

Business Transactions Analysis Based on Multiple Data Coordinated Views

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Abstract

Getting to know clients and their behavior is essential in the growing process of any company that searches for improvement and business opportunities. One of the ways to discover more about their clients' behavior is to analyze the history of their transactions with the company or partners. The amount of transactions is often huge, what demands tools that help explore and analyze data in search for patterns or outliers. The tool used in this paper is called PRISMA and is based on multiple coordinated visualization techniques. Its major goal is to enhance the user's perception about data and what is related to it, identifying problems that might occur during transactions, in order to improve or find business opportunities in them.

Keywords--- Information Visualization, Multiple Coordinated Views, Business Transactions

1. Introduction

The success of any business can be evaluated by many criteria, the major of them being client satisfaction. Sometimes client satisfaction can be translated into user satisfaction over business profit. Client satisfaction is not a simple fact, but a sequence of information and decisions about the quality of services (predict improvement of infrastructure based on client growth), offered products (defining expansion, with variety or specialty), getting to know the clients (establish client profile, what services and products they acquire and the frequency – regularly or rarely), among other things.

If criteria are known, why do so many companies have trouble achieving their goals? The analysis of large amounts of data is not a trivial task and system reports do not always answer all of the questions. Decision makers

often have not enough information because data is too summered up or they get lost in overly detailed data reports. These reports are generally static, what brings difficulties to the information relating process and time is usually a critical factor for the success of the decision to be taken.

Automating the generation of information and manipulating it in an easy and intuitive way is what every decision maker looks for. Over the last years, data mining techniques, among others, have been used to generate new business information, but manipulating and understanding the results is not always a simple task. A growing number of information visualization tools are being created to fill the blanks left by these techniques regarding data exploring and analysis, hoping to be able to shout the famous “Eureka!”.

The greatest contribution of an information visualization tool is to make it possible for the decision maker to identify the expected and discover the unexpected [1], what brings process improvement and business opportunities. For every company, knowing its business transactions is the same as to understand the behavior of their clients and the requirements to satisfy them.

The purpose of this paper is to use a multiple coordinated views tool[2][3], named PRISMA, to explore, visualize and analyze the behavior of business transactions, identifying problems that might be occurring during transactions, in order to improve or discover business opportunities in them.

This paper is organized as follows: related work of business transaction behavior analysis and information visualization; description of the tool PRISMA; description of the used dataset; discussion of the obtained results from the analysis; final remarks and future work.

2. Related Work

This section presents related work on business transactions analysis and information visualization.

Ziegler & et al. propose a technique for visualizing financial time series data based on a pixel-based paradigm which consists of a two-dimensional rectangular box model in a Cartesian coordinate system with orthogonal axes [4].

Keim & et al. presented a new technique named value-cell bar charts for visualizing large transaction datasets [5] for monitoring and analyzing business operations. The user visualizes the data based on either the number of transactions (as in pixel bar charts) or the total value of the transactions (as in traditional bar charts) to identify the transactions that are important to their business.

This work focuses the use of multiple coordinated views to support the analysis of business transactions and the identification of patterns and opportunities related to the analyzed transactions.

3. PRISMA

PRISMA is an information visualization tool based on multiple coordinated views to explore multidimensional datasets using the visualization techniques of treemap, scatterplot and parallel coordinates [6].

The main characteristics of the PRISMA are:

- Extensible, portable and easy to maintain since it has been developed in Java using design patterns.
- The graphic interface is automatically customized to data types and the range of data values in each dataset.
- The filter components are optimized for the user tasks using the same principle.
- Coordination is supported in filter, color, shape and size settings, as well as in the details-on-demand component.
- Many data sources are supported, such as relational databases, XML files and pre-formatted text files.
- Pie, bar and line graphics and automatically-generated reports are additional coordinated components.

The tool implements three information visualization techniques, each favoring a different kind of data analysis: parallel coordinates, Treemap and scatterplot [7] [8] PRISMA allows the user to analyze data either individual or simultaneously in all views.

PRISMA stores an user interaction history including manipulation and configuration data and allows the user to save the state of an explored visualization.

4. Dataset

The selected dataset contains information on electronic transactions performed by clients of a financial company during a 30-day period. The dataset includes the date, time, product, status of the transaction (successful, denied, canceled, returned and on hold), transaction_amount, account_amount, credit_amount, number_instalment.

5. Analysis Results

A growing number of companies provide their clients with a digital relationship channel through which services or products may be offered.

The analysis of these electronic transactions helps to understand the relationship between the clients and the company. Client transaction may be split into the following categories: successfully finished; denied due to a business rule; on hold; canceled by system failure; and returned (automatically or manually).

A competitive advantage may be reached by the appropriate analysis of the transactions that were refused because of a business rule. The understanding of client behavior helps to measure client satisfaction with a product or the company itself.

A denied client transaction may represent a simple and typical occurrence related to the main characteristic of the company business, such as an invalid password or insufficient amount available at the client account. On the other hand, the same transaction category may indicate an opportunity to improve the product of create a new product that is more appropriate to an specific group of clients, such as the identification of clients trying to use a product but failing to do so because of inappropriate profiles.

For example, if the average number of denied transactions is between 15% and 25% and it raises considerably in an specific month of the year, this may indicate that the clients do not have the proper information about the product or that the electronic interface is difficult to use or that a similar product should be provided for the group of interested clients.

The goal of this study is to analyze problems that may be occurring with electronic transactions and improve them or in some cases, determine the need to create new ones.

The analysis of the status of transactions (O – success, E – denied, C – canceled, R – returned and P – on hold) was based on the color associated to each status on the three views of the tool. The treemap view was organized by transaction status and error code. In the scatterplot view the axis was either the amount on the account, the requested amount of the transaction or the available credit amount. The parallel coordinates view included the transaction amount and the number of instalments. The pie chart and the treemap view point out that 70% of transactions were successful, 23% were denied, 2% were canceled by system failure or timeout

and the others totalized 1%. These were expected

percentiles confirmed by the analysis.

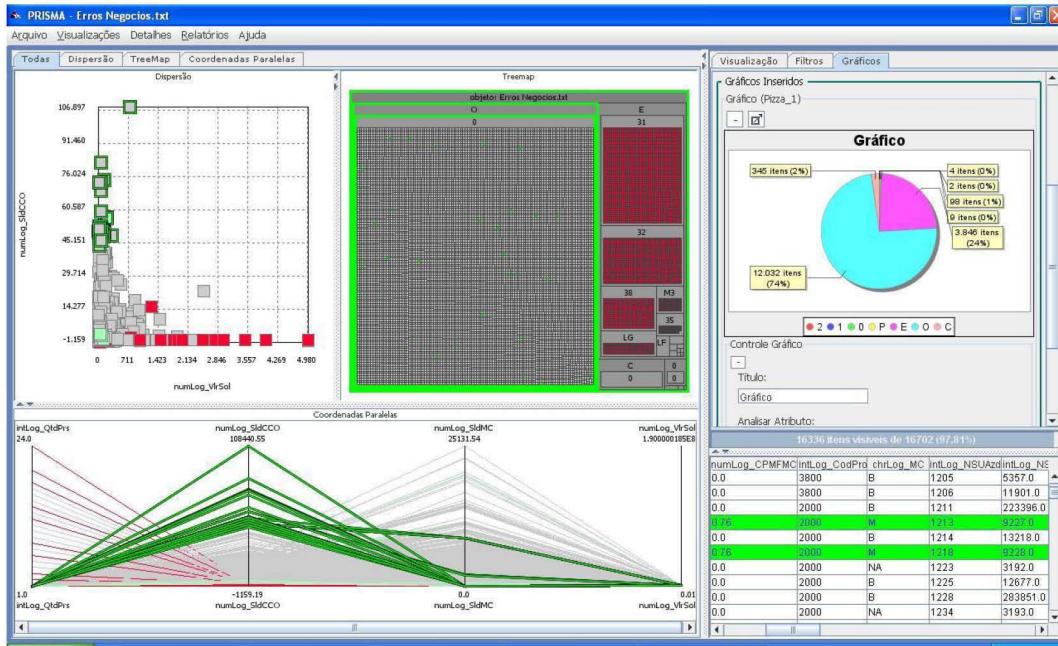


Fig. 1. Brushing technique in PRISMA

After the identification of the expected distribution of transaction status, other scenarios were explored. First, a filter selection was applied to present only denied and canceled transactions. On the treemap view the main error code was related to insufficient amount on the client's account. This perception is confirmed in the scatterplot view as highlighted in red (Fig. 2). An unexpected pattern, however, indicated a number of

denied transactions for clients with sufficient amount on their accounts (highlighted in blue). The selection of these occurrences brought the attention to error message M5 – clients were trying to perform transactions for products unavailable for their client categories. This was interpreted as a business opportunity directed to the identified group of clients.

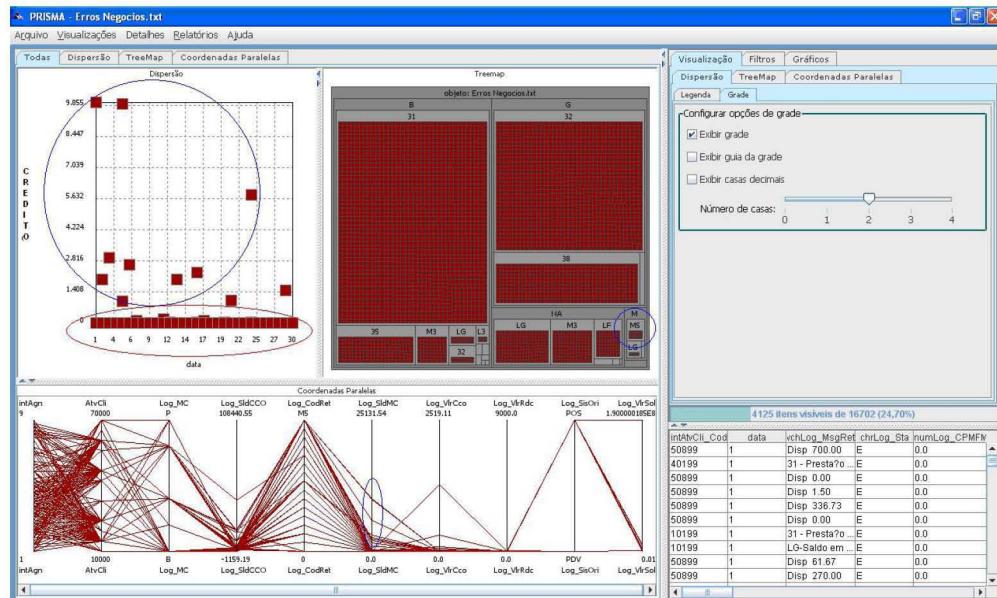


Fig. 2. Transactions with error in three views.

In a different scenario the canceled transactions were added to the visualization (Fig. 3). It was then possible to notice that these transactions although in small number are significant when the total amount is considered. For example, for a total movement of \$30.000.000 in a month, \$1.000.000 was lost in canceled transactions. This numbers raise concerns about the image of the company that may be harmed by system failures or low

performance. Additionally, the total amount available for transactions for these clients represent 12,06% of canceled transactions (Fig.3) and 2,48% of denied transactions(Fig.4). The total amount available for these clients reaches 14,54%. For a total volume of transactions of \$30.000.000 the potential volume of lost business transactions was of approximately \$4.300.000.

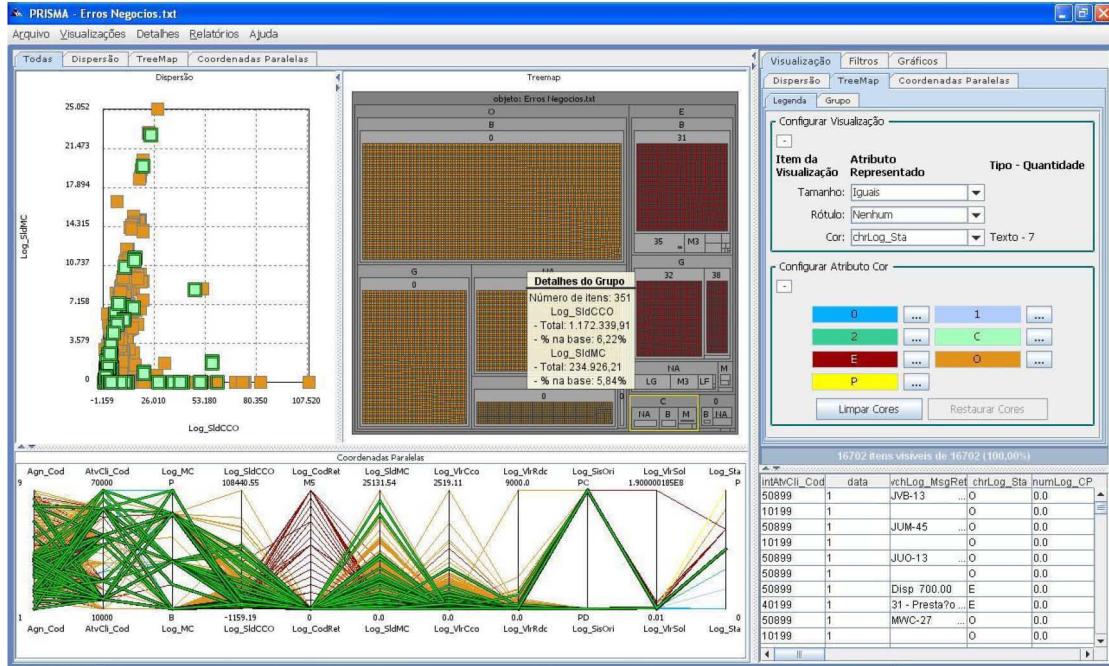


Fig. 3. Multiple coordinated view in PRISMA to detect patterns

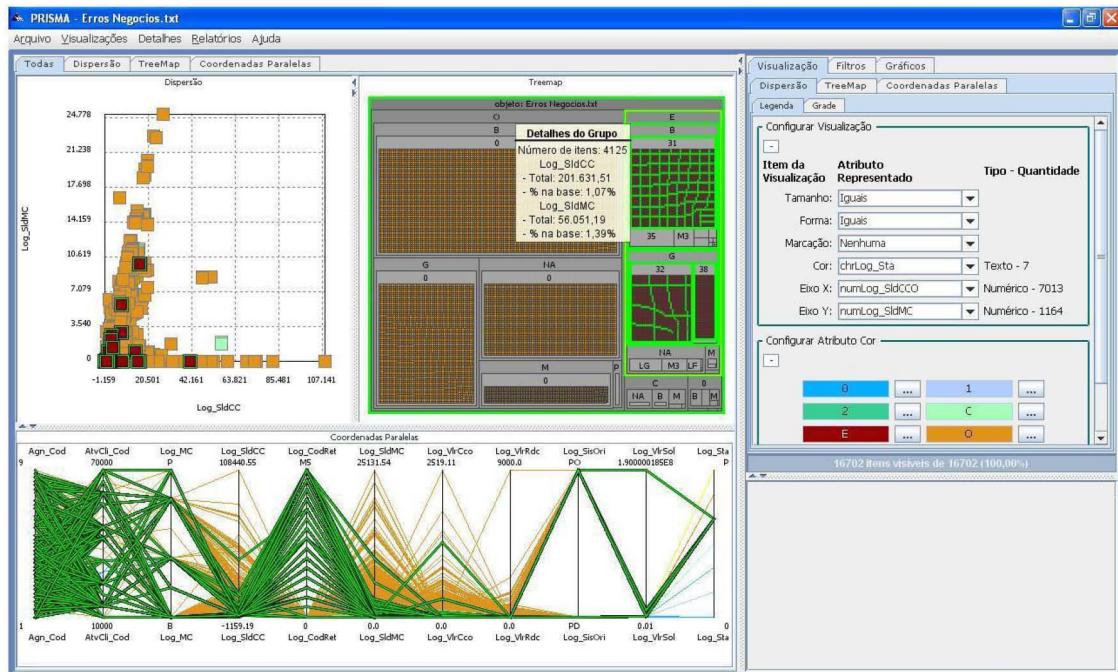


Fig. 4. Selection of transactions denied because of business rules.

The visualization was then rearranged to present treemap grouped by product and status. The attribute status was filtered to show only successful and denied transactions. An interesting pattern shows that product M is associated to 7.86% of transactions and almost no rejection (Fig.5). When analyzing the scatterplot and

parallel coordinates views it is possible to identify the potential of the associated clients. They have considerable amounts on their accounts and available for credit. Product M is therefore a prominent candidate for further promotion on the company.

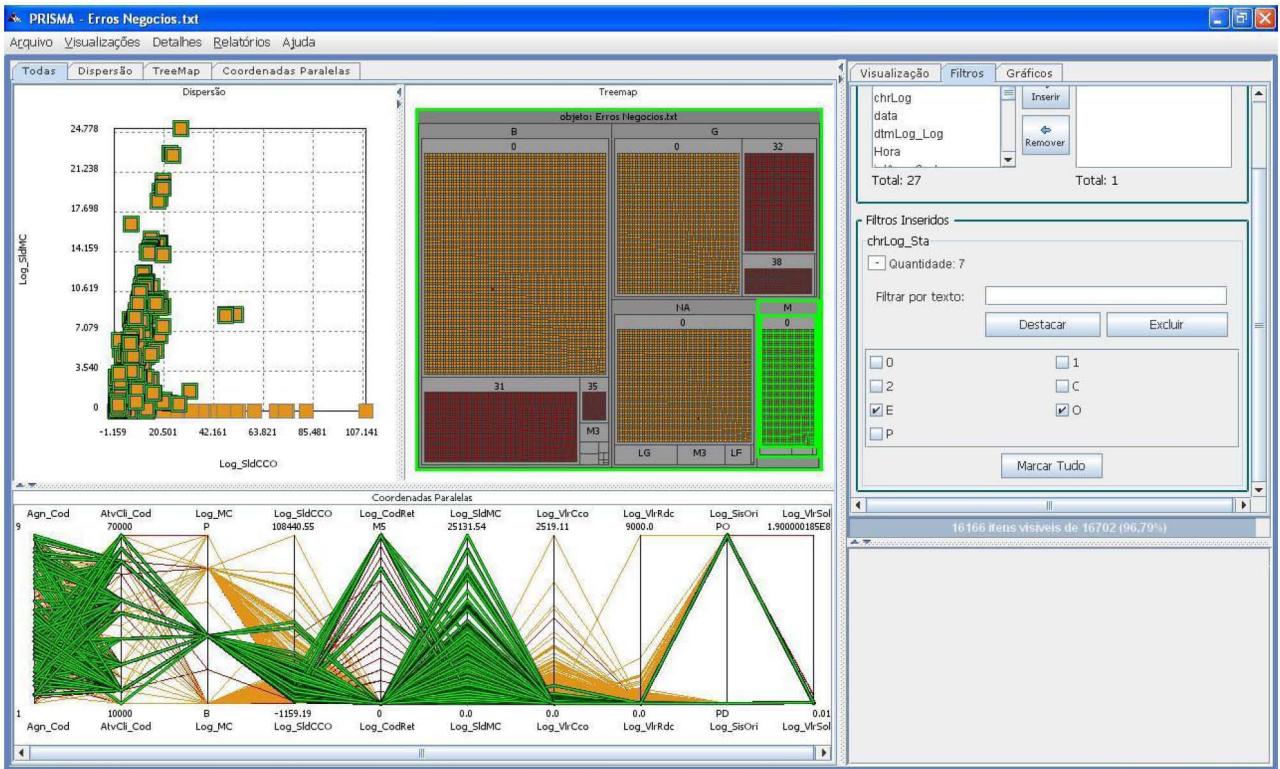


Fig. 5. Identification of a potential product for new business opportunities

Conclusions

Large companies offer a growing number of products and services to their clients through electronic channels. Information related to the complete and incomplete transactions processed by this channel is an important resource to better understand the behavior of the clients and the relationship between clients and offered products. Information visualization tools support the analysis of these large datasets. In particular, this paper focused on the use of multiple coordinated views for this task.

The use of an Information Visualization tool with the characteristics of PRISMA has proven in this study to potentially facilitate the analysis of business transactions, support the decision-making process and therefore improve the efficiency of products and services. This paper has presented how the parallel coordinates technique may be used to identify the expected

information and discover new information as a powerful tool for business planning.

The analysis focused on transactions either denied because of a business rule or canceled due to system failure or low performance. Although the transactions were correctly refused, the behavior of the clients and their transactions shown the available products were inappropriate to a typical client profile. The company has lost many business opportunities because of the lack of more appropriate products for its clients.

The technique also identified that even a small number of canceled transactions (345 items) may potentially compromise 14,5% of the total amount of transactions.

We highlight the following future developments:

- Application of the tool to different types of customer-relationship electronic transactions;
- Extensive tests for usability purposes;
- Development of new visualization techniques for business analysis;

- Support of real-time visualization and comparison of real-time data to historic data.

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