Chapter XIII
User Interface Formalization in Visual Data Mining

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ABSTRACT

Despite the existence of various data mining efforts that deal with user interface aspects, very few provide a formal specification of the syntax of the interface and the corresponding semantics. A formal specification facilitates the description of the system properties without being concerned about implementation details and enables the detection of fundamental design issues before they manifest themselves in the implementation. In visual data mining, a formal specification can enable users to decide which interaction/operation to apply to get a desired result; help users to predict the results of their interactions/operations with the system; and enable the development of a general interaction model that designers/developers can use to understand the relationships between user interactions and their compositions. In this work, we describe an approach for formalizing the visual interface of a core data mining system, which has been employed in the development of a visual data mining system named VidaMine.

INTRODUCTION

In this day and age, data still present formidable challenges to effective and efficient discovery of knowledge. It should be acknowledged that a lot of research work has been and is being done with respect to knowledge discovery (KD). Much of the work has concentrated on the development and the optimization of data mining algorithms using techniques from other fields such as artificial intelligence, statistics, and high performance computing (Fayyad, Piatetsky-Shapiro, & Smyth, 1996b). Besides various glaring issues (such as the need to have an overall framework that can
In information visualization, various specifications/models for characterizing visualization aspects have been proposed such as (Baudel, 2004; Chi & Riedl, 1998; Chuah & Roth, 1996). In fact, it does turn out that most of the efforts that are related to our work are mainly found in information visualization and exploration efforts rather than in core data mining. Some of the benefits of specifications/models such as the foregoing do apply to visual data mining as well, where visualization tends to be a key ingredient. Consequently and borrowing from Chi et al. (1998), a similar formal specification in visual data mining can: enable users to decide which user interaction/operation to apply in order to get a desired result; help users to predict the results of their interactions/operations with the visual data mining system; and enable the development of a general interaction model that designers/developers can use to classify and understand the relationships between user interactions and the composition of interactions. In fact, such a model could help eliminate errors caused by other imprecise or incorrect models. In this work, we describe an approach for formalizing the visual interface of a core data mining system. The proposed approach has been employed in the development of a visual data mining system named VidaMine.

**BACKGROUND**

**Knowledge Discovery**

Knowledge discovery (KD) may be defined as the process of identifying valid, novel, potentially useful, and ultimately understandable models and/or patterns in data (Fayyad, Piatetsky-Shapiro, Smyth, & Uthurusamy, 1996a; Fayyad et al., 1996b). On the whole, the knowledge discovery process may be defined as an interactive and iterative non-trivial process that entails various phases as seen in Figure 1.
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