Supporting User Views With Multidimensional Trees

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ABSTRACT

Large collections of information have to be structured to be usable. Users structure information hierarchically, the resulting hierarchies being both user- and task-specific. Traditional structuring techniques often fail to support these. We try to support the use of individual conceptions of the information space with a general structure. We also try to minimize the number of forced decisions in the user's decision tree.

Keywords

Information structure, information space, user-specific views, task-specific views, multidimensional trees

USER- AND TASK-DEPENDANT VIEWS

When building up knowledge, humans utilize hierarchical structure to organize information [1,3,4]. The form of these structures depends on the learning context and the task at hand [5]. The same information can be represented by different structures, created by different users or with different tasks in mind. These user- and task-dependant views have to be supported by information systems.

Often, users cannot specify exactly what they are looking for. To support this, information systems need to provide the opportunity for users to interactively narrow their search specifications.

PROBLEMS OF TRADITIONAL APPROACHES

Different structures have been used to support the search for information. The most prominent examples are trees and searching machines.

Trees

Trees support the interactive search for not fully specified information. But since the classification in done only once at creation time by the system designer, the hierarchical structures used by the user and the system often differ. This has several implications: Firstly, the user may be forced to make decisions he isn't ready to make. Secondly, he may want to choose a category the system does not offer yet. Thirdly, if a strict tree is used, item that are categorized differently by user and system may not be found. Trees with a great number of information items tend to be deep and slow to navigate..

Searching Machines

Searching machines, on the other hand, offer a direct way to a search target, they are fast and most useful for well-known domains. But since they require the use of a pre-defined vocabulary, do not convey any structural information and do not support the interactive search for not fully specified information, they are not adequate for most other search tasks.

USING MULTIPLE DIMENSIONS TO STRUCTURE INFORMATION

We try to avoid the problems of both trees and searching machines by supporting

- incompletely specified search targets
- individual decision trees
- the search for not fully specified information..

Structuring Method

We do this by structuring the information along several orthogonal dimensions. These dimensions correspond to independent attributes of information elements. For each dimension, a multitree [2] is used to hierarchically structure the information and at the same time provide support for "fuzzy" category members.

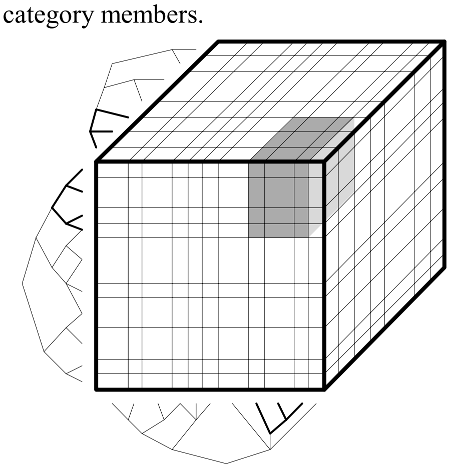

Figure 1. 3-dimensional information cube. Selection in multitrees is used to hierarchically select part of the elements.

The Resulting Structure

Thus, the structure can be described as a multidimensional cube with a multitree allowing access in each dimension. By offering the choice between different dimensions of decisions we ease the problem of forcing the user to make unwanted decisions. On the other hand, he can himself choose the time when to make a selection in one of the given dimensions. The use of multitrees makes it possible for an information item to belong to several categories, thereby creating additional access paths. By narrowing the selection step by step, always choosing the appropriate dimension, the user can interactively search for not fully specified information..

A VERY SIMPLE EXAMPLE

An information set contains information about several geometrically formed things. There are red and blue, rectangular and roundish objects. Access to this information would traditionally be structured via a tree. This tree could take two very different forms (see fig. 2). If a user with the first tree in mind encountered a system with the second tree implemented, the user could not make the decision he wanted (red or blue) and would instead be forced to use the system's categorization scheme (rectangular or roundish).

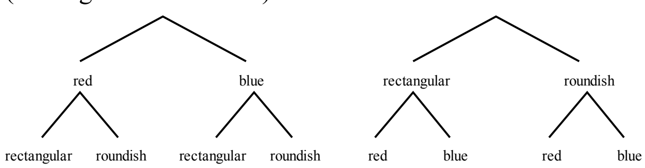

Figure 2. Different cognitive structures for sample objects.

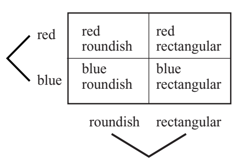

Figure 3. 2-dimensional structure for the very simple example.

Using our structure, color and shape would be identified as two independent attributes. The information would be organized along two dimensions representing color and shape (see fig. 3). The system would accept input in both dimensions, thus enabling the using to choose the appropriate dimension. This also allows for an overview of all information items that fit an incomplete specification (e.g. all red objects).

DEMO APPLICATION

We have implemented a catalog as a demonstration application (see *http://www.stud.uni-hamburg.de/flea*) with four independent dimensions.

CONCLUSION

Different user- and task-dependant views on information can be supported by a general structure. By ordering the information along several dimensions the user gets more freedom for the domain of his next decision. By using multitrees to access the information, support for an interactive step-by-step selection process is provided, allowing several paths to a search target.

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