

Sumerian Networks

DS URAP 2017-2019

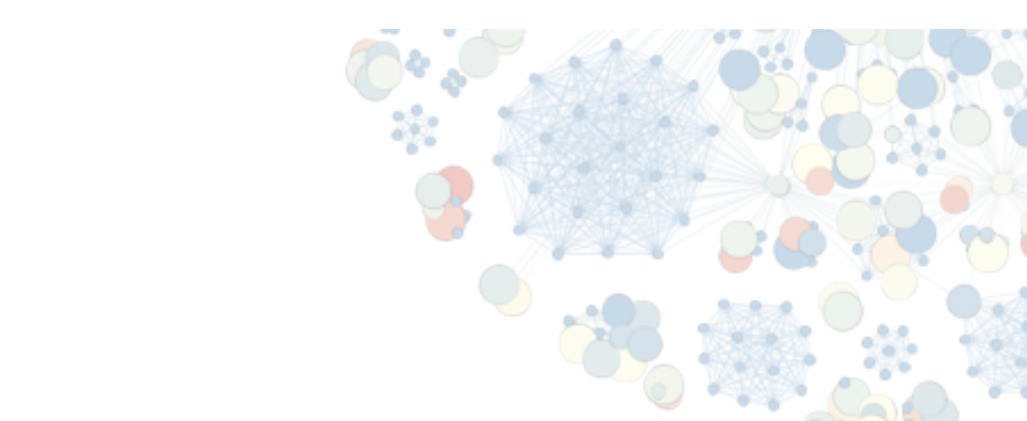
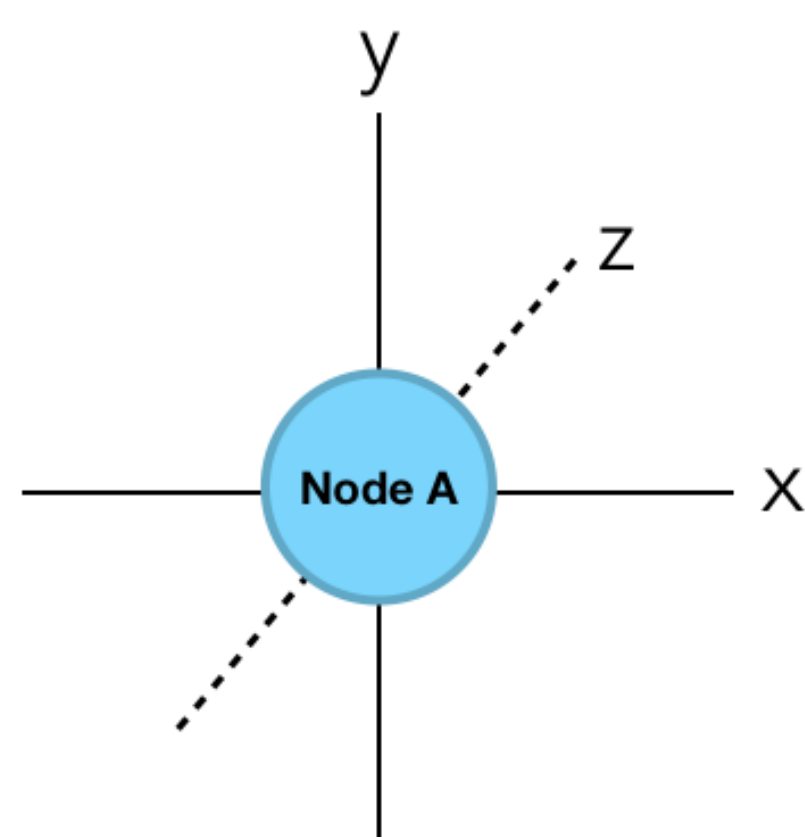
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What is a network?

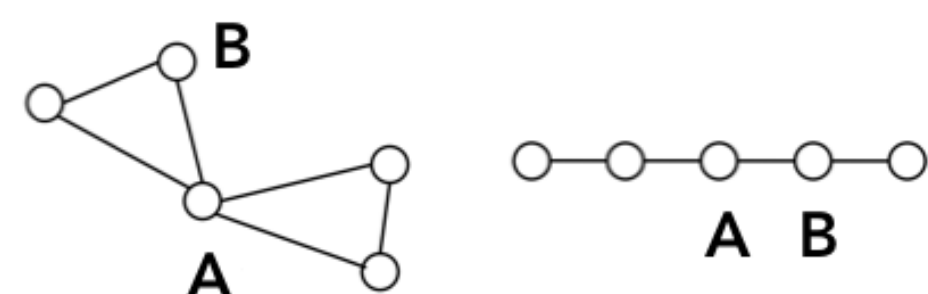
Networks provide a way of counting *things* and *entities* as data points. Networks also count *how* things are related to each other.

Every *thing*, or data point, is represented by a 'node', the smallest unit of analysis. Every node has three coordinates (x, y, z), which are used to place each node in a relational framework in which the position of the node says something about its **centrality** in the network.

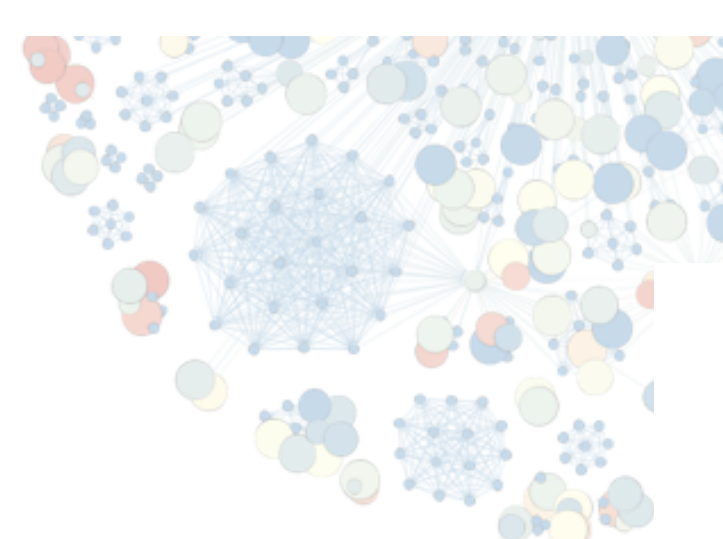


Node List

ID	Label	Position	Deg.
110	Node A	x, y, z	4
111	Node B	x, y, z	2

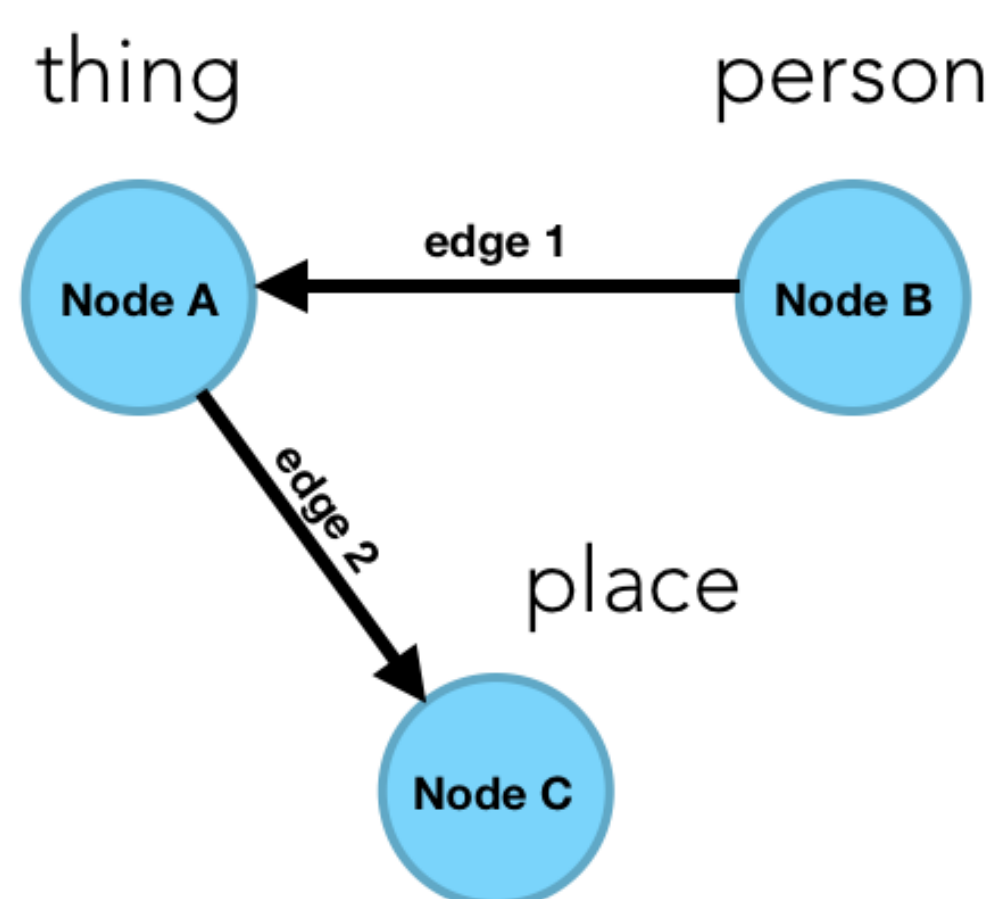


betweenness degree & centrality
closeness



What is a node?

Nodes can represent different categories of data, e.g. persons, places, and things. Each category is referred to as a 'mode'. Multi-modal networks analyze multiple categories of nodes within the same network.



ID	Label	Type	Degree	Mode
110	Node A	thing	2	2
111	Node B	person	1	1
112	Node C	place	1	3

ID	Source	Target	Type	Weight
1	111	110	directed	1
2	110	112	directed	1
3				

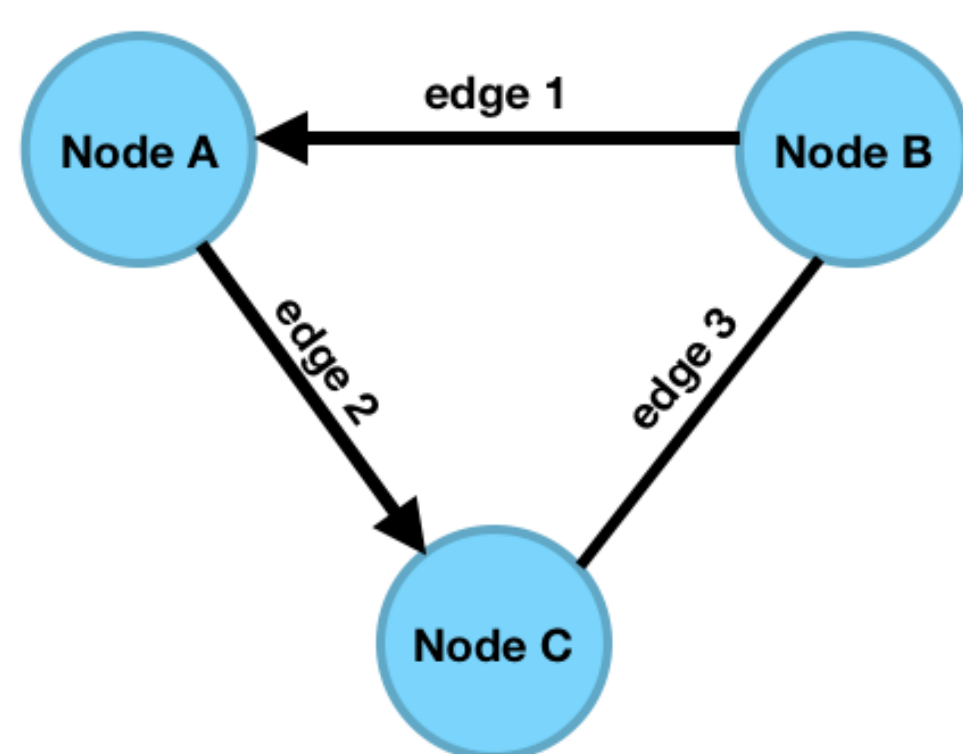
ID	Label	Dates	In_deg	Out_deg
110	Node A	80-120	5	5
111	Node B	70-105	0	1
112	Node C	89-110	1	0

What is an edge?

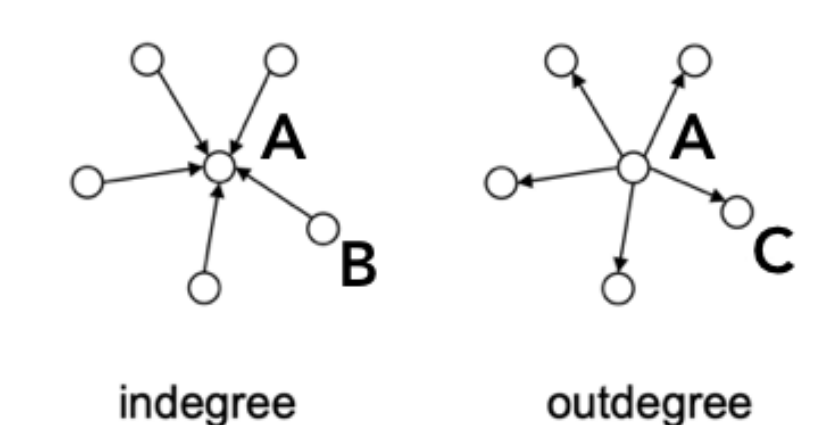
Edges can contain directional information, useful for designating the flow of action from one node to another, from a 'source' to a 'target'.

When there is only relatedness without direction or hierarchy, edges can also be undirected, and given a weight. There can be a number of different categories (i.e. partitions) of edges (e.g., attested association, family ties, proximity, etc.).

Directed edges provide important statistical information, e.g., Eigenvalues: 'hubs', 'authorities', 'leaders', etc. (see Kleinberg 1999)



ID	Source	Target	Type	Weight
1	111	110	directed	1
2	110	112	directed	1
3	111	112	undirected	1



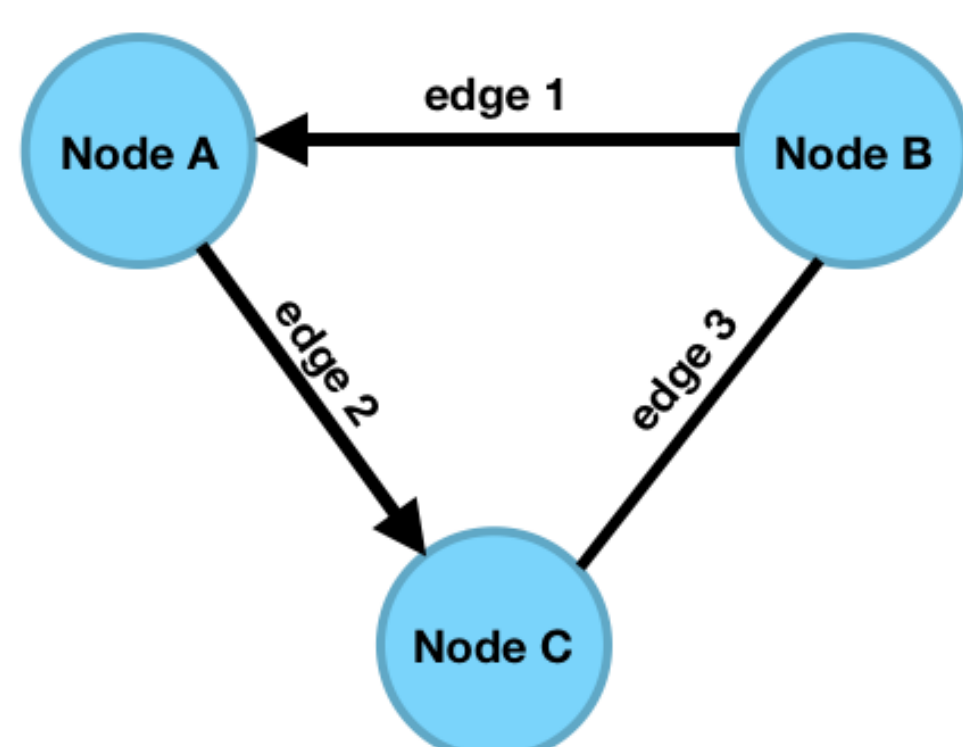
indegree outdegree

Network Attributes

Both nodes and edges are given unique IDs and listed in spreadsheets with their values and metadata (i.e. 'attributes').

Attributes for nodes can include:

- Geo-location (x, y) coordinates for known locations, geographical names, places, buildings, and events.
- Chronological dates (start & end) which can be visualized in a time interval



ID	Label	Dates	Geo_x	Geo_y
110	Node A	80-120	35.6	38.8
111	Node B	70-105	35.4	40.8
112	Node C	89-110	35.8	40

ID	Source	Target	Type	Weight
1	111	110	directed	1
2	110	112	directed	1
3	111	112	undirected	1

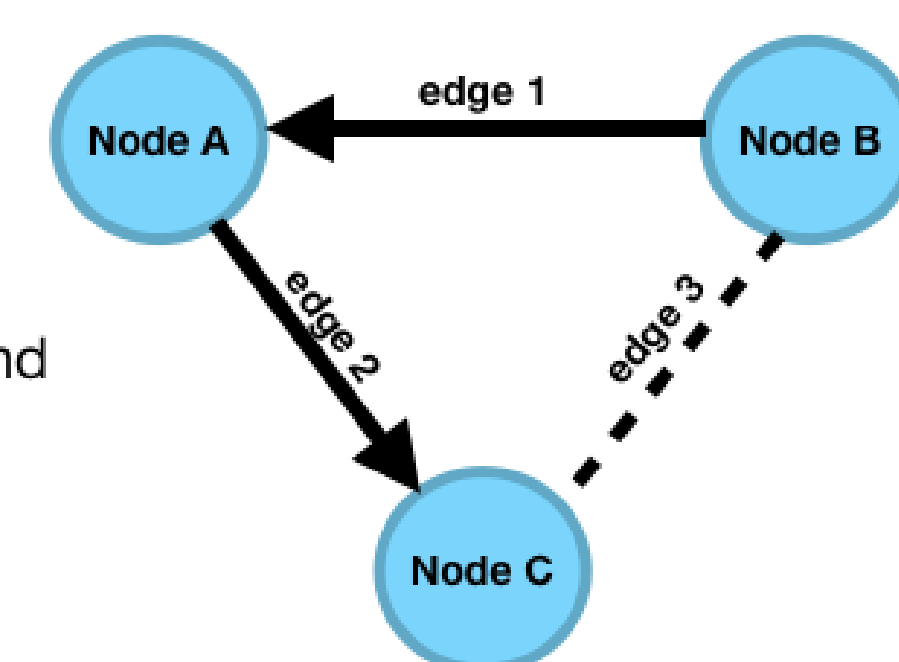
The Ur III Sumerian Networks

The goal of the project has been to build reproducible socio-economic networks from the Ur III textual archives. We apply a method for name disambiguation, and built a control based on name instances based on textual attestations of c. 15,000 documents. This research project has brought together archaeologists, cuneiform specialists, experts in Computational Text Analysis and Natural Language Processing from around the world. Current results for reproducible network models are available in Jupyter Notebooks (see [GitHub/niekveldhuis/Sumerian-network](https://github.com/niekveldhuis/Sumerian-network)).

What is a network?

Beginning with a single document, we count the proper names (PN), which we list in the Node List. For each PN we include the P-number add attributes including: role, profession, patronymic, date, archive, and commodities.

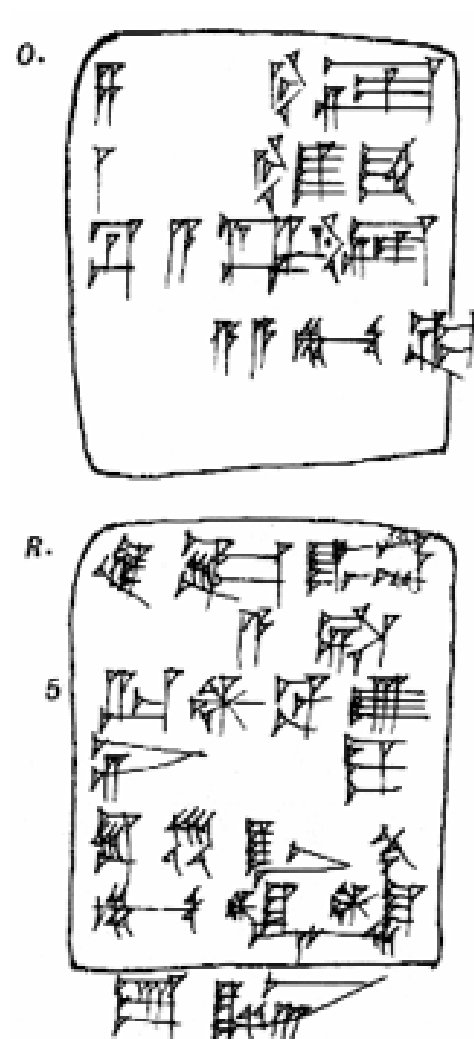
We also make an Edge List which accounts for the relationships mentioned in the document. Edges also include the P-number, year name, and roles for source and target.



Node List

ID	Label	role	P_num
110	a-a-mu-SAG	'intermediary' (giri _s)	103953
111	gu ₃ -de ₂ -a	'source' (ki)	103953
112	ur- ^d ba-u ₂	'recipient' (l ₃ -dab ₅)	103953

AUCT 2 135
= P103953



	Text
1	4 kir ₁₁
2	1 munu _s aš ₂ -gar ₃
3	diri sanga [?] kir ₁₁ a-a-mu-SAG
r. 4	ki Gu ₃ -de ₂ -a-ta
5	Ur- ^d Ba-u ₂
6	l ₃ -dab ₅
7	iti še-KIN-ku ₅
8	mu ^d Su- ^d Suen lugal

ID	Source	Target	Type	Weight
1	111	110	directed	1
2	110	112	directed	1
3	111	112	undirected	1

15,000 Texts
Ur III Drehem

low (1) Degree high (400)
43,000 nodes
2,300 nodes

