UNIVERSITY OF ILLINOIS AT CHICAGO
DEPARTMENT OF COMPUTER SCIENCE
CS 524

# Summary of "Weighted Graph Comparison Techniques for Brain Connectivity Analysis"

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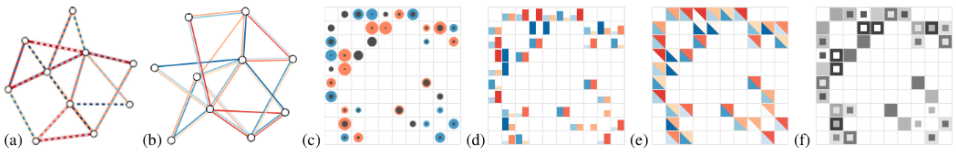


Figure 1: This figure collects the two main methodologies proposed to address the weighted graph comparison problem. The first two images from the left show two different node-link visualization, while in the remaining there are different versions of the matrix-based visualization.

## 1 SUMMARY

This paper addressed the challenging problem of how to compare weighted graphs. Although this is a quite common issue related to graph drawing in general, the authors focus their attention on graphs derived from the connectome studies. Especially in this research field more than others, it is very important to have an effective visualization tool that allows neuroscientists to compare at least two different weighted graphs. In fact, from the accurate and very well written tasks analysis there are at least two aspects that require a tool like the one described above. On the one hand, there is the need to understand the alteration in brain connectivity that replace functionality after some traumatic event. On the other hand, being able

to identify the existence or the loss of given patterns in brain connectivity allows neuroscientists to understand the differences there are between healthy and diseased subjects. To this regard, many works have shown that in Alzheimer's disease, some functional connectivity properties of healthy people are not present in diseased patients. To achieve the goal briefly described before, the authors proposed two main techniques and they are as follows: matrix diagram or node-link diagram. With the matrix diagram, in each cell it is represent the weight of the link using a brightness encoding. The other methodology is the node-link diagram in which all the edges are drawn. If an edge is present in both of the adjacency matrices, there are two edges as well and the one with higher weight has a bright color. When just one edge is drawn, it simply means that the connection is missing in one of the two graphs. Figure 1 shows better than words the prototypes proposed by the authors. The paper reports also a very strong validation process that involved 11 participants. They measured many different metrics and the results are quite interesting. Conversely to what people may think, the matrix diagrams revealed to be more effective than node-link diagrams are. This is a very important and novel result, since it is the first comparison tool I have seen in the literature and the result is not intuitive. It would be interesting to go further in this study and try to have a study with more participants.

## 2 COMMENTS

The design decision most impressed me is that a 3D visualization has been excluded a priori since the authors claim that "the clutter and complexity of the visual encoding in these spatial/volumetric representations makes it difficult to perform accurate weighted edge comparison tasks". Moreover, writers state that the vast majority of neuroscientific task can be fulfilled using a 2D representation and that the third dimension could be misleading in the interpretation. This is a quite strong statement and it makes me remind what Tamara Munzner said about the third dimension. She claimed that the third dimension should be strongly motivated, because it is not true that having three dimensions is always better than having just two of them. So, in my Connectome project I should understand the relevant aspects that could reasonably motivate the choice of a 3D rendering. In my opinion, an interesting kind of visualization for the dataset I am dealing with would be to integrate and coordinate together 2D and 3D visualization. I have not found yet a general visualization paper that talks about the combination of different views on the same model at the same time. To me seems reasonable, because in that way would be possible to have different levels of abstraction in the same view.
The main aspect less clear to me was the choice of using an artificial dataset. Since they are focusing their study on weighted graph taken from connectomics studies, it would have been interesting to understand which the best comparison visualization was with a real dataset.