Sumerian Networks

DH Cuneiform Name Authority

DDS/DSEP-URAP Team 2017-2020:

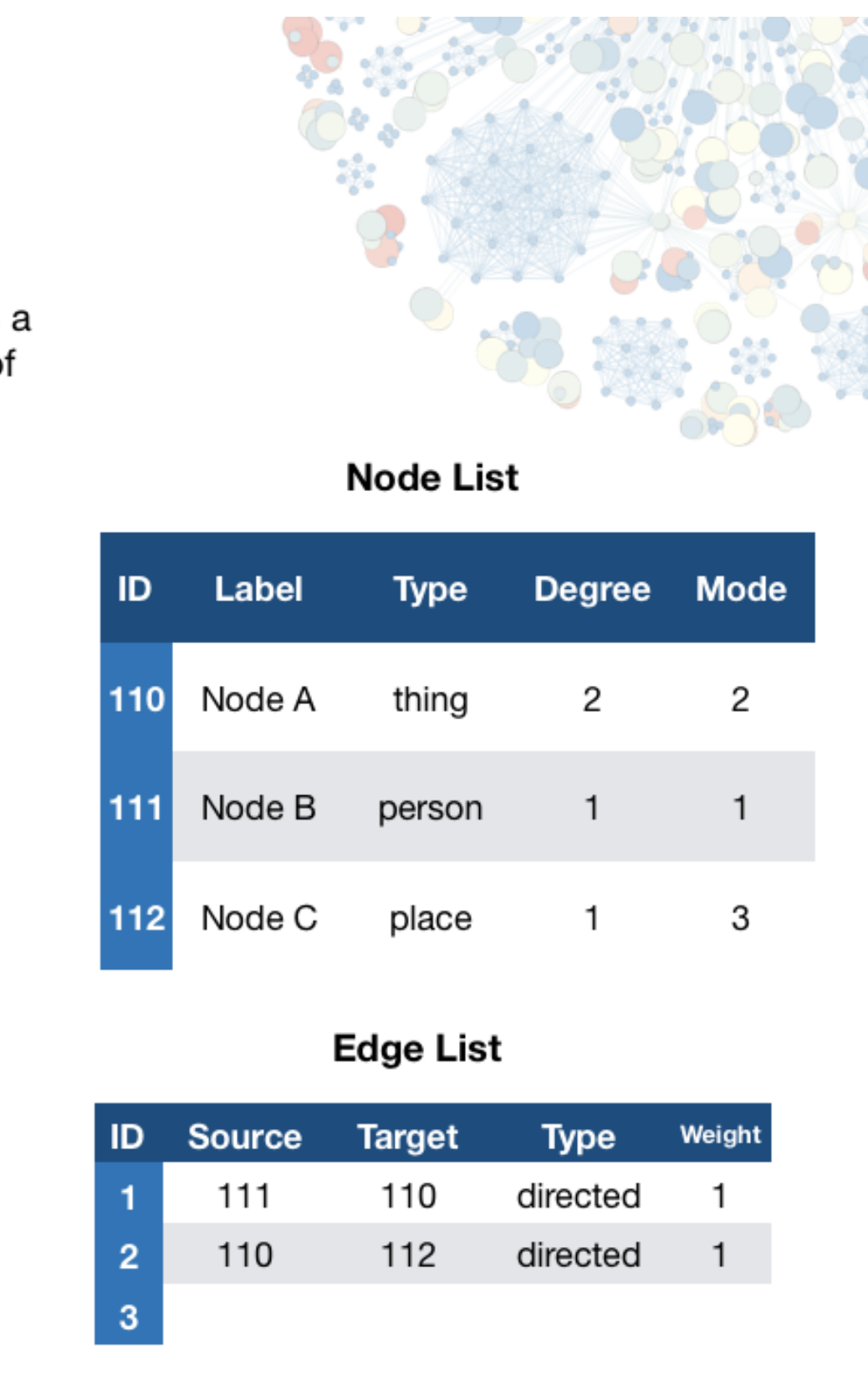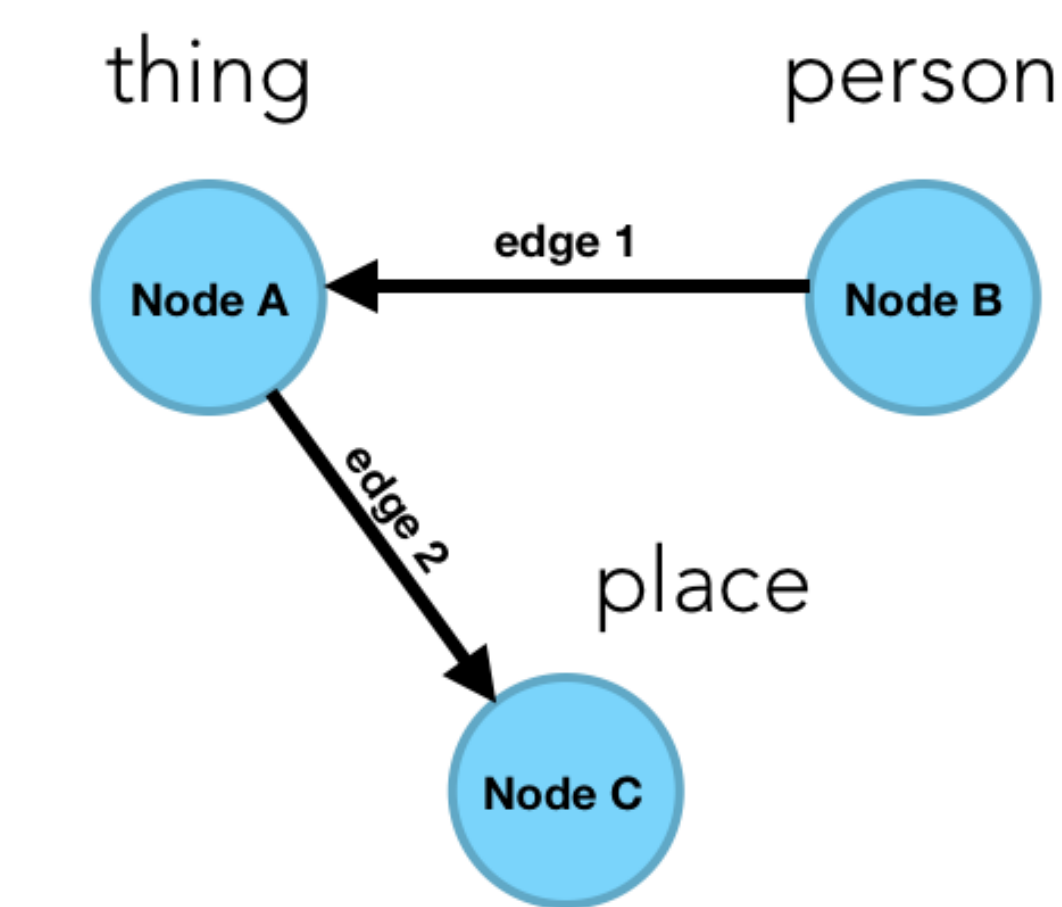| Current Team	Email	GitHub	Role	Semesters
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What is a network?

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   closeness

degree & centrality

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).

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.

thing   person

place

Node List

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

Edge List

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

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.

AUCT 2 135 = P103953

Text	
1	4 kir$_{11}$
2	1 ^{munus}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	i$_3$-dab$_5$
7	iti še-KIN-ku$_5$
8	mu ^{d}Šu-^{d}Suen lugal

Node List

ID	Label	role	P_num
110	a-a-mu-SAG	'intermediary' (giri$_3$)	103953
111	gu$_3$-de$_2$-a	'source' (ki)	103953
112	ur-^{d}ba-u$_2$	'recipient' (i$_3$-dab$_5$)	103953

Edge List

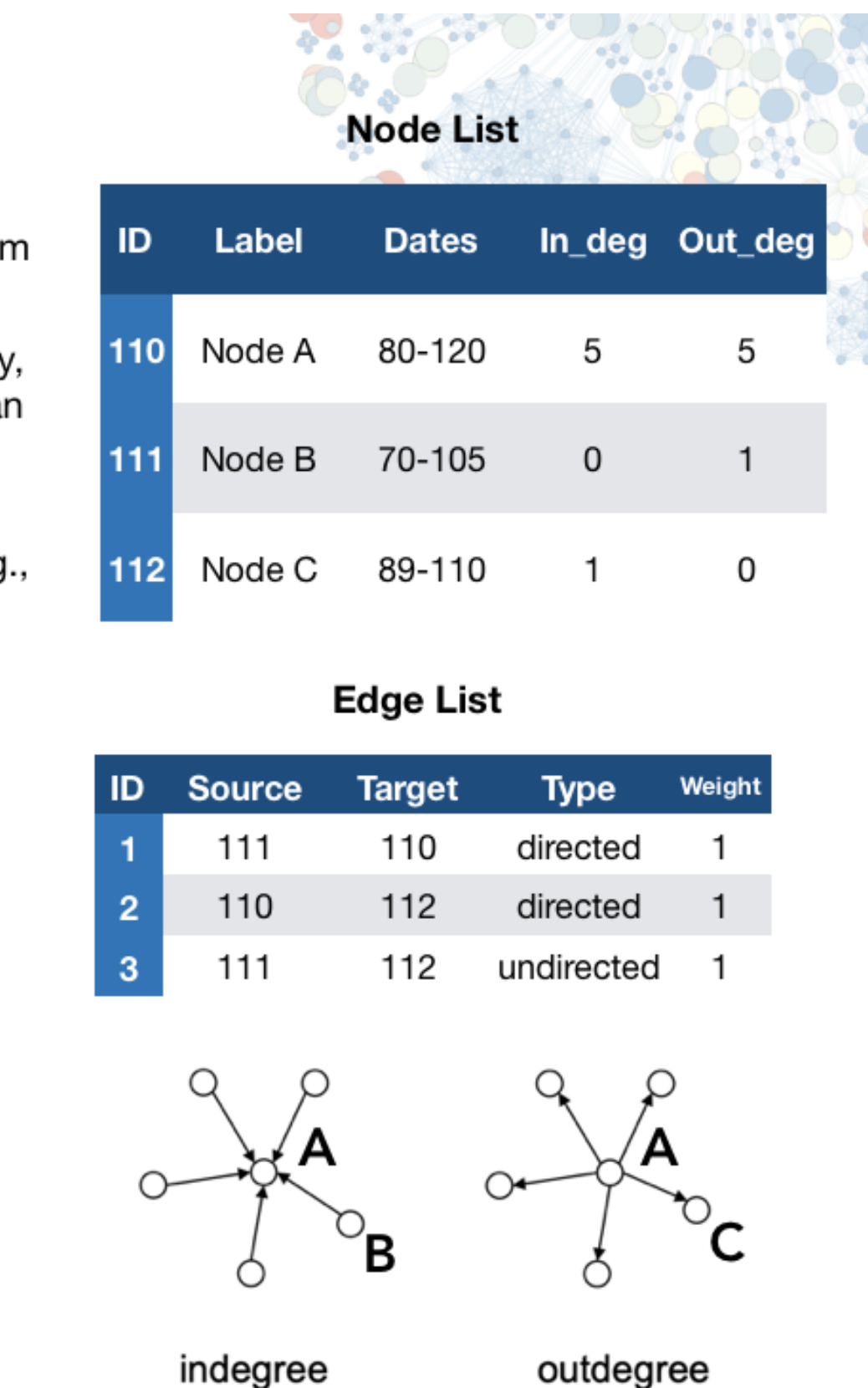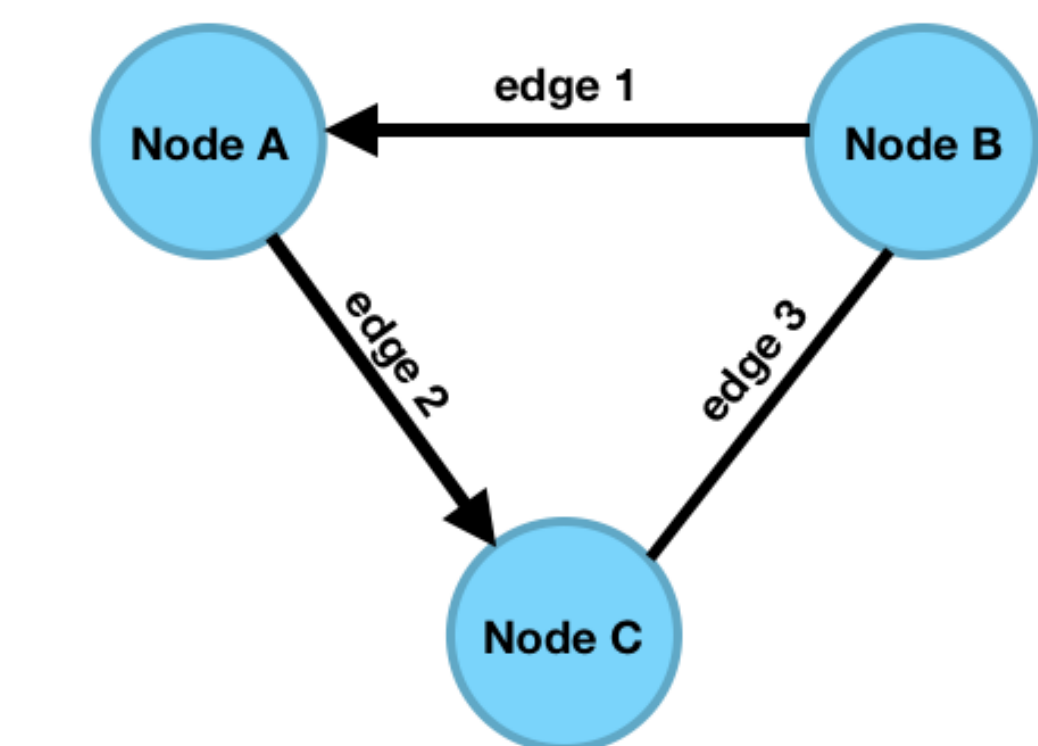| ID	Source	Target	Type	Weight
1	111	110	directed	1
2	110	112	directed	1
3	111	112	undirected	1

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)

Node List

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

Edge List

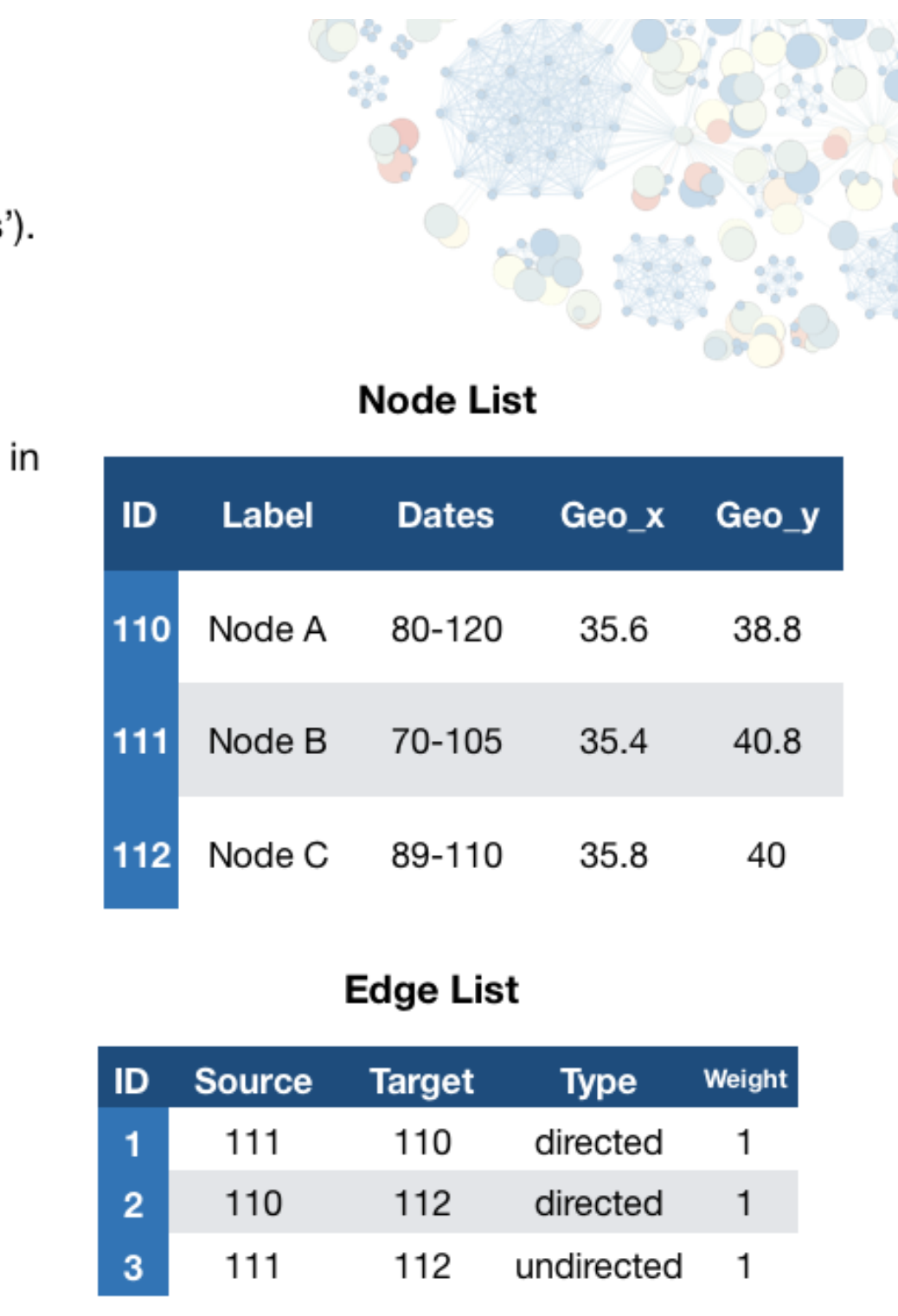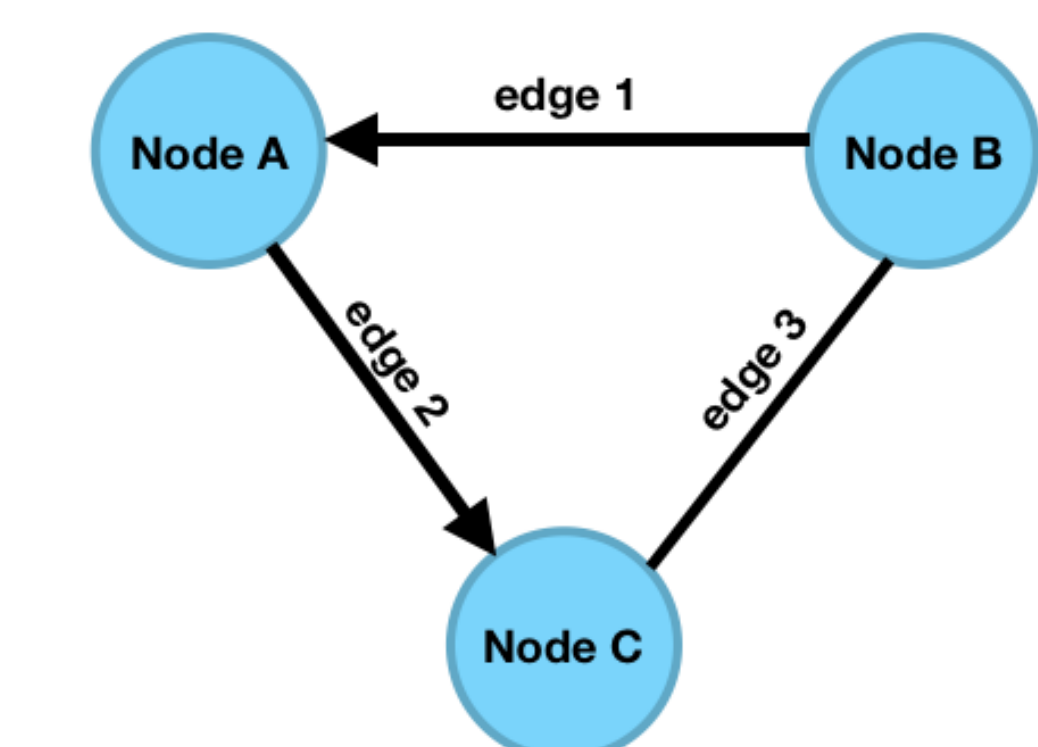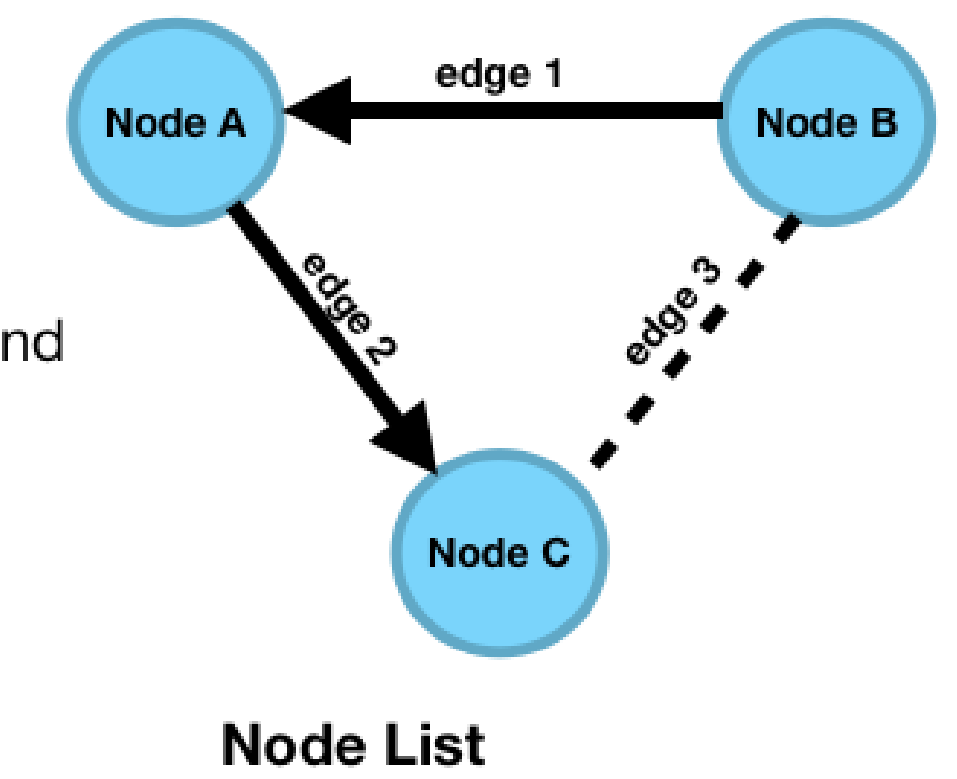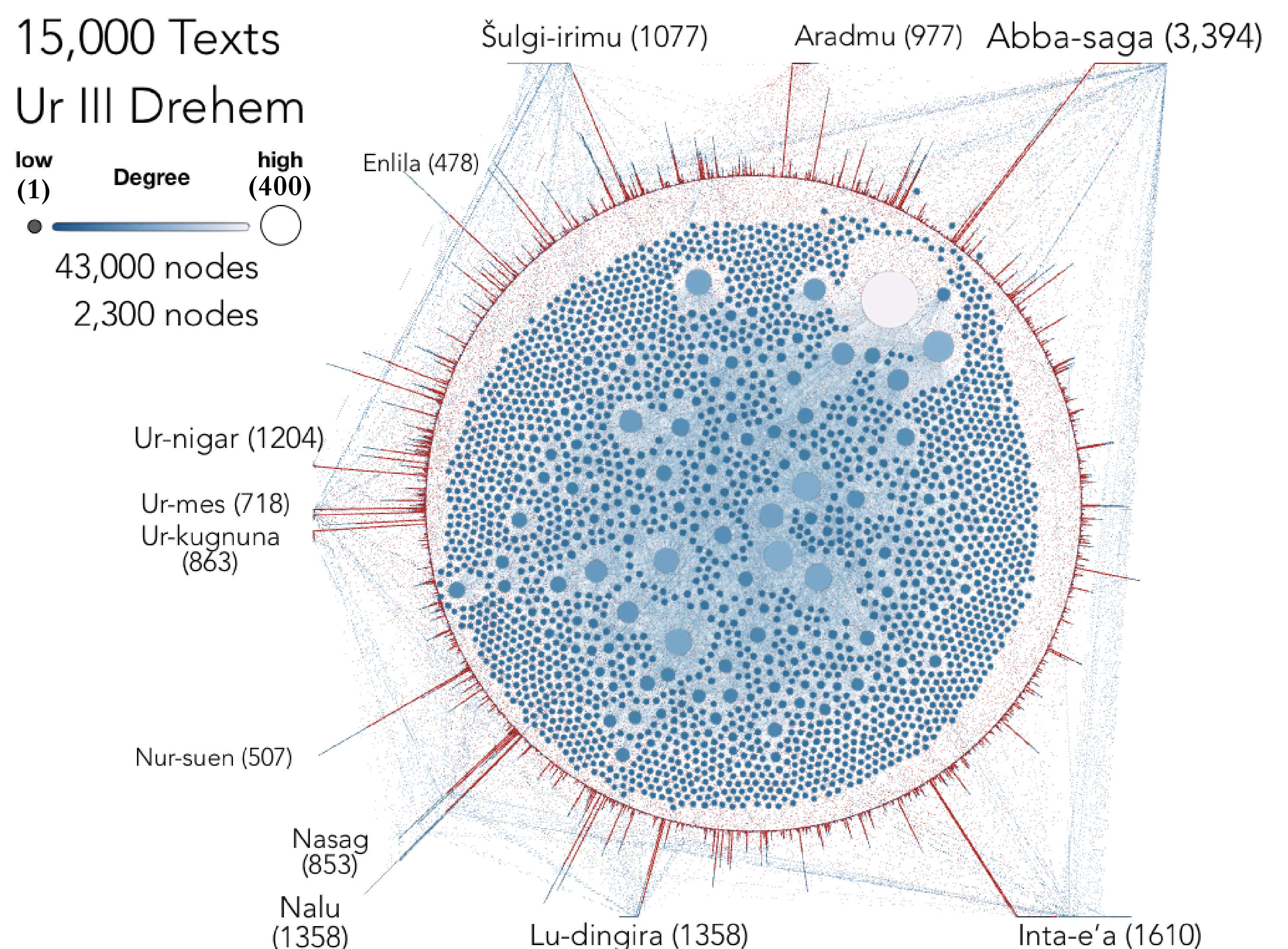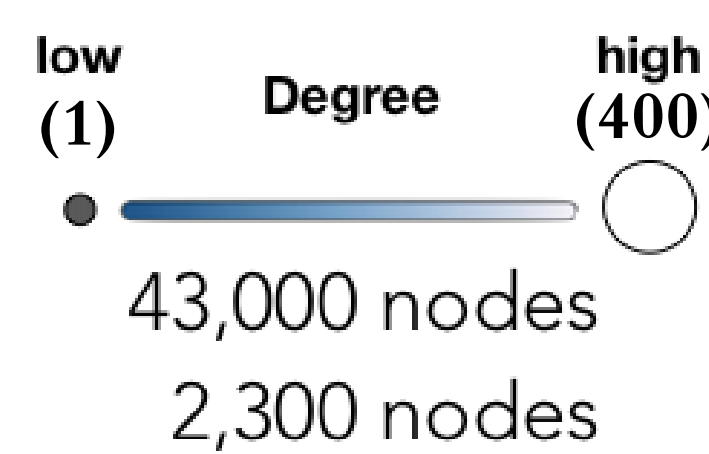| ID	Source	Target	Type	Weight
1	111	110	directed	1
2	110	112	directed	1
3	111	112	undirected	1

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

Node List

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

Edge List

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

Šulgi-irimu (1077)   Aradmu (977)   Abba-saga (3,394)
Enlila (478)
Ur-nigar (1204)
Ur-mes (718)
Ur-kugnuna (863)
Nur-suen (507)
Nasag (853)
Nalu (1358)   Lu-dingira (1358)   Inta-e'a (1610)

The figure above illustrates two overlapping networks, which were made from the 15,000 texts from Puzriš-Dagan (Drehem). The outlying nodes in red show the number of attestations of each of the named entities in the texts (43,000 nodes), with labels for the most frequent names. The inner network uses a number of variables associated with each entity (e.g. role, title, family name, date, etc.) in order to disambiguate and deduplicate the attestations into a more representative network of ca. 2000 nodes. Preliminary results are described in the Assyriology newsletter, Mar Šiprim (2018).