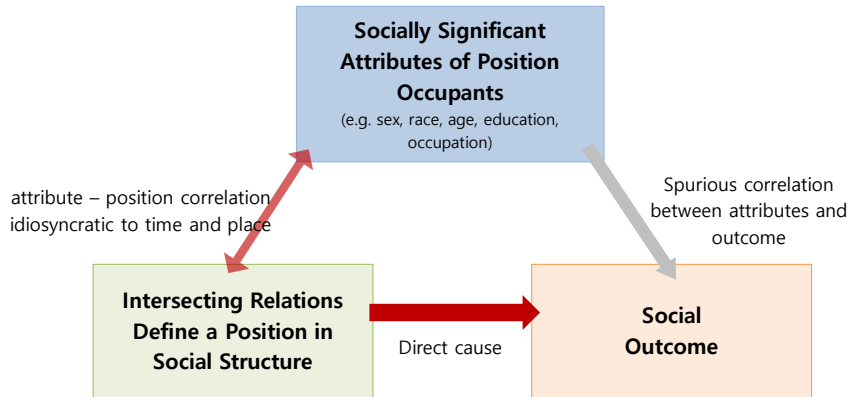


Georg Simmel
(1858-1918)



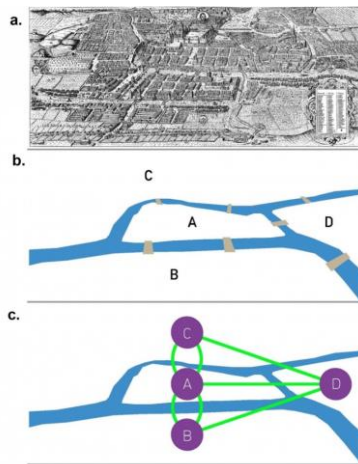
Sociation





Source : Ronald S. Burt. (1991). STRUCTURE : Reference Manual. Columbia University.

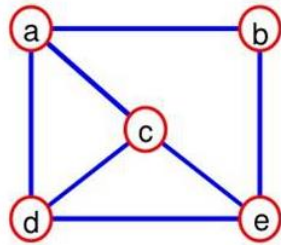
Graph Theory



사물과 그들 간의 관계에 대한 Abstraction(抽象化)

$$G = (V, E)$$

- A graph $G = (V, E)$ is composed of:
 - V : set of **vertices**
 - E : set of **edges** connecting the **vertices** in V
- An **edge** $e = (u, v)$ is a pair of **vertices**
- Example:



$V = \{a, b, c, d, e\}$
 $E = \{(a, b), (a, c), (a, d), (b, e), (c, d), (c, e), (d, e)\}$

Graph 는 한 쌍의 집합!
(a pair of sets)

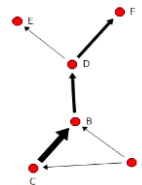
네트워크 데이터 = 노드 테이블 + 링크 테이블

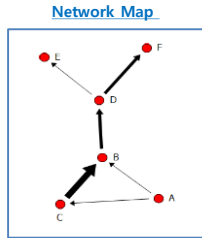
Node Table

	성별	연령	부서	직위
A	Male	28	Marketing	Manager
B	Female	35	Accounting	Team Member
C	Male	42	Marketing	Team Member
D	Male	33	Finance	Team Member
E	Female	25	Finance	Manager
F	Male	30	Marketing	Team Member

Link Table

개체	개체	강도	시간	맥락
A	B	1	10:00	Borrow
C	B	3	14:00	Borrow
A	C	1	10:00	Meeting
B	D	2	15:00	Borrow
D	E	1	14:00	Love
D	F	2	14:00	Love





Matrix

	A	B	C	D	E	F
A	0	1	1	0	0	0
B	0	0	0	2	0	0
C	0	3	0	0	0	0
D	0	0	0	0	1	2
E	0	0	0	0	0	0
F	0	0	0	0	0	0

Edge List

Source	Target	Weight
A	B	1
C	B	3
A	C	1
B	D	2
D	E	1
D	F	2

Matrix

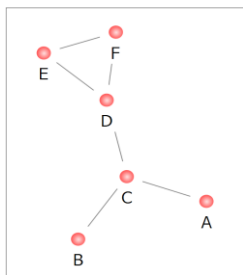
- 네트워크 분석의 기초 형식임
- 데이터가 많은 경우에는 Matrix 형식으로 데이터를 구성하기 어려움

Edge List

- 대부분의 네트워크 데이터가 Edge List 형태로 수집되므로 별도의 데이터 가공 과정이 필요 없어 데이터 입력이 쉬움

Matrix Representation of Graphs

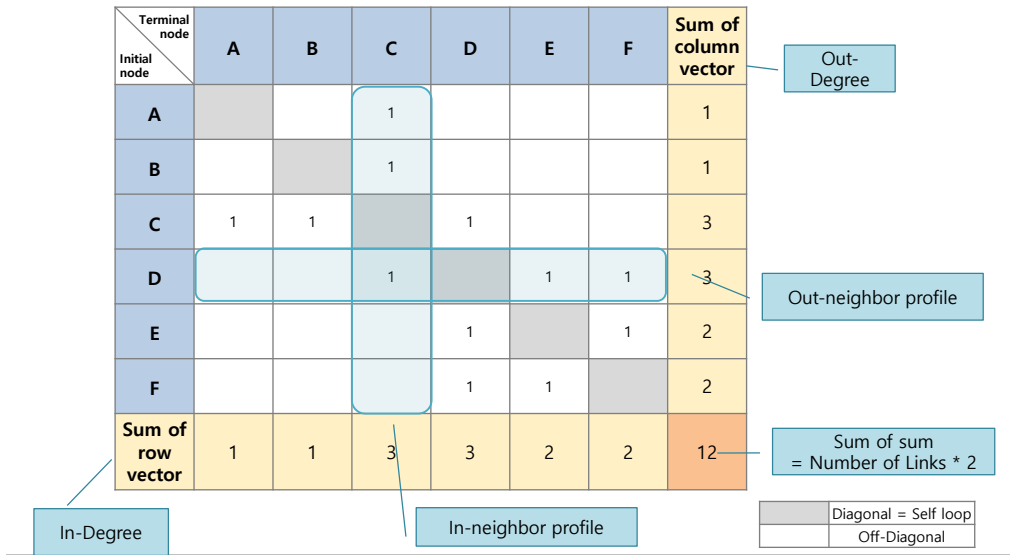
Graph



Adjacency Matrix

	A	B	C	D	E	F
A			1			
B			1			
C	1	1		1		
D			1		1	1
E				1		1
F				1	1	

Adjacency Matrix

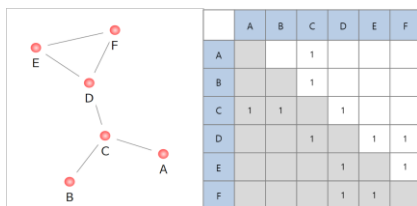


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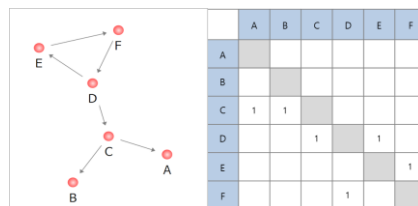
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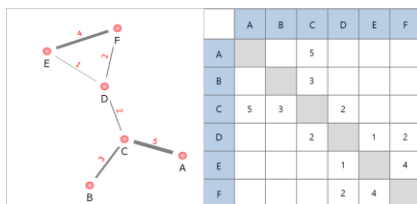
Simple Graph



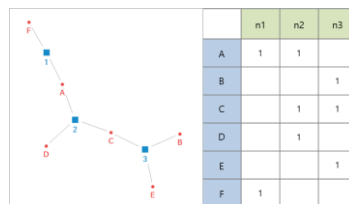
Directed Graph



Weighted Graph



Bipartite Graph



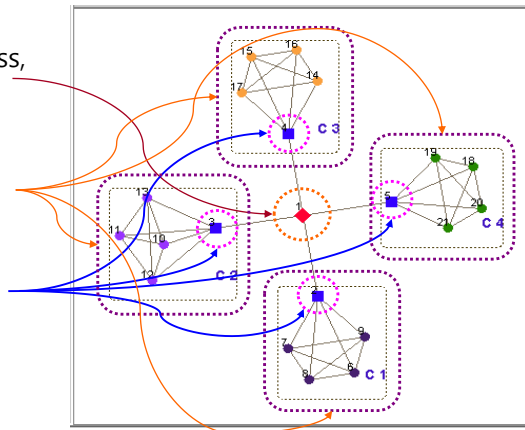
다음 자료를 보고 각 질문(1~3)에 가장 적합한 사람을 1명씩 찾아 주십시오.

누가	누구와 만다
배두나	서태지
차태현	서태지
장나라	채림
배용준	김민종
김민종	채림
김민종	장나라
차태현	배두나
배용준	차태현

1. 채림, 김민종과 함께 응집된 그룹을 이루고 있는 사람은?
2. 다른 사람들을 연결하는 길목에 가장 많이 등장하는 사람은?
3. 차태현과 네트워크 내의 위치가 가장 비슷한 사람은?

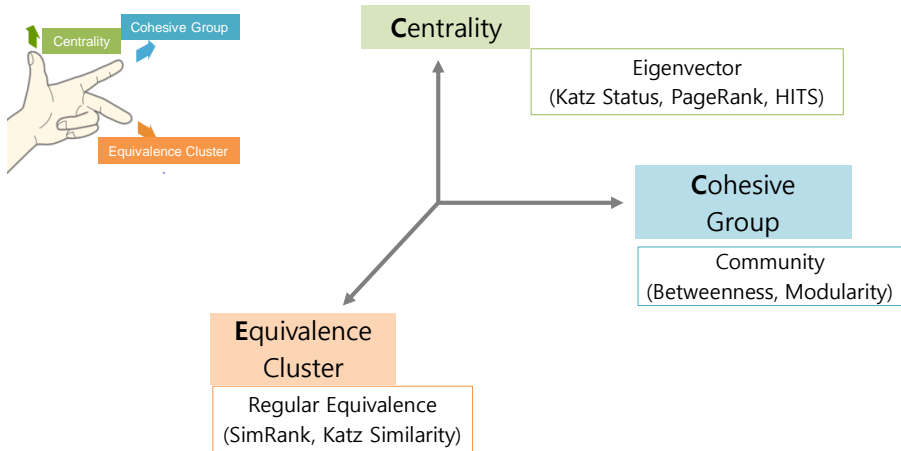
SNA measures

1. **Centrality (중심도)**
Degree, Closeness, Betweenness, Eigenvector...
2. **Cohesive Subgroup (하위집단)**
Component, Clique ...
3. **Equivalent Role-set (역할 집합)**
Structural, Role, Regular...



SNA Measures

Measure positions in social structure defined by intersecting relations



Centrality: Eigenvector Centrality

$$C(i) = \frac{1}{\lambda} \sum_j A_{ij} \times C(j)$$

Iteration 1 Normalized Value = 7.21

1	2	3	4	5	6	7	8			
1	0	1	1	0	0	0	0	1	1	0.277
2	1	0	1	0	0	0	1	1	3	0.416
3	1	0	0	1	0	0	1	1	3	0.416
4	1	1	0	0	1	0	1	1	2	0.277
5	0	0	0	0	1	0	1	1	2	0.277
6	0	0	0	1	0	1	0	1	3	0.416
7	0	1	1	0	1	0	0	1	3	0.416
8	0	1	0	1	0	0	0	1	2	0.277

Iteration 2 Normalized Value = 2.63

1	2	3	4	5	6	7	8			
1	0	1	1	0	0	0	0	0.277	0.832	0.298
2	1	0	1	0	0	0	1	0.416	0.971	0.855
3	1	0	0	1	0	0	1	0.416	1.109	0.974
4	1	1	0	0	1	0	1	0.416	1.248	1.192
5	0	0	0	0	1	0	1	0.277	0.555	0.457
6	0	0	0	1	0	1	0	0.277	0.693	0.457
7	0	1	1	0	1	0	0	0.416	1.109	0.636
8	0	1	0	1	0	0	0	0.277	0.693	0.596

Iteration 3 Normalized Value = 2.65

1	2	3	4	5	6	7	8			
1	0	1	1	0	0	0	0	0.316	1	0.321
2	1	0	1	0	0	0	1	0.369	2	0.366
3	1	0	0	1	0	0	1	0.422	3	0.366
4	1	1	0	0	1	0	1	0.474	4	0.449
5	0	0	0	0	1	0	1	0.211	5	0.486
6	0	0	0	1	0	1	0	0.204	6	0.486
7	0	1	1	0	1	0	0	0.422	7	0.434
8	0	1	0	1	0	0	0	0.264	8	0.224

Iteration 4 Normalized Value = 2.66

1	2	3	4	5	6	7	8			
1	0	1	1	0	0	0	0	0.298	0.855	0.306
2	1	0	1	0	0	0	1	0.397	0.974	0.389
3	1	0	0	1	0	0	1	0.457	1.192	0.467
4	1	1	0	0	1	0	1	0.457	1.292	0.489
5	0	0	0	0	1	0	1	0.198	0.457	0.174
6	0	0	0	1	0	1	0	0.238	0.636	0.228
7	0	1	1	0	1	0	0	0.437	1.153	0.441
8	0	1	0	1	0	0	0	0.219	0.596	0.202

Iteration 5 Normalized Value = 2.66

1	2	3	4	5	6	7	8			
1	0	1	1	0	0	0	0	0.321	1	0.815
2	1	0	1	0	0	0	1	0.366	2	0.366
3	1	0	0	1	0	0	1	0.449	3	0.449
4	1	1	0	0	1	0	1	0.486	4	0.486
5	0	0	0	0	1	0	1	0.172	5	0.172
6	0	0	0	1	0	1	0	0.239	6	0.239
7	0	1	1	0	1	0	0	0.434	7	0.434
8	0	1	0	1	0	0	0	0.224	8	0.224

Vertex ID

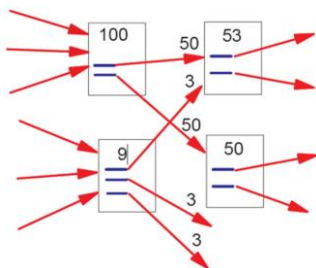
Eigenvector Centrality

Centrality: PageRank

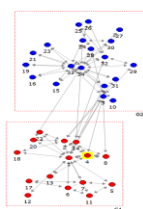
$$\text{PageRank of site} = \sum \frac{\text{PageRank of inbound link}}{\text{Number of links on that page}}$$

OR

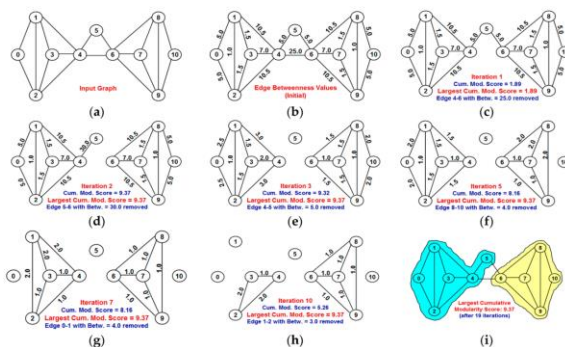
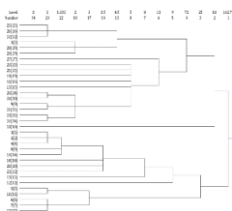
$$PR(u) = (1 - d) + d \times \sum \frac{PR(v)}{N(v)}$$



Community: Betweenness

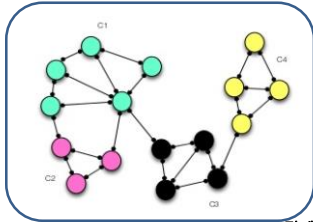


$$C(i) = \sum_{j < k} \frac{g_{jk}(i)}{g_{jk}}$$



Community: Modularity

$$Q = \sum_{s=1}^m \left[\frac{l_s}{|E|} - \left(\frac{d_s}{2|E|} \right)^2 \right]$$

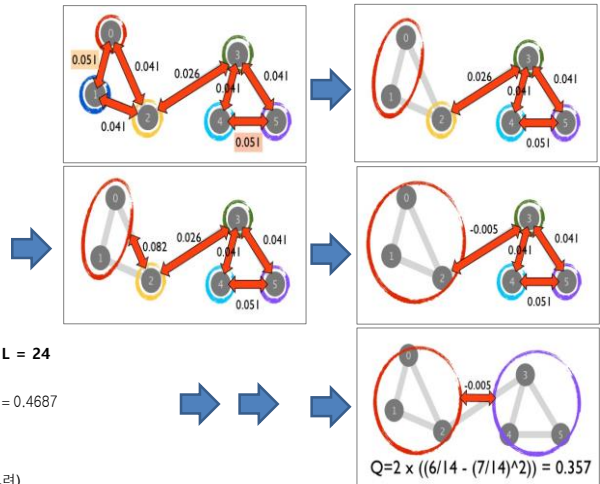


전체 edge수 L = 24

$$\frac{7}{24} - \left(\frac{2 \cdot 10}{2 \cdot 24} \right)^2 + \frac{3}{24} - \left(\frac{2 \cdot 5}{2 \cdot 24} \right)^2 + \frac{5}{24} - \left(\frac{2 \cdot 7}{2 \cdot 24} \right)^2 + \frac{5}{24} - \left(\frac{2 \cdot 6}{2 \cdot 24} \right)^2 = 0.4687$$

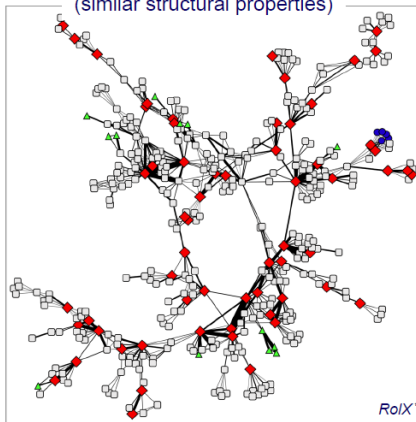
S=1그룹내에 edge수는 7개

S=1그룹에 속한 노드의 총 degree수는 20개 (in, out 모두 고려)



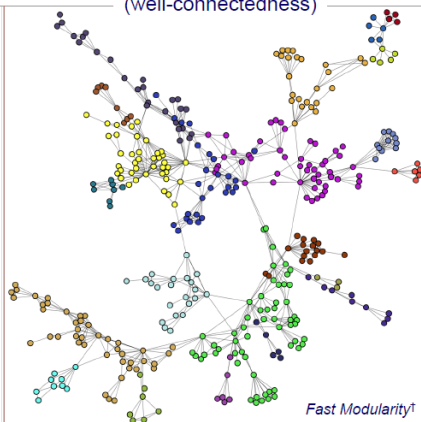
Roles

(similar structural properties)



Communities

(well-connectedness)



* Henderson, et al. 2012; † Clauset, et al. 2004

Network Styling & Video

The screenshot shows a network visualization software interface. On the left is a network graph with nodes of various colors and shapes connected by edges. On the right is a control panel with 'Record' and 'Edit' sections. Below the graph is a video player interface with a progress bar and a play button.

Record

- Record New
- Record Insert
- Record Stop

Edit

- Undo
- Redo
- Change Speed
- Dissolve
- Delete

Clustering 2D

Node Color Styling

- CEO (Red circle)
- Finance (Green circle)
- Marketing (Cyan circle)
- Production (Blue circle)

Node Size Styling

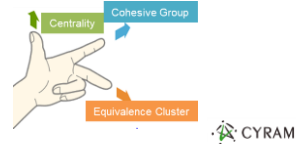
- Advice PageRank
- Centrality

Node Shape Styling

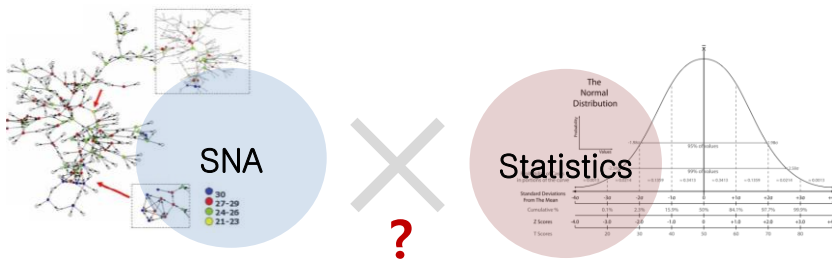
- CEO (Red star)
- Dept. Manager (Red star)
- Team Manager (Red star)
- Team Member Level 01 (Red circle)
- Team Member Level 02 (Red circle)

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SNA 와 통계 분석

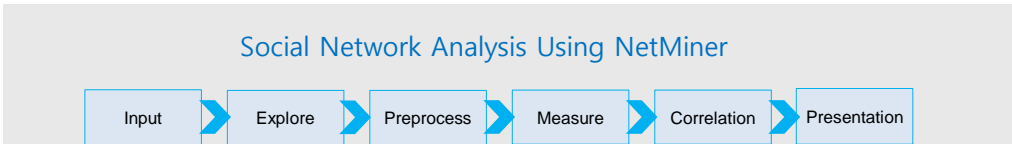
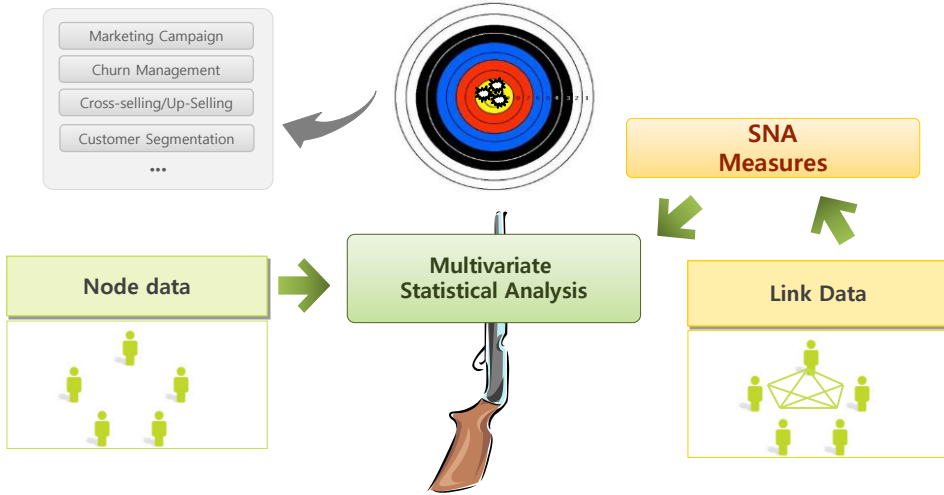


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사이람

SNA 와 통계 분석



Analysis of variation(ANOVA)

Will those who play an **important role in the advice relationship** have higher **positions**?

Dependent : **advice PageRank Centrality**
Independent : **Position**

ANOVA(Vector)

PERMUTATION TEST					
Observed	Expected(mean)	Std. Dev.	P (>= Obs.)	P (= Obs.)	P (<= Obs.)
19.861	1.035	0.987	0	0	1

- F-value : 19.861, P-value : 0.000
- The degree of playing important role in the advice relationship varies depending on positions.

Social Network Analysis Using NetMiner



Regression

The more people know about people's **personal issues**, and the older **age**, the greater the impact of their **advice**?

Dependent :
advice In-Degree Centrality
Independent :
Age, personal issue In-Degree Centrality



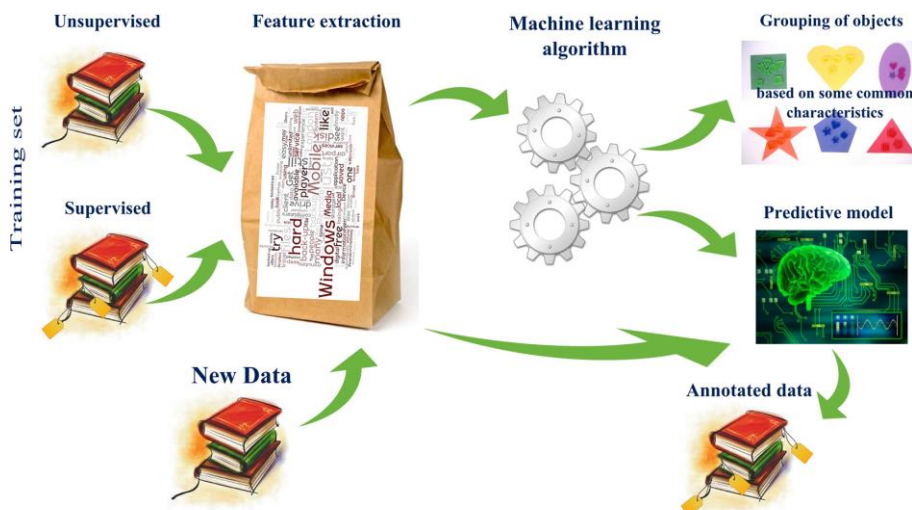
Regression(Vector)

ANALYSIS OF VARIANCE					
R-square	F-value	p (Normal)	P (>= Obs.)	P (= Obs.)	P (<= Obs.)
0.353	48.046	0	0	0	1

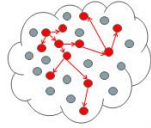
PARAMETER ESTIMATES (QAP)						
	Observed	Expected(mean)	Std. Dev.	P (>= Obs.)	P (= Obs.)	P (<= Obs.)
Age	0.412	-0	0.106	0	0	1
In-Degree Centrality_Talk About Personal Issue_With	0.397	0.001	0.109	0	0	1

- R-square : 0.353, P-value : 0.000
- People who know a lot of people's personal issues, and older age increases, the greater the influence of advice.
- Age has a greater influence.

Machine learning workflow



Graph Analytics



Compute graph metric(s)

Machine Learning

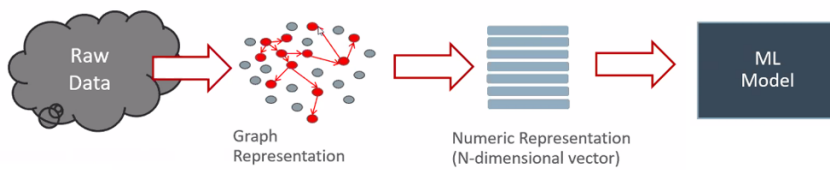


Build predictive model using graph metric

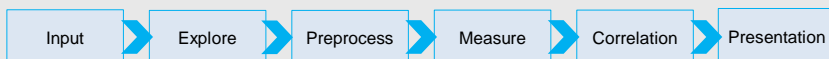
Explore graph or compute new metrics using ML result



Build model(s) and score or classify data



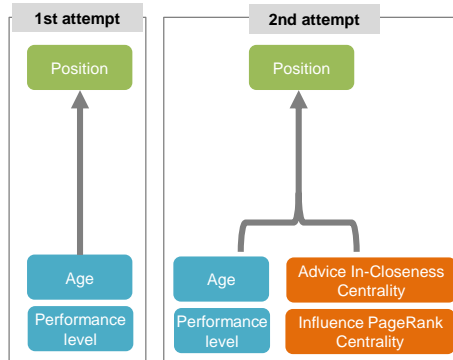
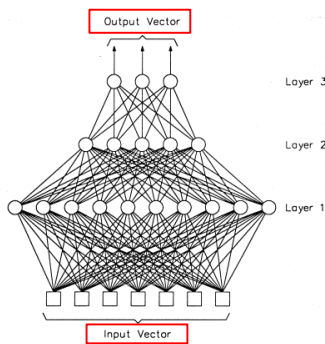
Social Network Analysis Using NetMiner



Multi-Layer Perceptron

What attributes define positions?

Multi-Layer Perceptron



Social Network Analysis Using NetMiner



Multi-Layer Perceptron

1st attempt

Label Vector : Position
Feature Vectors : Age, Performance Level

Test Accuracy	
Correctly Classified Instances	23(85.19%)

Training Accuracy	
Correctly Classified Instances	47(74.6%)

	Allocation	Original	Predicted	Revised	Matching	Probability
NM0027	Test	member Level 01	member Level 02	member Level 01	N	0.6349
NM0029	Test	member Level 02	member Level 02	member Level 02	Y	0.9395
NM0030	Test	member Level 02	member Level 02	member Level 02	Y	0.8078
NM0031	Training	member Level 02	member Level 02	member Level 02	Y	0.9573
NM0032	Training	team Manager	member Level 02	team Manager	N	0.483
NM0033	Training	member Level 02	member Level 02	member Level 02	Y	0.9361
NM0034	Training	member Level 02	member Level 02	member Level 02	Y	0.7829
NM0035	Training	member Level 02	member Level 02	member Level 02	Y	0.8915
NM0036	Training	team Manager	member Level 02	team Manager	N	0.3872
NM0037	Training	member Level 02	member Level 02	member Level 02	Y	0.9224
NM0038	Training	member Level 02	member Level 02	member Level 02	Y	0.463
NM0039	Training	member Level 02	member Level 02	member Level 02	Y	0.9336
NM0040	Training	team Manager	member Level 02	team Manager	N	0.3524
NM0041	Training	member Level 02	member Level 02	member Level 02	Y	0.9063
NM0042	Test	member Level 02	member Level 02	member Level 02	Y	0.9194
NM0043	Training	team Manager	member Level 02	team Manager	N	0.4317

Social Network Analysis Using NetMiner



Multi-Layer Perceptron

2nd attempt

Label Vector : Position
Feature Vectors : Age, Performance Level, Advice In-Closeness Centrality, Influence PageRank Centrality

Test Accuracy	
Correctly Classified Instances	24(88.89%)

Training Accuracy	
Correctly Classified Instances	53(84.13%)

	Allocation	Original	Predicted	Revised	Matching	Probability
NM0027	Test	member Level 01	member Level 02	member Level 01	N	0.4521
NM0029	Test	member Level 02	member Level 02	member Level 02	Y	0.9704
NM0030	Test	member Level 02	member Level 02	member Level 02	Y	0.932
NM0031	Training	member Level 02	member Level 02	member Level 02	Y	0.8735
NM0032	Training	team Manager	member Level 02	team Manager	N	0.8104
NM0033	Training	member Level 02	member Level 02	member Level 02	Y	0.9673
NM0034	Training	member Level 02	member Level 02	member Level 02	Y	0.9263
NM0035	Training	member Level 02	member Level 02	member Level 02	Y	0.9536
NM0036	Training	team Manager	team Manager	team Manager	Y	0.3975
NM0037	Training	member Level 02	member Level 02	member Level 02	Y	0.9638
NM0038	Training	member Level 02	member Level 02	member Level 02	Y	0.8476
NM0039	Training	member Level 02	member Level 02	member Level 02	Y	0.984
NM0040	Training	team Manager	team Manager	team Manager	Y	0.4983
NM0041	Training	member Level 02	member Level 02	member Level 02	Y	0.9539
NM0042	Test	member Level 02	member Level 02	member Level 02	Y	0.9801
NM0043	Training	team Manager	team Manager	team Manager	Y	0.4227

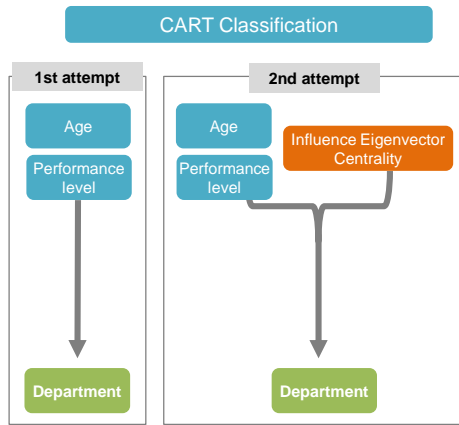
Accuracy rose, more likely to predict position.

Social Network Analysis Using NetMiner



CART Classification

What attributes define Department?



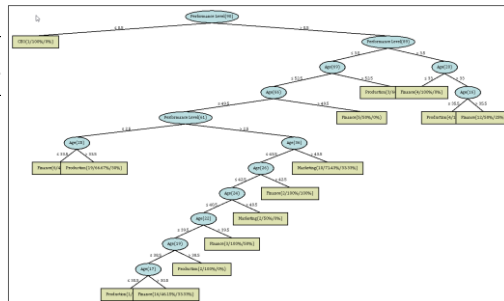
Social Network Analysis Using NetMiner



CART Classification

1st attempt	Test Accuracy
Age	Correctly Classified Instances 10(37.04%)
Performance level	Training Accuracy
Department	Correctly Classified Instances 40(63.49%)

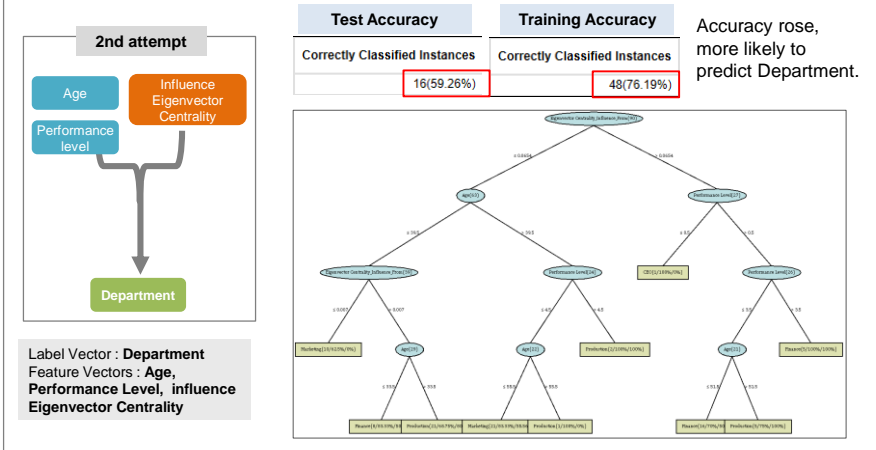
Label Vector : Department
Feature Vectors : Age,
Performance Level



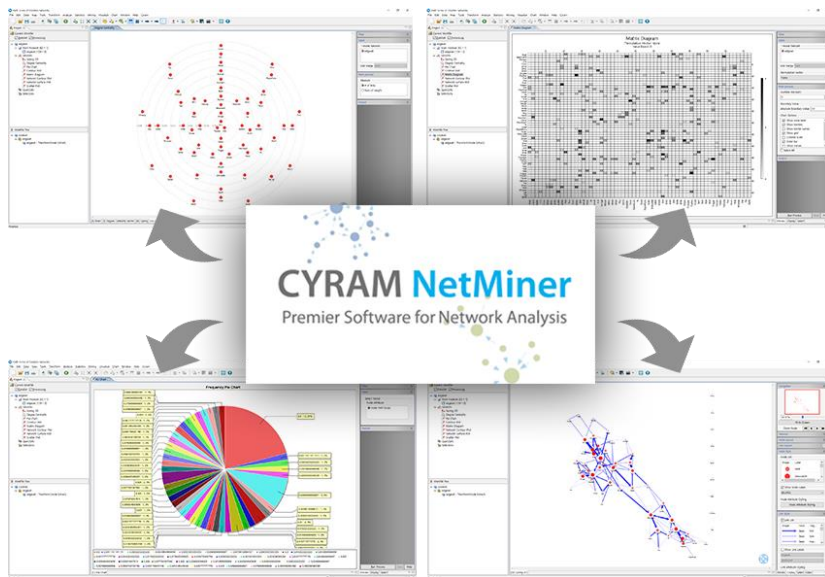
Social Network Analysis Using NetMiner



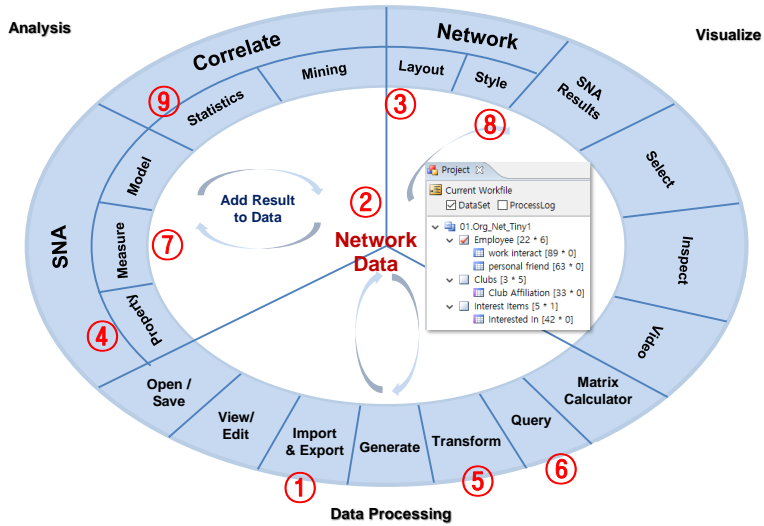
CART Classification



II.2 Short Tour of SNA with NetMiner



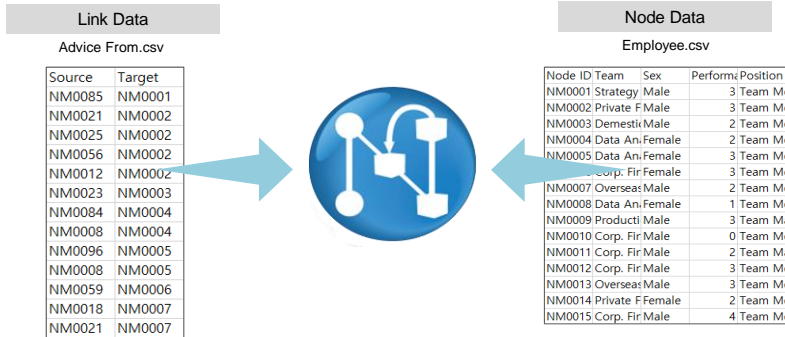
II.2 Short Tour of SNA with NetMiner



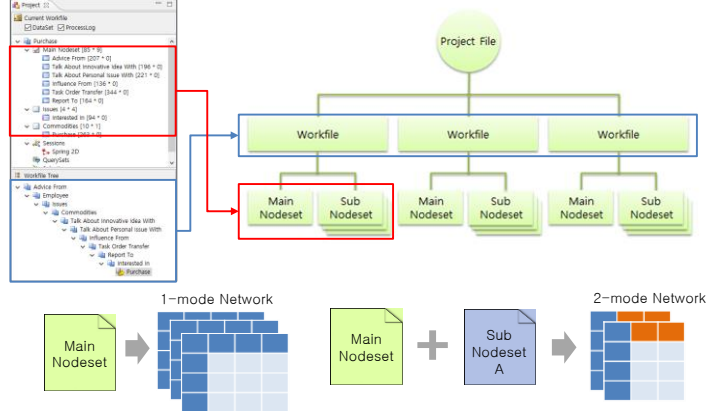
Social Network Analysis Using NetMiner



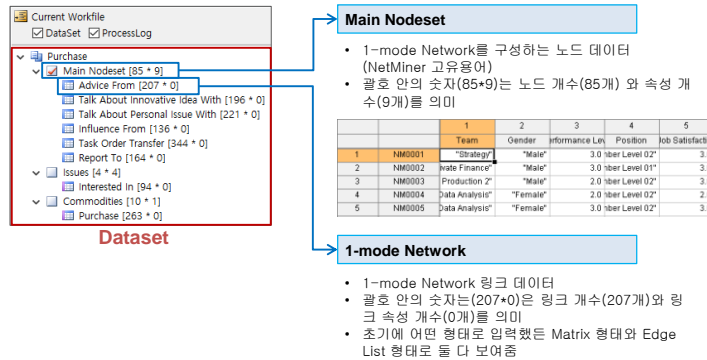
Import network data file



Data Structure of NetMiner



Data Structure of NetMiner

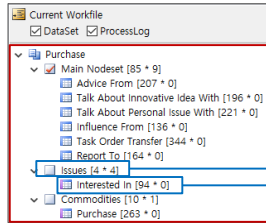


	1	2	3	4	5
	Team	Gender	Performance Lev	Position	Job-Satisfactor
1	NM0001	"Strategy"	"Male"	3.0 'iber Level 02"	3.0
2	NM0002	"Private Finance"	"Male"	3.0 'iber Level 01"	3.0
3	NM0003	"Production 2"	"Male"	2.0 'iber Level 02"	3.0
4	NM0004	"Data Analysis1"	"Female"	2.0 'iber Level 02"	2.0
5	NM0005	"Data Analysis"	"Female"	3.0 'iber Level 02"	3.0

		1	2	3	4	5
1	NM0001					
2	NM0002					
3	NM0003					
4	NM0004					
5	NM0005					
8	NM0006					
7	NM0007					
8	NM0008				5.0	4.0

	1	2	3
	Source	Target	Weight
1	NM0001	NM0040	5.0
2	NM0001	NM0075	4.0
3	NM0002	NM0021	5.0
4	NM0002	NM0075	4.0
5	NM0003	NM0068	5.0

Data Structure of NetMiner



Dataset

Sub Nodeset

- Main Nodeset과 함께 2-mode Network를 구성하는 노드 데이터(NetMiner 고유용어)
- 괄호 안의 숫자(4*4)는 노드 개수(4개)와 속성 개수(4개)를 의미

		1	2	3	4
		Importance	Subject	Proposed Date	Proposer
1	Issue 1	8.0	"Promotion"	5/28 00:30:00	"John"
2	Issue 2	4.0	"Competition"	4/17 15:25:00	"Mathew"
3	Issue 3	5.0	"Relationship"	6/12 18:40:00	"Mark"
4	Issue 4	7.0	"Retirement"	7/11 00:10:00	"Paul"

2-mode Network

- 2-mode Network 링크 데이터
- 괄호 안의 숫자는(94*0)은 링크 개수(94개)와 링크 속성 개수(0개)를 의미
- 초기에 어떤 형태로 입력했든 Matrix 형태와 Edge List 형태로 둘 다 보여줌

		1	2	3	4
		Issue 1	Issue 2	Issue 3	Issue 4
1	NM0001	1.0			
2	NM0002		1.0		
3	NM0003	1.0			
4	NM0004	1.0			
5	NM0005	1.0			

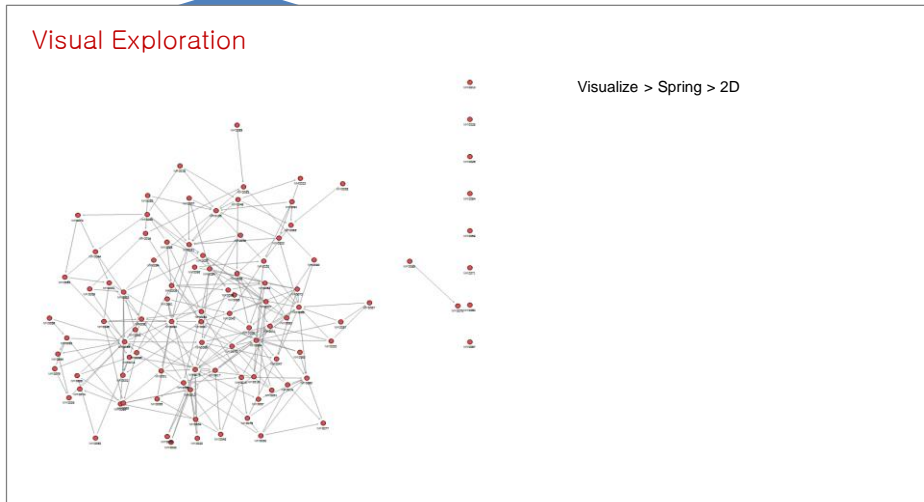
Edge List

	1	2	3
	Source	Target	Weight
1	NM0001	Issue 1	1.0
2	NM0002	Issue 2	1.0
3	NM0003	Issue 1	1.0
4	NM0004	Issue 1	1.0
5	NM0005	Issue 1	1.0

Social Network Analysis Using NetMiner



Visual Exploration



Social Network Analysis Using NetMiner



Extract Giant Component & Query

Analyze > Cohesion > Component, Query Composer

Target: Employees
 Attribute Type:Att. Value
 @LABEL: Text NM0001
 Name: Text Corp. Pms
 Gender: Text Female
 Performan.: Number 0.0
 Position: Text Dept. Mgr
 Job Satisf.: Number 0.0
 Name: Text BARBARA
 Age: Number 24.0
 Organizat.: Number 0.0

Query: "Component Partition" == 1

Log: PRODESSET Employees == 90 / 100
 PRODESSET Employees == 90 / 100 applied

Social Network Analysis Using NetMiner



Link weight distribution & Link Reduction

Statistics > Frequency > Matrix
 Transform > LinkSet > Link Reduction

Source	Target	Weight
NM0048	NM0081	4.0
NM0056	NM0081	4.0
NM0082	NM0081	4.0
NM0086	NM0081	4.0
NM0006	NM0081	4.0
NM0012	NM0081	4.0
NM0017	NM0081	4.0
NM0086	NM0082	3.0
NM0005	NM0082	1.0
NM0008	NM0082	2.0

RESULT OF FREQUENCY

Value	Frequency	Proportion	Cumulative Proportion
1.0	10	0.04	0.04
2.0	20	0.08	0.12
3.0	90	0.359	0.478
4.0	46	0.183	0.661
5.0	85	0.339	1
Total	251	1	

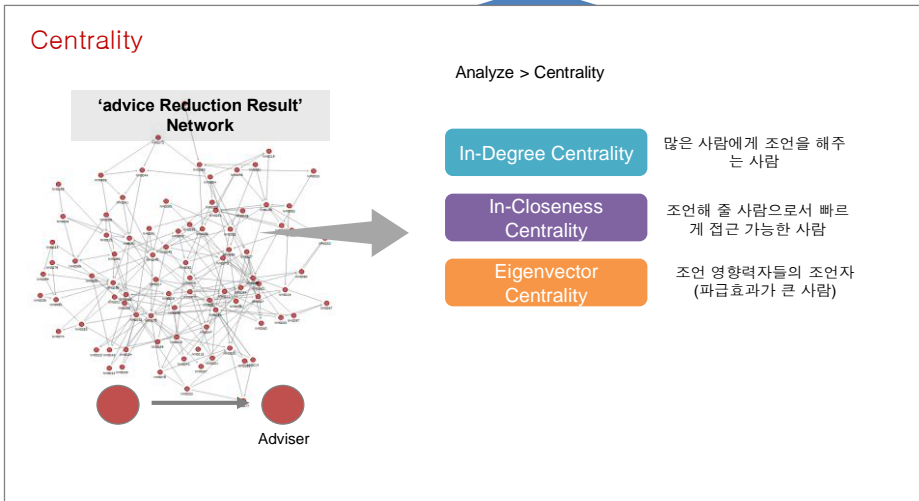
Source	Target	Weight
NM0048	NM0099	3.0
NM0096	NM0099	3.0
NM0006	NM0099	3.0
NM0021	NM0002	5.0
NM0025	NM0002	5.0
NM0056	NM0002	5.0
NM0012	NM0002	5.0
NM0023	NM0003	5.0
NM0084	NM0004	5.0

Frequency Pie Chart

Social Network Analysis Using NetMiner



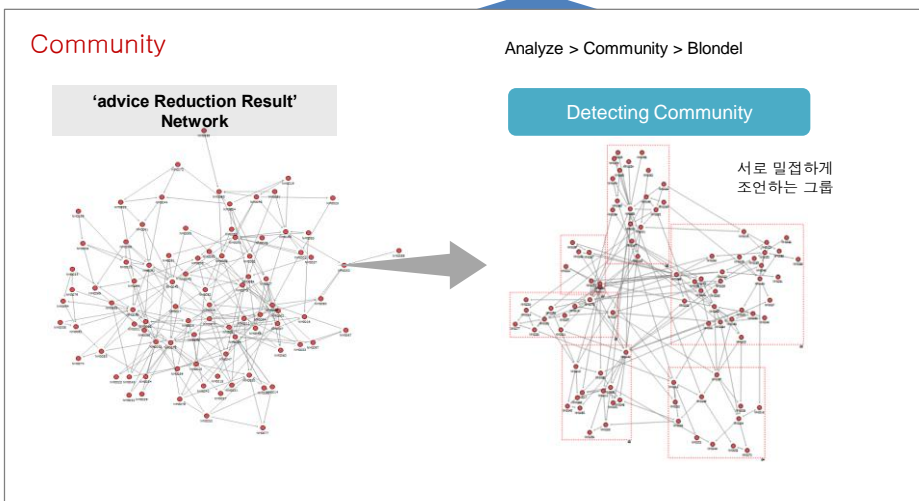
Centrality



Social Network Analysis Using NetMiner



Community



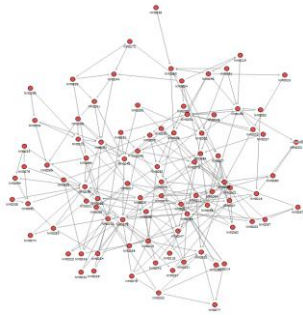
Social Network Analysis Using NetMiner



Equivalence

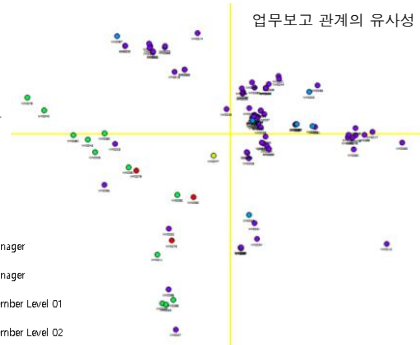
Analyze > Equivalence > Structural > Profile

'Report to' Network



관계 패턴의 유사성

업무보고 관계의 유사성

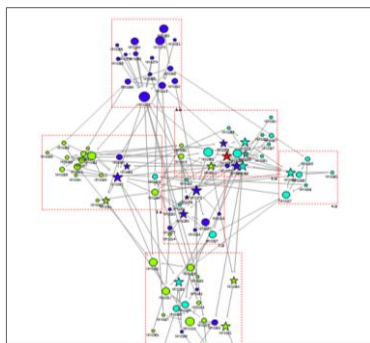


- CEO
- Dept. Manager
- Team Manager
- Team Member Level 01
- Team Member Level 02

Social Network Analysis Using NetMiner



Network Styling



Clustered 2D

Node Color Styling

- CEO
- Finance
- Marketing
- Production

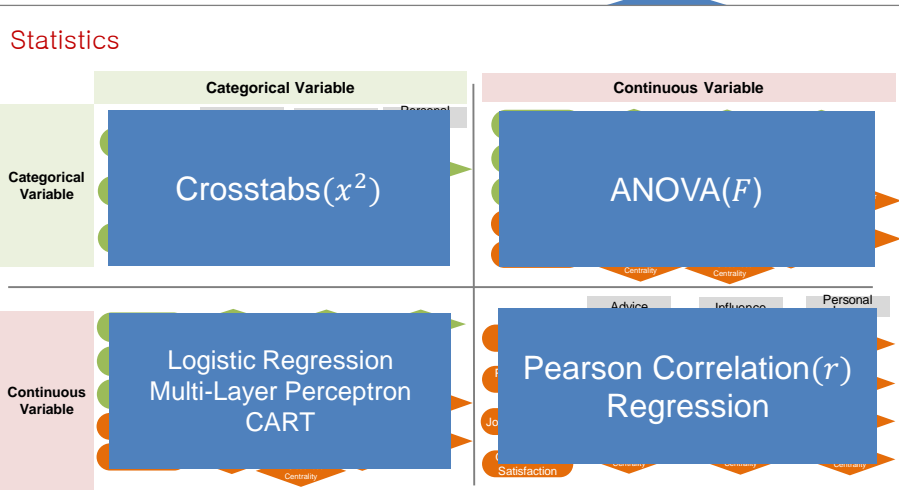
Node Size Styling

Advice In-degree
Centrality

Node Shape Styling

- ★ CEO
- ★ Dept. Manager
- ★ Team Manager
- Team Member Level 01
- Team Member Level 02

Social Network Analysis Using NetMiner



Social Network Analysis Using NetMiner

