Chapter 52
Geographic Visual Query Languages and Ambiguities Treatment

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ABSTRACT

The main issues of spatial databases and Geographic Information System (GIS), concern the representation, the management and the manipulation of a large and complex number of spatial objects and spatial relationships. In these systems many concepts are spatial and, therefore they are intrinsically related with a visual representation, which makes also easier to formulate queries by non-expert users. The main problems in visual query languages for spatial databases concern imprecision, spatial integrity and ambiguities in query formulation. Our concern in this chapter is with the ambiguity of visual geographical queries. In particular, a review of existing visual query languages for spatial databases and their classification on the grounds of the methodology adopted to resolve the ambiguity problem are provided.

INTRODUCTION

Spatial databases and Geographic Information System (GIS) represent, manage and manipulate a large and complex number of spatial objects and spatial relationships.

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Visual queries for spatial databases can be expressed using one of the following four approaches. The first approach uses predefined icons to retrieve pictorial information. Examples of languages that use this approach are: Cigales (Calcinelli and Mainguenaud, 1994), the language defined by Lee and Chin in (1995) and the card-based language proposed by Ju et al. (2003). The second approach specifies spatial relationships by freehand drawing. Sketch (Meyer, 1993) Spatial-Query-By-Sketch (Egenhofer, 1997; Blaser and Egenhofer, 2000), VISCO (Wessel and Haarslev, 1998), GeoPQL (Ferri and Rafanelli, 2005; Ferri et al., 2004) and, finally, the language proposed by Erwig and Schneider (2003), belong to this approach. The third approach uses symbolic images for representing a set of objects and a set of spatial relations among them. Languages that belong to this approach are Pictorial Query By Example (Papadias and Sellis, 1995), SVIQUEL (Kaushik and Rundensteiner, 1997), and the language proposed by Rahman et al. (2005). Finally, the fourth approach combines text and sketching in a hybrid solution, such as the language proposed by Szmurlo et al. (1998).

The main problems in visual query languages for spatial databases concern imprecision, spatial integrity (Favetta & Laurini, 2001) and ambiguities in query formulation. Some authors have proposed solutions to resolve ambiguities. For example, Favetta and Aufaures-Portier (2000) proposed a taxonomy for classifying different types of ambiguity during query formulation. They state that the best solution for ambiguities is a hybrid language (textual and visual) with a more intensive dialog between user and system.

Lbath et al. (1997) have proposed to resolve ambiguities through a standard for semantics using specific menus. They argue that it is possible to define the interpretation for the query and suggest a hybrid visual language named Aigle-Cigales, in which the system works with default semantics. Details should be explicitly mentioned through a specific contextual menu or by textual format.

Since ambiguity can represent a restriction for visual languages, it is very interesting to analyze several language proposals and classify them according to the methodology used to resolve the problem of ambiguity. A first group of languages, such as Pictorial Query By Example and SVIQUEL, faces ambiguity by allowing the use of a few operators and/or spatial relationships. A second group disambiguates language through the use of actions in query formulation by modifying the query semantics. The iconic language defined by Lee and Chin (1995) belongs to this group. A third group of languages tries to increase the user's ability to formulate more complex queries by the use of several operators without facing the ambiguity problem. Languages that belong to this group are Cigales and LVIS. A fourth group of languages proposes approximate solutions as well as the exact answer to the query enabling the user to select what he/she requires. Sketch and Spatial Query By Sketch are part of this category. Finally, a fifth group of languages, such as GeoPQL, resolves ambiguities by introducing special new operators to manage them.

This chapter is structured as follows. Section 2 gives a brief overview of the approaches used for the definition of visual querying for spatial databases. Section 3 illustrates problems about ambiguity treatment in these kinds of visual languages. In section 4 a classification of different languages on the grounds of methodology adopting to resolve the problem of ambiguity is proposed. Section 5 presents some future perspectives on the growth of visual languages for spatial databases and conclusions.

VISUAL QUERY LANGUAGES FOR SPATIAL DATABASES

Several proposals of visual languages for geographic data exist in the literature. The following discussion expressed in detail the classification of the languages presented in the introduction. To conceptually represent geographic objects, different visual query languages consider three types of symbolic graphical objects (SGO): point, polyline and polygon.

The first approach uses predefined icons for retrieving pictorial information. The shortcoming of this method is that the predefined icons do not have strong expressive power, and the consequent query capability is limited.