NetEvViz:
Extending NodeXL for Dynamic Network Visualization

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Outline

- Introduction
- Timeline
- Timeslider
- Video
- Evaluation
- Future Work and Conclusion
Introduction

- Network data are ubiquitous
- Visualization is an important approach to analyze network data
- Related work on dynamic network visualization
  - Node-link-based representation
    - 3D visualization with time as an additional dimension
    - Static flip books
    - Dynamic movies
  - Matrix-based representation
    - TimeMatrix
Related Work

3D network visualization

C. Erten et al. (VDA 2003)
Related Work

TimeMatrix

Aggregate

Collapse

J. S. Yi et al. (Journal of HCI 2010)
Key Contributions

- NetEvViz helps the users
  - Visualize the dynamics of the network with multiple graph metrics plotted over time
- Compare the network at two different time points
NodeXL

- Network Analysis and Exploration
- Microsoft Excel Plugin
- Populate Edges and Nodes in workbook
- Click to obtain
  - Network Layout
  - Node metrics
  - Cluster detection
NodeXL -> NetEvViz

Why extend NodeXL?
- Easy to add new attributes
- Extend layout, metric computation
- Use Excel’s features like plotting
- NodeXL has a large audience
NetEvViz: Start and End Times

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Timeline

- Metric to assess change over time
  - a.k.a Network Evolution

- Graph properties
  - Average Degree
  - Density
  - Others possible
    - Average Eigenvector centrality
    - Median Betweenness centrality
Timeline on NetEvViz
Two headers are used to specify the two timestamps, $t_1$ and $t_2$, to compare.

Given $t_1$ and $t_2$, all edges are grouped into 4 different categories.
Categorizing edges

1. Edges appear only in $t_1$ but not $t_2$
2. Edges appear only in $t_2$ but not $t_1$
3. Edges appear in both $t_1$ and $t_2$
4. Edges do not appear in $t_1$ nor $t_2$
Coloring the edge

- The edges are colored with respect to their calculated category
- Users can customize the color to be used
Video

- [http://www.youtube.com/watch?v=Vy0SDN0LEOM](http://www.youtube.com/watch?v=Vy0SDN0LEOM)
User Study

- Subjects
- Experimental Setup and Procedure
- Results and Analysis
User Study - Subjects

- Subjects

  - we recruited 5 graduate students, denoted by P1, P2, P3, P4, and P5 who are currently taking a graduate-level course in information visualization.

  - P1 and P3 were also familiar with Twitter data.
User Study - Experimental Setup and Procedure

- Complete a questionnaire focusing on their experience on NodeXL and temporal network analysis

- A 10-minute tutorial about NodeXL and NetEvViz
  - Introduction of the new features of NetEvViz
  - Providing two sample tasks

- Perform 3 analytical tasks

- A post experiment questionnaire
User Study - Results and Analysis

- All participants finished the tasks

- Found it useful to use NetEvViz to visualize and compare temporal networks at two different time points.

**Pro**
- Useful to visualize and compare temporal networks at two different time points.
- Color selection and comparison.

**Con**
- Occlusion of edges made it hard to detect the target edges
- Inconvenience in selecting the exact time in the Timeslider.
User Study - Results and Analysis

**Usability**

- I find the time slider functions smoothly and correctly as I move the handlers: 4.6
- How to you rate your overall performance on the tasks given: 5.2
- I find the feature of changing the color for different types of edges useful: 5.4
- I am comfortable with using the time slider: 5.6
- I am comfortable with using the timeline: 6.2
- I am comfortable with detecting different types of edges given two selected time points: 6.4
- I find the ability to edit the spreadsheet while visualizing the network is useful: 6.6
- I think NetEvViz will be an useful extension for NodeXL: 7.2
- My overall impression of the NetEvViz is positive: 7.4
- I am comfortable with changing the color of different types of edges: 8.2
- I am comfortable with changing the color of different types of edges: 8.4
- I find the feature of changing the color for different types of edges useful: 8.4
Task 1: Visualize network statistics over time
1. What is the number of edges added to the network during period $T_1$ after period $T_2$?
2. What is the number of nodes added to the network during period $T_1$ after period $T_2$?
3. How does the density of the network at time $t_1$ change after time $t_2$?

Task 2: Visualize the differences of network at different points in time
1. Move the handlers of the Timeslider in order to compare the network at time $t_1$ and $t_2$.
2. Change the colors of edges that appear in the network at time $t_1$ but not at time $t_2$ to Red.
3. Change the colors of edges that appear in the network at time $t_2$ but not at time $t_1$ to Blue.
4. Change the colors of edges that appear in the network at both $t_1$ and $t_2$ to Green.
5. How many edges appear in the network at time $t_1$ but not at time $t_2$?
6. How many edges appear in the network at time $t_2$ but not at time $t_1$?
7. How many edges appear in the network at both $t_1$ and $t_2$?

Task 3: Visualize temporal network with interactive spreadsheet
1. Add some new edges with time stamps to the Edge Sheet.
2. List all the edges that appear in the network at time $t_1$ but not time $t_2$.
3. List all the edges that appear in the network at time $t_2$ but not time $t_1$.
4. List all the edges that appear in the network at both $t_1$ and $t_2$.

Table 2: Post experiment questionnaire used. For each question, we used 9-point scale with 9 being positive.

1. How do you rate your overall performance on the tasks given?
2. I am comfortable using the Timeline.
3. I find the Timeline plots showing the three network statistics (number of edges, number of nodes and density) changing over time useful.
4. I would suggest adding the following network statistics.
5. I am comfortable using the Timeslider.
6. I find the feature of changing the color for different types of edges useful.
7. I am comfortable with detecting different types of edges given two selected time points.
8. I am comfortable with changing the color of different types of edges.
9. I find the ability to edit the spreadsheet while visualizing the network is useful.
10. I find the Timeslider functions smoothly and correctly as I move the handlers.
11. Are you aware of any other tool/software which allows you to compare network at two time points? If yes, please provide the name of the tool/software.
12. My overall impression of the NetEvViz is:
13. I think NetEvViz will be an useful extension for NodeXL.
14. Please leave any comments to the NetEvViz team. Any comment/feedback is much appreciated.