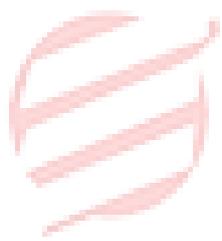


**PAPER REVIEW**



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## **Chosen article: “Graph Visualization and Navigation in Information Visualization: A Survey”**

### **Introduction:**

The current assignment focuses on reviewing an article named “**Graph Visualization and Navigation in Information Visualization: A Survey**”. The main focus of the review is to find out the problems associated with graph visualization and different types of layouts in graph visualization. Further, the techniques used for navigation of graph visualization are also taken into consideration.

### **Analysis:**

#### **Definition of graph visualization and issues with it:**

Graph visualization is defined as the process of representing structural information into diagrams. In the chosen article, graph visualization is described as a file hierarchy in a computer system (Demenev *et al.* 2012). In case of representing structural data into diagrams, there are certain issues that are inherent with it.

The main issue encountered with graph visualization is the size of the diagram to view. In most of the cases, large diagrams create issues for the performance of the diagram whereas it reaches to the limits of the viewing platform. On the other hand, in large diagrams, even after identifying the layouts of the image and displaying it properly, it creates problem in the usability as it becomes difficult to differentiate between the edges and nodes. However, for a small sized graph, it becomes easier to comprehend whereas for larger images, the issue of comprehension of the data becomes difficult even though it makes it possible to display the entire structure of data. Thus, it becomes clear that the main issue of graph visualization is the size of the diagram. It is easier to display data in small images than large images even though most of the images come as large images.

#### **Tree layouts and its categorization as per the article:**

The chosen article identified different types of tree layouts. It has described tree layouts as classical tree layouts, spanning trees, 3-D tree layout as well as horizontal tree layouts of

diagrams. However, these four types of tree layouts can be categorised in three sections, traditional or classical, tree spanning and horizontal 3-D tree layout.

The traditional layout has different elements in it mainly H-tree layout, radial layout and balloon layout. These three types of tree layouts are categorised into the traditional form as they are the first tree layouts used for data visualization. Further, due to the applicability of these three layouts as none or less hierarchical, they can be defined as the classical ones. The spanning tree has become an important tree layout in comparison to the traditional tree layout. The main reason for combining 3-D and hyperbolic layout is that by using 3-D graphing, hyperbolic tree layout is able to represent data in proper manner.

#### **Technical features of the tree layouts identified:**

The main technical feature of the traditional tree layout is that it has the capability to present structural data into top-down side. Further, it has the capability to present data into left-to-right tree layout. Further, the structural data for image visualization can be put to present in grid-like positioning. By this way, it becomes possible to draw images in less hierarchical manner.

In case of the spanning trees, the main technical feature is that it spanning trees use all nodes of a graph to visualise the data properly. Further, for making a spanning tree, it is important to visit the nodes of graph by using breadth first search whereas collecting the edges for forming the tree.

The main technical feature of the hyperbolic tree is that it uses the 3-D technology for displaying data into tree layout. Apart from 3-D, it can also be implemented into 2-D technology. The hyperbolic tree layout uses interaction in mind for representing data.

#### **Advantages and disadvantages of the approaches:**

The main advantage of the classical tree layout is that it helps in reflecting the intrinsic hierarchy of the data visualised. Further, it takes low small size for visualise the data with different layouts. Further, with the help of classical tree payout presentation, it becomes easier to explore the graph with the help of less hierarchical manner. However, one of the most persisting problems is that in classical approaches it is difficult to perceive the structure of the data in this approach. Further, the traditional approach requires testing of several hundred nodes or planetary which is a huge issue for the traditional approach. Therefore, it

can be said that in terms of human cognition and aesthetic rules, this approach might create difficulty whereas for space utilisation and computation cost, it creates efficiency.

As far as spanning tree is concerned, it also uses less size for image visualization of structural data. Spanning tree uses all nodes of a graph which is extracted from the actual graph in case of traditional approach. Further, spanning trees use weight functions to bring out different layouts of the same graph with different weight. It tends to use 3-D for visualization. However, it creates problem in visualising the graph as nodes and edges in the graph collude with each other in a 3-D setting. Therefore, it can be said that in spanning trees, even though, computing cost, aesthetic rules and space utilization, this method is proper. However, for human cognition, it is a disadvantage factor.

In case of hyperbolic tree layout, it is useful for create distorted view of an image. Further, the distorted view of the image helps in real life applications viewing, especially for large trees. However, it is a matter of fact that in image visualisation, very few know the hyperbolic tree layout due to its mysterious and complex background. Therefore, it can be said that the computing cost as well as aesthetic rules and human cognition is difficult through this approach.

#### **Navigation techniques identified in the article:**

There are mainly three types of navigation techniques identified in the article. They are zoom and pan, focus+context technique and incremental exploration.

These navigation techniques are categorised in their very three techniques identified. From the review of the techniques, it is identified that the navigation techniques are subdivided, especially the focus+context technique. The main reason why the categorisation is intact as seen in the article is that there no other navigation techniques that can be described better than the article. The zoom and pan technique helps in navigating a graph in both geometric and semantic way whereas the focus and context technique makes it useful to navigate graphs in a more clear context. The incremental one categorised as one of the most important due to its ability to display images as required.

### **Main technical features of the navigation techniques:**

The main technical feature of zoom and pan is that of its ability to explore large images with the help of geometric and semantic zooming. It readjust the screen contents by transforming and adjusting the screen.

The main technical feature of the focus+context technique is that it complements the technique of zoom and pan by making it more useful (Ware, 2012).

The third category incremental technique has the main feature of adjusting web based content.

### **Advantages and disadvantages of the navigation techniques:**

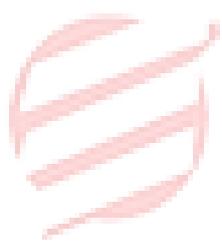
The main advantage of zoom and pan technique is that it allows zooming a graph both in geometric way and semantic way. Even though the geometric blow up the content in a graph, the semantic technique adjusts the screen resolution and shows a clear picture of the graph. However, one disadvantage is that zoom and pan creates problem for usability as all contextual information is lost. Therefore, it can be said that for human cognition and computational cost, it creates credible situations though for real time response, it is not useful as images are entirely distorted.

As far as focus+context technique is concerned, the main advantage with it is that it helps the zooming and pan more suitable to focus on objects that require more detailing whereas other portions of content in less detail. However, this technique uses general curve for focusing on the objects which the standard graphics system might not be able to focus on. Therefore, the real time response even though higher, it includes high computing cost whereas human cognition is also low.

The third category which is incremental navigation technique has become one of the most important navigation techniques. It allows the users to focus on a single portion of a large graph whereas the other parts of the graph can be focused and zoomed as required. It provides detail information about a graph. The World Wide Web is a good example where this technique is being in use. However, one problem is that if the same logical algorithm is not used for every single frame, the use of this navigation technique creates problem like as saturation of the image content.

**Conclusion:**

Thus, from the above analysis and review of the chosen article, it is clear that both navigation techniques and graph visualization are linked with each other. No graph visualisation can be able to fulfil the purpose of displaying structural data in the form of image if there is no navigation technique. In this context, the graph visualisation techniques, especially tree layouts and navigation techniques identified are important for providing clear representation of data. Even though there are classical or traditional methods exists, with the new technology coming, the use of new tree layout methods like hyperbolic layout and navigation technique like incremental exploration might replace the existing ones in near future.



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