EgoNetCloud: Event-based Egocentric Dynamic Network Visualization

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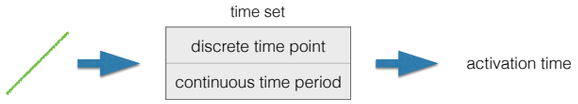
Presented by: Dylan

Context

Event-based Egocentric Dynamic Network

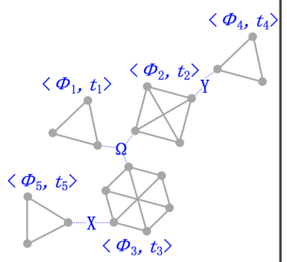
- time-varying graph



Context

Event-based Egocentric Dynamic Network

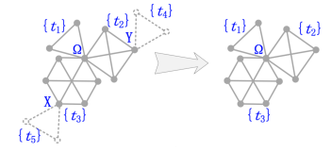
- in event-based network, discrete time point (continuous time period) of the edge is associated with an event
- every dynamic network can be seen as event-based
  - establishing a friendship tie in online social networks sending a mobile short message



Context

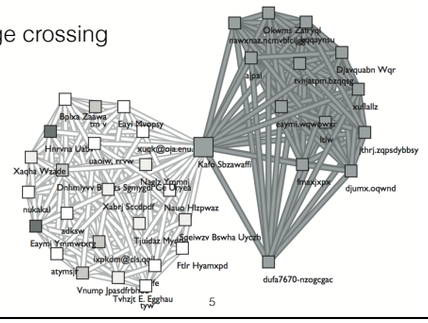
Event-based Egocentric Dynamic Network

- subgraph of the full-scale graph
- node: ego node vs. alter node
- edge: ego -> alter; alter -> alter
- help understand the role of the ego in full-scale network



Problems

- visual clutter
- edge crossing



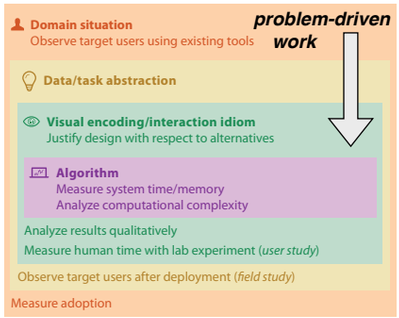
Goals

- reveal egocentric network structure
- reveal the temporal dynamics of the ego/ alter nodes
- requirements on performance, visual metaphor, layout constraint
- redesign interaction

Contributions

- **Data-driven empirical algorithms**: prune, compress and filter networks into smaller but more informative abstractions
- **EgoNetCloud visual metaphor and interactions**: display and explore both the egocentric network structure and their temporal dynamics
- **Fast and constrained layout computation**: fulfill requirement of the new visual metaphor and maintain fine readability
- **Comprehensive evaluations**: demonstrate the effectiveness of the EgoNetCloud design through a user study and a real-world case study

Levels of Design



Framework

System	EgoNetCloud
What: Data	Event-based egocentric dynamic network data
Why: Tasks	Identify clusters, values, trends
How: Encode	Nodes linked with connections; size; category colors;
How: Reduce	Edge pruning; node compression; graph filtering
How: Manipulate	Select
How: Facet	NetCloud; EgoCloud; Static Ego Network

How

Edge Pruning

- remove low-weight edges

prune as many edges as possible

retain important edges

preserve the connectivity

smallest connected maximum weighted spanning graph

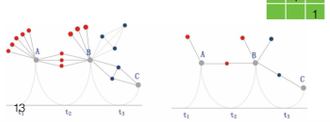
- authors not listed in alphabetical order
  - sparse matrix

$$M = \begin{pmatrix} 1/3 & 1/3 & 0 & 1/3 & 0 \\ 1/3 & 1/3 & 0 & 0 & 1/3 \\ 1/4 & 1/4 & 1/4 & 0 & 1/4 \end{pmatrix}$$

  - cosine similarity as weight
  - recency based scaling: inverse of paper's age
  - author ordering based scaling
- authors listed in alphabetical order
  - credit allocation algorithm
    [Shen, H. W., & Barabási, A. L. (2014). Collective credit allocation in science. Proceedings of the National Academy of Sciences, 111(34), 12325-12330.]

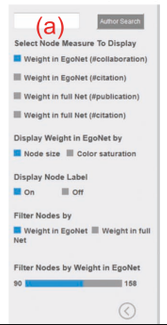
Node Compression

- group nodes with the same or similar connection pattern
- graph adjacency matrix
  - merge nodes with exactly the same connectivity
  - merge nodes with the same connectivity and linked to each other
  - fuzzy compression



Graph Filtering

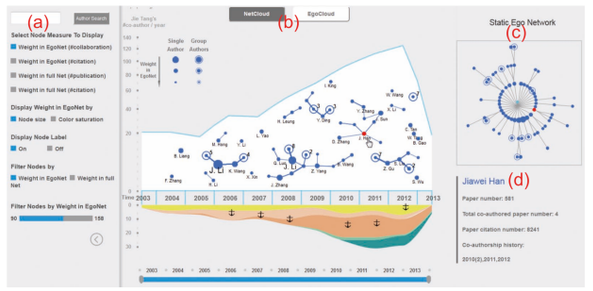
- reduce nodes and related edges by rule-based policy
  - importance degree
  - time period
  - # citations
  - # collaborations
  - # publications

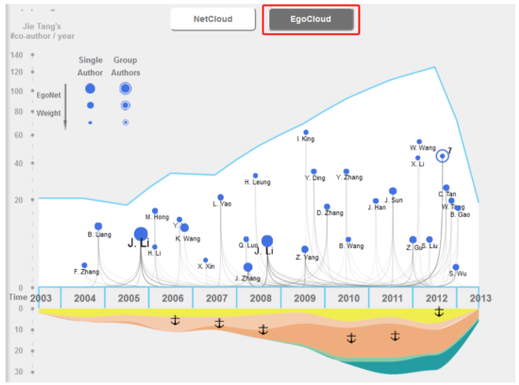


Layout Algorithm

- initial layout
  - alter's interaction time & frequency with ego
- constrained stress majorization approach
  - deal with position constraints

EgoNetCloud





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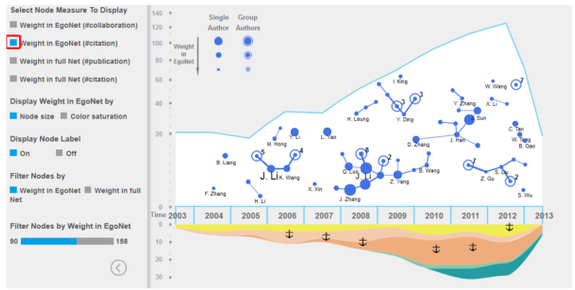

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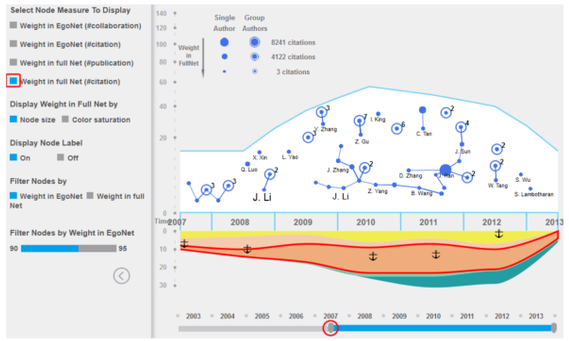

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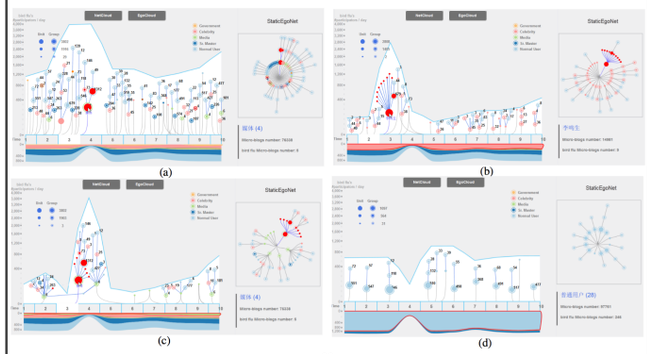
Case Study



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User Study

- temporal information related
- the egocentric network related
- a combination of the two

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Critique

- suspicious about result of weighted graphs
  - nodes compression algorithm for unweighted graphs
- “no edge in the complement of the simplified subgraph has weight greater than any of the edges in this subgraph”
  - efficiency should be 1
- can’t see the particular benefit apply to other networks

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Questions

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