# Visualizing Multidimensional and Multivariate Data in Radial Layouts: A Survey

Gabriel Zhou gabriel_zxs@outlook.com

## Introduction

Radial layouts have a lot unique and interesting characteristics like inherently cyclic, integrated length and angle channel, which makes it one of the most flexible visualization methods out there. Its popularity can be seen from widespread visualization idioms with radial layouts presenting various data types like hierarchical structures (trees) and networks. On the other hand, with the rapid development of computing and sensing technologies, the available number of data continuously grows. Visualizing these data is critical for further study and analysis. However, high dimensionality has always been a big challenge in data visualization. What about using radial visualization layouts to present multidimensional and multivariate data? I believe with the prominent properties of radial layouts, some amazing interactions can be generated between them. In this survey paper I want to look into the application of radial layouts on multidimensional and multivariate data. What are the strengths of such combination and what are the limitations? Is it a more preferred method for these types of data than others? What are some of the available applications used in different fields and how effective they are? Does it have the potential to even advance in the future?

## Related Works

Although the term “radial visualization” has been mentioned as early as in 1997 by Hoffman et al [3]. It was not considered as a unique visualization methodology until the survey paper done by Draper et al. in 2009 [1]. Draper and his colleagues provided a comprehensive overview of radial visualization as a distinct visualization technique. The paper traced down the origin and history of radial visualization, examined the domains and patterns of recent radial visualization works, and gave out some notes for designers when creating a radial layout visualization system. Although Draper et al. did a splendid job on summarizing the status of radial visualization at that time, one decade has passed and the scope of radial visualization has certainly grown as well. I will address some significant progresses in the past ten years and provide state-of-art information about radial visualization. Moreover, Draper’s work presented a very general guideline of applying radial visualization, while my proposed survey paper would contract the scope and focus on the application of radial visualization on multidimensional and multivariate data, a topic few have studied on.

Similarly, a few comprehensive survey papers on the visualization of multidimensional and multivariate data have been done to create an overview of current techniques [2][4]. However, they either mainly talks about pre-processing of high dimensional data to reduce its complexity, or just barely mentioned radial layouts as one of the valid visualization methods to present these data.

## Milestones

- Nov 12: Search potential papers that are related to this topic. An excess amount of papers than needed is ok for this stage. The papers should at least concern one of these three subfields of visualization: Multidimensional Data, Multivariate Data and Radial Visualization. Briefly read through all the collected papers to get an idea of their focuses and contributions. Discard papers that produce insufficient or repetitive information and start reading on filtered out papers. (10 hrs)
- Nov 19: Read all filtered out papers thoroughly. Highlight significant sentences for potential citation. Try to write a summary for each paper for future references. Meanwhile, generate a rough framework for the survey paper and start writing. (30 hrs)
- Dec 3: Try to finish all the readings and get a draft of the paper done. (30 hrs)
- Dec 10: Use the time to refine the paper. Cut or add content when it is necessary. Also, prepare the presentation. (20 hrs)
- Dec 13: Finish the write up. (10 hrs)

## References

[1] G. M. Draper, Y. Livnat, R. F. Riesenfeld, "A survey of radial methods for information visualization", IEEE Transactions on Visualization and Computer Graphics, vol. 15, no. 5, pp. 759-776, September 2009.

[2] X. He, Y. Tao, Q. Wang, et al. “Multivariate spatial data visualization: a survey”. J Vis 22: 897, pp. 897-912, 2019.

[3] P. Hoffman, G. Grinstein, K. Marx, I. Grosse, and E. Stanley, “DNA Visual and Analytic Data Mining,” Proc. Eighth Conf. Visualization, pp. 437-ff., 1997.

[4] A. Maalej, N. Rodriguez, O. Strauss, “Survey of multidimensional visualization techniques”, CGVCVIP’12: Computer Graphics, Visualization, Computer Vision and Image Processing Conference, pg. N–A