

# VisMeB: A Visual Metadata Browser

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**Abstract:** The video-paper describes a java prototype of a generic visual information retrieval system called VisMeB, developed to visualize metadata within various contexts. We reconsidered common visualization strategies and applied them to different domains. The system we describe offers visual assistance in exploring large amounts of datasets from different application domains like geographical metadata, movie databases and the Web. The video demonstrates a scenario using a movie database.

**Keywords:** Visual Information Retrieval, Metadata Visualization, ScatterPlot, SuperTable

## Introduction

To ease the visual information retrieval process we joined different proven and elaborated visualizations and filter techniques in a single system, called *VisMeB – Visual Metadata Browser*. A *ScatterPlot* in combination with a so called *SuperTable* is used to facilitate the process of finding relevant information in an intuitive yet multifunctional way. *Browser*- and *CircleSegmentView* (a kind of query preview) complete the system. The *SuperTable* is developed in two different versions – as a *Level*- and as a *Granularity*-Table. Visual Filters and the interaction between the visualizations play an important role in this context. Although specific visualizations can handle only a specific type of data (e.g. bars are applied to display a number, not a text) the application domains are nearly unlimited. VisMeB includes a configuration and assignment tool, which allows an administrator to easily adopt VisMeB to different domains. An ordinary user can also use this tool to customize the visualizations to his needs. Additional information regarding theoretical aspects and usability issues of VisMeB can be found in [Klein et al 2002] [Limbach et al 2002] or [Müller et al 2003].

## 2 VisMeB – Fields of Use

VisMeB is based on Client/Server architecture (see Fig. 1). A server stores and manages the different

sessions, configurations and assignments of the visualizations. The client will be available on different devices like workstations, TabletPCs or PDAs.

The VisMeB framework allows programmers, administrators and users to easily adopt the visualizations' look and feel, select the appropriate database and change the assignments of metadata to different visualizations. This is achieved through a visual configuration and assignment tool. The client consists of a query preview or alternatively a form based query and the set of result visualizations. The result visualizations are either table based or scatter plot based (additionally there exists a browser view that displays various metadata sets as a whole). The different views of the result set are tightly coupled.

The possibility to filter the result set is given through a movable visual filter. The filtering is tightly coupled to the result visualizations.

To start a search on the database, the user can use a query form (the look and feel depends on the application domain) or the query preview functionality to restrict the result set of data, which will be analyzed to an agreeable size.

The *SuperTable* or the *ScatterPlot* in combination with the *BrowserView*, just as requested, will be used to explore the result set. In this stage the user can use the functionality of a visual filter to further focus on the result set.

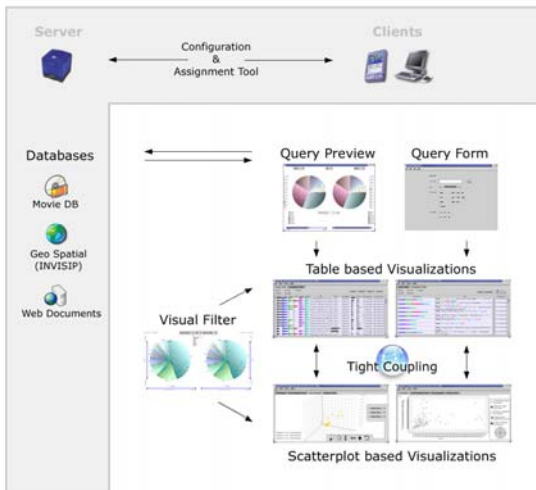


Figure 1: Components of VisMeB.

### 3 SuperTable

Two design variants of the SuperTable were implemented. Each design study of the SuperTable itself consists of a combination of different visualizations. Bar charts, TileBars, and colored highlighted text are a couple of those. The main idea behind both versions is the *granularity concept*, which enables the users to change the depth of information they are looking for. The first granularity level (low resolution) offers an overview of all documents; the last level (high resolution) shows the document itself. In between you find different levels increasing their amount of information from the first to the last level. We call this drill-down functionality “Focus of Interest” operation.

The first of the design variants is called *LevelTable*. It is also based on the granularity concept. Based on the fact that the change from one level of detail to another is only possible for the whole result set shown in the table, we called it LevelTable. To change from one level to another, users have to click on the four buttons labeled ‘Level 1’ through ‘Level 4’, which are located in the upper right corner. Pressing a button moves the whole document corpus to the corresponding level. Each metadata has its own column, but not all metadata are visible in all of the four existing level. The first level provides an overview of the documents, displaying only numerical values as bars e.g. the relevance or size. Moving a mouse over a row shifts this row to the next level (=focus) still showing all other rows in the granularity of the first level (=context). Level 2 displays numerical information about the keyword relevancies. An easy comparison about the quality of

each search term is possible here. Additional textual information is shown, in the case of the scenario the title of the movie, its language, genre, version, quality, and the reviewer of the movie. Additionally, a subjective rank given by the reviewer is displayed with a bar and a numerical value.

Level 3 introduces new, so far not viewable columns. One special feature is the ‘Relevance Curve’. It represents the data item as a whole, whereas the width reflects the data item’s length. Query relevant information in artificial text segments is marked by vertical bars whose height illustrates the relevance. This kind of global relevance distribution can only be seen in level 3 of the LevelTable. In return the ‘Language’ or ‘Genre’ columns of level 2 disappear in this stage. In accordance to our granularity idea, level 4 uses a detailed relevance curve describing the appearance of keywords in the data set availing colored stacked columns. The color conforms to the one visible in the legend of the keywords above the table.

The second design variant named *GranularityTable* differs slightly from the LevelTable. Here a slider substitutes the four level buttons as the main device to change the level of detail. The basic idea of this concept is to provide a smooth transition from the overview visualization to the actual text. In order to provide such a smooth transition more different visualizations are needed than in the LevelTable. Ideally, no distinct steps should be identifiable at all. For practical reasons, the current prototype uses only six different levels of detail. Thus a perfectly smooth transition is not provided by now. Only four columns are used to show all the information: selection, visualization, text, and the granularity slider. The visualization as well as the text column change their content from level to level, always giving more detailed information than in the previous level. In this version it is also possible to move single rows to another stage, not only the whole document corpus. Therefore the user can compare data sets arranged in different levels. The LevelTable did not offer this opportunity because of the varying number of columns in diverse levels.

Level 1 shows the whole datasets at a glance. Only the relevance bars are visible to the user. In level 2 the global relevance bar is split up into the different keyword relevancies responsible for the length. This procedure continues in level 3 by distributing the different colored bars to single rows. The text column at level 3 includes more information, e.g. title complemented by language or date. Level 4 adds the respective values to the colored relevance bars and an abstract to the text column. Keywords

are always highlighted by assigned colors. Up to this level the visualization column uses bars exclusively. This changes in level 5. Here, a vertically aligned TileBar, comparable to the detailed relevance curve in the LevelTable's level 4, replaces the horizontally aligned bars. This is admittedly a violation of the above mentioned design rational of smooth transition. This is due to a special feature integrated in the TileBar: It can be used as a specific kind of scrollbar. Each row in the TileBar represents a segment of the text. Clicking on one of the rows of the TileBar automatically scrolls the text to the corresponding position. Finally, level 6 shows each data item as a whole without visualizations, e.g. all metadata and the full text of a document

## 4 ScatterPlot

The ScatterPlot is an alternative view to the SuperTable. Our previous user tests [Mann 2002] have shown, that some users prefer to start the visual exploration of the result set with it. Others only use the table view. So we offer the users of VisMeB both alternative views and so the user can decide himself whether to use the ScatterPlot or the SuperTable or even both of them. The ScatterPlot is a two-dimensional coordinate system enhanced by the possibility to associate the x- and y-axis with every kind of metadata used in the current context. It eases the comparison of data item properties, for example year, language or rank.

The change of axis alignments can be done by a popup menu, opened by the right mouse button or by clicking on the respective axis. If the ScatterPlot is used together with the SuperTable a tight coupling via brushing and linking is very important. Additional features of the ScatterPlot are moveable filters and distortion techniques.

To provide the possibility of seeing a selected data item at a glance or to compare them, a BrowserView has been integrated. Multiple data items can be arranged in this view, which facilitates the comparison of for example interesting movies not only by metadata but the data itself. The text is displayed as html-text, so it is possible to use an underline, bold or colored text.

## 5 Interaction Techniques

Using the SuperTable and ScatterPlot together enables the user to get a general idea of the entire result set as well as the possibility to explore interesting documents in detail. To reach this goal both visualizations are tightly coupled, using

*brushing and linking*, e.g. marking rows in the SuperTable marks the respective data points in the ScatterPlot.

The *Moveable Filter* of the ScatterPlot affects the SuperTable as well. Data items that are visible through the filter, take the filters color in the SuperTable. It is possible to use different lenses simultaneously, which made it necessary to add half-transparent lens colors. If multiple filters apply to a data item, the color values are added on to a new color.

The BrowserView was primarily created in order to display an entire data item. It uses additional interaction features, too. The tooltip approach applied to the ScatterPlot works in a comparable way in the SuperTable. Moving the mouse over a row in the SuperTable lets the data item itself appear in the BrowserView. Furthermore a direct comparison between different data items is possible by adding them in succession to the BrowserView using a context menu, which shows up after clicking the right mouse button. Hence it is possible to change the alignment of the centralized datasets, e.g. arranging them top down or always two in a column. Another specific brushing and linking technique is used for the interaction between LevelTable, GranularityTable and the BrowserViews namely in the fourth (LevelTable) and fifth (GranularityTable) level. We divide the text as a whole in text segments. This division becomes visible if you move the mouse over a specific segment in the column 'Detailed Relevance Curve' or the TileBars: the corresponding segment text in the Browser View is colored darker. If a keyword is used in a segment, bars or tiles with the corresponding color are drawn in the visualizations. Hence it is possible to find important sections in the text in short time (considering the colored bars or tiles) even without regarding the text.

## 6 Related work

The usage of the Scatterplot was mainly inspired by the systems Envision [Nowell et al 1996], FilmFinder [Ahlberg, Shneiderman 1994] and xFIND [Andrews et al 2001]. The Tilebars were inspired by Hearst [Hearst 1995]. The SuperTable idea has been influenced by multifocal approaches using focus-plus-context techniques as found in a number of tabular data representations, for example the Table Lens [Rao, Card 1994]. The use of magic lenses and movable filters was mainly inspired by Fishkin and Stone [Fishkin, Stone 1995]. The use of bar charts for visualization of document relevance is

based on ideas from the system Inquiry [Veerasamy, Navathe 1995]. Synchronization of SuperTable and Scatterplot via brushing and linking was inspired by the work of North and Shneiderman [North, Shneiderman 2000

## 7 Outlook

Next steps will be user tests on the java prototype and a comparative evaluation between a form filling and a visual query preview interface. The 2D and a newly developed 3D Scatterplot will be compared concerning their effectiveness and efficiency, as well as the SuperTable vs. a stripped down, html-list based version of VisMeB.

## References

- Ahlberg, C. & Shneiderman, B. "Visual Information Seeking: Tight Coupling of Dynamic Query Filters with Starfield Displays, in B. Adelson, S. Dumais, J.S. Olson (Eds.), *CHI 1994: Conference Proceedings Human Factors in Computing Systems*, Conference: Boston, MA, April 24-28 1994. New York (ACM Press) 1994. p. 313-317.
- Andrews, K., Gütl, C., Moser, J., Sabol, V., Lackner, W.: "Search Result Visualization with xFIND". *UIDIS '01: Proceedings of the Second International Workshop on User Interfaces to Data Intensive Systems*, IEEE 2001
- Card, S.K., Mackinlay, J.D. & Shneiderman, B. "Readings in Information Visualization. Using Vision to Think", Morgan Kaufmann Publishers, Inc, San Francisco, CA, 1999.
- Card, S.K., Moran, T.P. & Newell, A. (1983), *The Psychology of Human-Computer Interaction*, Lawrence Erlbaum Associates.
- Fishkin, K. & Stone, M.C. "Enhanced Dynamic Queries via Movable Filters." in: I.R. Katz; R.L. Mack; L. Marks et al (Eds.): *CHI 1995: Conference Proceedings Human Factors in Computing Systems*. Conference: Denver, CO, May 7-11 1995. New York (ACM Press) 1995. p. 23-29.
- Gershon, N. & Eick, S.G. "Information Visualization" *IEEE Computer Graphics and Applications*. July/August 1997, pp. 29-31.
- Hearst, M. "TileBars: Visualization of Term Distribution Information in Full Text Information Access." in I. Katz; R.L. Mack; L. Marks et al. (Eds.): *CHI 1995: Conference Proceedings Human Factors in Computing Systems*. Conference: Denver, CO, May 7-11 1995. New York (ACM Press) 1995. p. 59-66.
- Klein, P., Müller, F., Reiterer, H. & Eibl, M. "Visual Information Retrieval with the SuperTable + Scatterplot", *6th International Conference INFORMATION VISUALISATION*, 10-12 July 2002, London.
- Limbach, T., Klein, P., Müller, F., Reiterer, H. "Visualising Metadata: Level- vs. Granularity Concept in the SuperTable/Scatterplot Framework" *HCI International Conference Proceedings*, Crete 2003
- Mann, T. "Visualization of Search Results from the World Wide Web" PhD Thesis, University of Konstanz, 2002, <http://www.ub.unikonstanz.de/kops/volltexte/2002/751/>
- Müller, F., Klein, P., Limbach, T., Reiterer, H.: "Visualization and Interaction Techniques of the Visual Metadata Browser VisMeB", to be published in *I-Know Conference Proceedings 2003*, 02-04 July 2003, Graz, Austria
- North, Christopher L.; Shneiderman, Ben: "Snap-Together Visualizations: Can Users Construct and Operate Coordinated Views". *International Journal of Human-Computer Studies*, Academic Press, 53(5), November 2000, p. 715-739
- Nowell, L.T., France, R.K., Hix D. et al., "Visualizing Search Results: Some Alternatives to Query-Document Similarity." in H.P. Frei; D.K. Harman; P. Schäuble et al. (Eds.): *SIGIR 1996: Proceedings of the 19th Annual International ACM SIGIR Conference on Research and Development in Information Retrieval*. Conference: Zürich, Switzerland, August 18 -22 1996. New York (ACM Press) 1996. p. 67-75.
- Rao, R., Card, S.K. "The Table Lens. Merging graphical and symbolic representations in an interactive focus + context visualization for tabular information." in B. Adelson; S. Dumais; J.S. Olson (Eds.): *CHI 1994: Conference Proceedings Human Factors in Computing Systems*. Conference: Boston, MA, April 24-28 1994. New York (ACM Press) 1994. p. 318-322.
- Veerasamy, A. , Navathe, S. B "Querying, Navigating and Visualizing a Digital Library Catalog" *Proceedings of the Second Annual Conference on the Theory and Practice of Digital Libraries*, 1995