RadialViz: An Orientation-Free Frequent Pattern Visualizer

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Abstract. Frequent pattern mining algorithms aim to find sets of frequently co-occurring items. Visual representation of the mining results is more comprehensible to users than the traditional long textual list of frequent patterns. Existing visualizers mostly show frequent patterns as graphs in a two-dimensional space with (x, y)-coordinates. Nowadays, in a collaborative environment, it is not uncommon for users to have face-to-face meetings when they show the graphs visualizing frequent patterns. In these situations, the viewing orientation of the graphs plays an important role as different orientations positively or negatively impact the graph legibility. A legible right-side-up graph to one user may become an illegible upside-down graph towards another user. In this paper, we propose a visualizer that uses a radial layout—which is orientation free—to show frequent patterns. Having such a visualizer is beneficial in the collaborative environment.

Keywords: Visual data mining, association analysis, frequent itemsets, human-machine interaction, pattern discovery.

1 Introduction

Frequent pattern mining [1] finds implicit, previously unknown, and potentially useful information in the form of sets of frequently co-occurring items or events (e.g., merchandises in a store, courses offered at a university). It plays an essential role in many knowledge discovery and data mining tasks. A common characteristic of these tasks is the identification of the frequencies of items, or sets of items, from datasets. For instance, a store manager may want to identify merchandise items that are frequently purchased together so as to place the items closer to each other (to reduce the distance required to travel by the shopper) or further apart (to encourage more purchase of items placed in between those frequently purchased ones). Similarly, a university administrator may want to know the collection of popular courses taken together by students in a semester (for lecture scheduling and exam scheduling). A book seller may want to recommend bundles of popular books to readers.

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(a) Right-side up

(b) RHS (90° rot.)   **(c)** Opposite side (180° rot.)   **(d)** LHS (270° rot.)
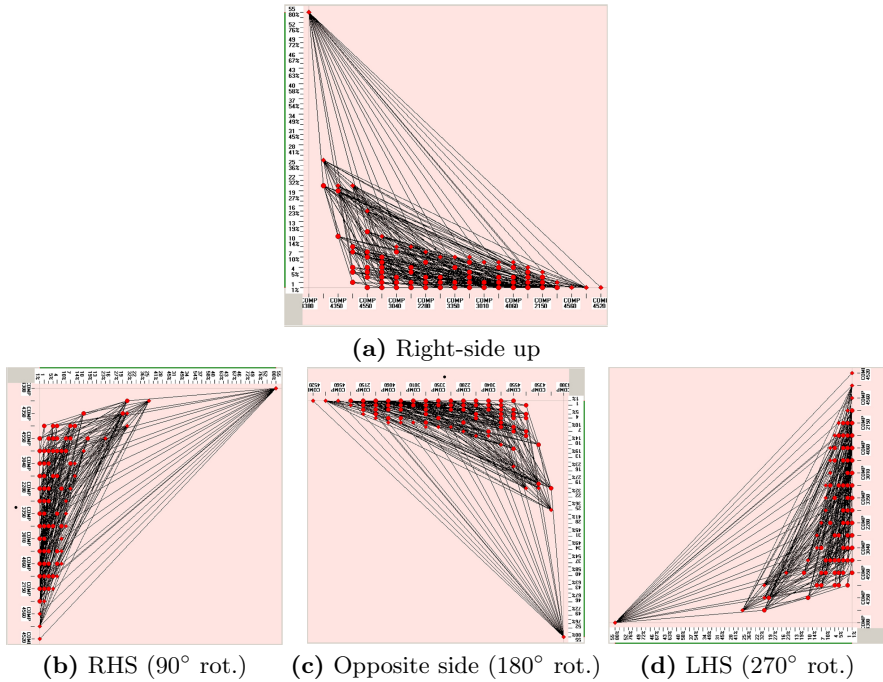
Fig. 1. Viewing frequent patterns with FIsViz [16] at different orientations

Over the past two decades, data mining researchers have designed and developed numerous frequent pattern mining algorithms. However, many of these algorithms have been focused on either functionality or efficiency. These algorithms usually return the mining results in textual form (e.g., a very long list of frequent patterns). Consequently, users may not easily comprehend the knowledge and useful information from the textual list. Conversely, visual representation of these patterns would be more comprehensible to users. However, not too many visualization tools have been developed to support frequent pattern mining. A common characteristic among the visualizers that were designed to support frequent pattern mining (e.g., FIsViz [16], PowerSetViewer [19]) is that they display the mined frequent patterns in a traditional two-dimensional rectangular space. For instance, FIsViz lists domain items on the x-axis, shows frequency values on the y-axis, and visualizes frequent patterns as polylines drawn on this two-dimensional rectangular space with (x, y)-coordinates. As such, the orientation of the graph displaying the patterns plays an important role in legibility of the graph. Consider a situation in which two users are facing each other and are discussing the frequent patterns shown on the graph (e.g., a marketing analyst was asked by a store manager, who sits on the opposite side of a table, to discuss the sets of merchandise items that are frequently purchased by shoppers). When showing frequent patterns in the graph as supporting evidence, it may be right-side up to the manager (e.g., as shown in Fig. 1(a)) but upside down to