CoCo Seminar Series Fall 2020

Visualizations of Collective Activity and Performance in Social Networks

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Collective design and innovation processes in a human group are complex and dynamic, involving a huge amount of qualitative narrative information that is difficult to monitor, analyze and visualize using traditional methods. In this study, we developed several new visualization methods for collective design and innovation processes, and applied them to online collaboration experiment data. We applied a word embedding machine learning algorithm (Doc2Vec) to convert narrative ideas posted by experimental subjects working on a collective design task to 400-dimensional numeric vectors. Principal component analysis was applied to the whole collection of idea vectors to reduce dimensionality. The first visualization is the "idea cloud," multiple 2D scatter plots of the idea vectors' first two principal components layered along a time axis, which helps monitor the collective idea posting activity and track idea clustering and transition intuitively. The second visualization is the "idea geography," a 3D surface plot in which a utility terrain is reconstructed on the 2D principal component space by elevating each final idea to its utility score evaluated by third-party experts. Idea geography helps understand how the idea space is structured and how the collective collaboration performed in that space. The third visualization is the "idea network", a 3D network plot that shows each idea at the height of its first principal component on top of the human node who posted it in the participants' social network structure, which can be animated over time. This visualization connects idea dynamics with the social structure of people who generated them and thus helps observe how social influence among neighbors may have affected collaborative activities and where innovative ideas arose and spread in the social network.

Yiding Cao is a Ph.D. candidate in Industrial and Systems Engineering at Binghamton University. She received her B.E. in Survey and Mapping Engineering at Hebei University of Technology, and her M.A. in Geography at Binghamton University. Her research interests include computational and simulation models, network analysis, multivariate statistical analysis, data mining, machine learning, geographic information systems, and spatial analysis. For more information, contact Hiroki Sayama (sayama@binghamton.edu). http://coco.binghamton.edu/