

Accepted Manuscript

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PII: S1045-926X(17)30192-1
DOI: [10.1016/j.jvlc.2017.10.003](https://doi.org/10.1016/j.jvlc.2017.10.003)
Reference: YJVLC 815

To appear in: *Journal of Visual Languages and Computing*

Received date: 1 September 2017
Accepted date: 14 October 2017

Please cite this article as: Zhiguang Zhou, Zhifei Ye, Jiajun Yu, Weifeng Chen, Cluster-aware Arrangement of the Parallel Coordinate Plots, *Journal of Visual Languages and Computing* (2017), doi: [10.1016/j.jvlc.2017.10.003](https://doi.org/10.1016/j.jvlc.2017.10.003)



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Cluster-aware Arrangement of the Parallel Coordinate Plots

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Abstract

The dimension ordering of parallel coordinate plots has been widely studied, aiming at the insightful exploration of multi-dimensional data. However, few works focus on the category distributions across dimensions and construct an effective dimension ordering to enable the visual exploration of clusters. Therefore, we propose a cluster-aware arrangement method of the parallel coordinate plots and design a visualization framework for the multi-dimensional data exploration. Firstly, a hierarchical clustering scheme is employed to identify the categories of interest across different dimensions. Then we design a group of icicle views to present the hierarchies of dimensions, the colors of which also indicate the relationships between different categories. A cluster-aware correlation is defined to measure the relationships between different attribute axes, based on the distributions of categories. Furthermore, a matrix map is designed to present the relationships between dimensions, and the MDS method is employed to transform the dimensions into 2D coordinates, in which the correlations among the dimensions are conserved. At last, we solve the Traveling Salesman Problem (TSP) and achieve an automated dimension ordering of the parallel coordinate plots, which largely highlights the relations of categories across dimensions. A set of convenient interactions are also integrated in the visualization system, allowing users to get insights into the multi-dimensional data from various perspectives. A large number of experimental results and the credible user studies further demonstrate the usefulness of the cluster-aware arrangement of the parallel coordinate plots.

Keywords: multi-dimensional data, parallel coordinate plots, hierarchical clustering,

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