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Visualization Techniques on the Examination Timetabling Pre-processing Data

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***Abstract*- This paper follows a method to effectively provide useful visualizations to the examination timetabling problem. The results are some interactive visualization that should provide a much more sensible way of analysis, since it requires having to pay more attention for a complete understanding of the data and also, offers more data at the same time frame and space for the schools. We present the analysis we have made to effectively provide the visualization that built-in us, the *Prefuse* Visualization Toolkit to develop within tree view on the data and other information visualization techniques are being handled based on the suitability. We call this raw data as preprocessing since it is not put into any scheduler to generate timetables. Finally, interactive visualization has helped timetablers, to improve on assigning of timeslots for the exams in a particular school.**

***Keywords*- Information visualization, Graph visualization, Examination timetabling, visual analytics**

I. INTRODUCTION

The intention is to turn the input information on the timetabling conflicts data into visualization. It has given a chance for the timetable designer and decision makers, should be able to examine substantial, multidimensional, highly constraint oriented, data stream to make effective decisions in terms of institutional requirements based upon time-critical situations [1]. Visualization means representation of something and how that representation rendered on the display. Another aspect is interaction that is positioned the involvement of human computer interaction (HCI) the interaction make a bridge between the user and the system as the user explores the data and learn the uncover insights which is a value of visualization.

Fundamental part of information visualization technique is interaction. However, without interaction, a system becomes a static or separately animated image (e.g. InfoCanvas[3]). Even though it is of static nature it has analytic and expressive value, the benefits are limited to the data set provided. If the data input is growing with more variables the usefulness becomes restricted. In reality, consider an advertisement banner with static images will perform several interactions however it is limited.

To achieve a specific challenge of visual analysis is that decision makers may focus their full cognitive and perceptual capabilities on the analytical process, while allowing them to apply into advanced computational capabilities. In common, *visual analytics* can be described as "the science of analytical reasoning facilitated by interactive visual interfaces" [8]. To be more precise, visual analytics is an iterative process that involves collecting information, data preprocessing, knowledge representation, interaction, and decision making.

In this research work, we adapt visual analytics with classification of interaction techniques assisted with Infovis. These novel efforts, we believe that a science of interaction would expand a core benefits to the timetable designers and value of interaction in these fields.

Our objective is to further current adaption of the role that interaction engage or plays in Infovis which facilitate to analyse the examination timetabling problem into stages. More specifically, we searched to identify the basic ways that interaction is used in Infovis systems and the benefits it provided to the timetable designers (users), timetabling systems. In the next section, we investigate prior research on interaction in Infovis techniques and examine how other researchers have represented the characterized [4]. In Section 3, we describe the examination timetabling problem, where lies the suitability of visualization assists. In Section 4. We describe the research methods used and analyze the interaction techniques. In Section 5, we describe the results of a general investigation of interaction and introduce how interaction contributes to the explorations and analyses timetablers (human) perform while using Infovis systems.

II. RELATED WORK

Sophisticated devices create meaningful visualizations and allow us not only to mentally visualize data and concepts, but to actually see and explore the representation of the data under consideration on a computer screen. However, transformation of data into meaningful visualizations is a non-trivial task that cannot be automatically improved through steadily growing computational resources. Often, there are many diverse ways to represent the data and it is unclear which representation is the best one. Visual analytics is more than just visualization and can rather be seen as an integrated approach combining visualization, human factors, and data analysis.

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A solid background work on the complex problem solving can be identified with the course time tabling problem in during the process with the help of visualization techniques [6]. These groundbreaking works clutch the challenge with visual analytics to develop a visual framework [1] for the examination timetabling problem. The visual representation on the problem model [1] illustrates the nature of visual aspects on this problem domain.

III. EXAMINATION TIMETABLING PROBLEM

The problem involves timetabling exams into a number of periods within a defined examination session while satisfying a number of hard constraints. Like other areas of timetabling, a feasible solution is one in which all hard constraints are satisfied. The quality of the solution is measured in terms of soft constraints satisfaction. For example, in terms of hard constraints room numbers and sizes are provided. In terms of soft constraints, much more practical information is provided in terms of how an organization measures the overall quality of a solution.

3.1 Problem description

- An examination session is made of a number of periods over a specified length of time. A set of exams that are to be scheduled into periods.
- A set of students enrolled on individual exams. Students enrolled on an exam are considered to take that examination.
- A set of rooms with individual capacities are provided.

A feasible timetable is one in which all examinations have been assigned to a period and room and all the following hard constraints are satisfied:

1. No student sits more than one examination at the same time.
2. The capacity of individual rooms is not exceeded at any time throughout the examination session.
3. Period lengths are not violated.
4. Satisfaction of period related hard constraints e.g. Exam I after Exam II
5. Satisfaction of room related hard constraints e.g. Exam I must use Room 201.

The soft constraints can be outlined as follows:
1. Two exams in a row
2. Two exams in a day
3. Period related soft constraints
4. Room related soft constraints

Institutions may weight these soft constraints differently relative to one another in an attempt to produce a solution this is appropriate for their particular needs. Above mentioned the examination timetabling problem, for the visualization suitability we use an extensible software framework *Prefuse* (Java) that helps for the raw data representation the other methods and categorical methods are discussed in the next section.

IV. METHODOLOGY

In order to build a visual framework [1] more meaningful we understand and identifying mechanisms of various interactions, with the goal of building a broad list of Infovis interaction techniques which is beneficial for the scheduler and the semi-automatic timetabling systems. However, it would not be possible to explore, examine and evaluate all existing systems and methods; we have instead on review the existing literature which is available on social network analysis, gene analysis, and network analysis field areas and identified the suitable interactions that can be adapted for our novel visual framework here again, the interaction would be focusing on the usefulness, beneficial aspects. A related work on the complex problem solving can be identified with the course time tabling problem with visual optimization interaction techniques [9].

V. CATEGORIES

The categorical illustration is based on the user intent to perform interactions. Each category will be discussed in the sub sections. We describe each category to provide a definition of what it means individual interaction techniques.

Category	*Description*
Selection	*Mark something interesting(Graphviz)*
Explore	*Show me something else(Prefuse)*
Encode	*Show me a different representation(Daisychart)*
Filter	*Show me something conditionally(VAE)*
Connect	*Show me related items*

Table-1 Visual Interaction Performance Methods

A. Select: make the data interesting and mark it

This will provide the user with the ability to mark data values of interest. When too many data values are presented we can change the view of representation. The main idea is to making the values of interest visually distinct, and each to track.

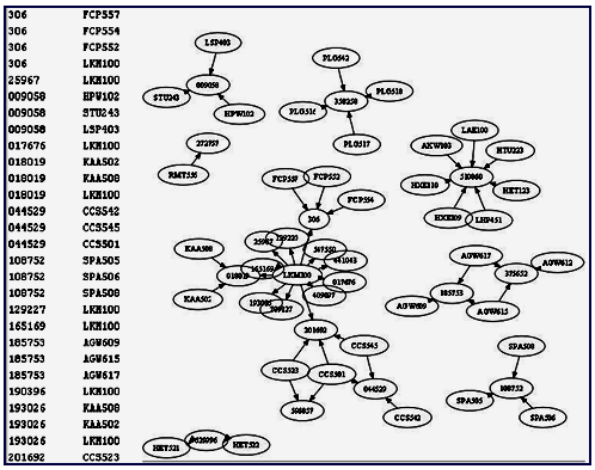

Figure 1.0 Cluster graph view

In Figure 1 it shows the order between the enrolled candidates with the course registered for a particular semester. The arrow head indicates the link between enrolled candidates with a course. For example, Student number 306 registered for FCP537, FCP554, FCP552, LKM100, 25967 registered for LKM100 and so on. The diagram illustrates the courses verses the student number for the same semester or current semester which is one of the significance of visualization on this pre-processing stage.

B. Explore: show me something else

Here we use *Prefuse* a visualization toolkit to explore the sample data items. We identified tree view as it displays the subset of data values. The most common explore interaction technique is panning. It works like a camera across the viewpoint. Many InfoVis systems use panning techniques for example Vizter[14].

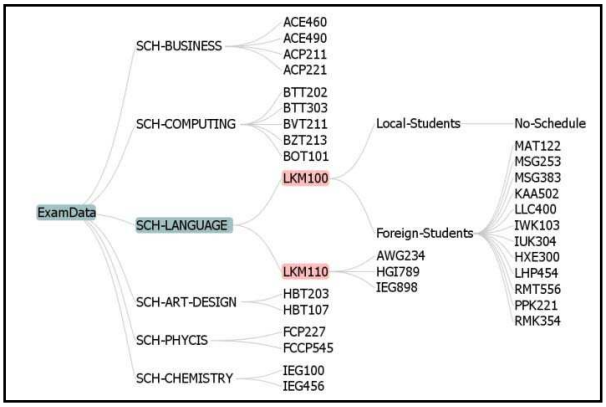

Figure 2 Tree view of the data values

In figure 2 the interaction is toward on the subject LKM100 which can be color coded as Red. The exploration are identified such as; Exam data from SCH-LANGUAGE the papers are LKM100 and LKM110. LKM 100 to be schedule for foreign students whereas LKM110 is a different subject.

C. Encode: show me a different representation

These techniques allow the user to alter the basic visual representation of the data into different type of visualization with color, histogram and view of each data element.

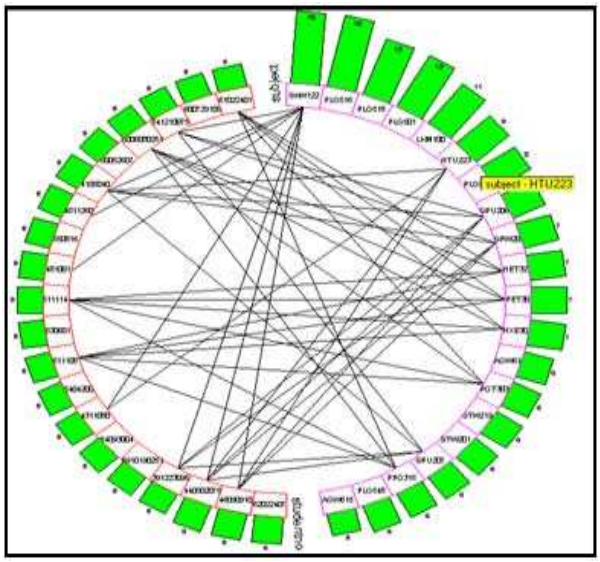

Figure 3 Daisy Chart circular view

The data relates to the subject enrolled verses studentid. Note the histograms on each node, which show how many subjects are enrolled by a semester for the current semester. Each arc of nodes is linked to records that have the same values. As you examine this chart, look at the values on the histograms and the detail in the nodes and links. In Figure 3 illustrates the studentid in the red box, the green color histograms represented how much paper that the studentid has registered for the current semester and the links shows the detail of the related students enrolled for the subject. The subject name has been tooltip once you move the mouse over on any red box containing studentid.

D. Filter: show me something conditionally

Filter is an important technique for any type of visualization. Here the technique allows the user to change the set of data values based on certain criteria. After the condition has been set, the visualization will be presented based on the criteria are presented. The data outside the condition will be hidden outside the display.

In figure 4, basically three types of data items are loaded rooms, subject and time slots. The criteria over the data set as follows:

1. Display the room with the subject allocated
2. Display the subject with the room assigned
3. Display the subject, room and timeslot

The above criteria has been achieved once you move the slider or move the mouse cursor on the dataset, it has a very useful tooltip interactions.

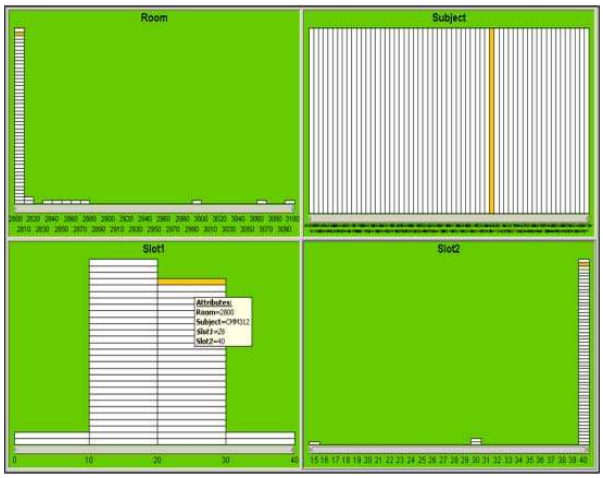

Figure 4 Visual attribute Explorer after change limits

E. Connect: show me related items

This type of interaction will highlight the relationships of the data which has already represented and hid the irrelevant data values. In figure 5 illustrates the situations involving the concurrent subject has to be assign the examination schedule.

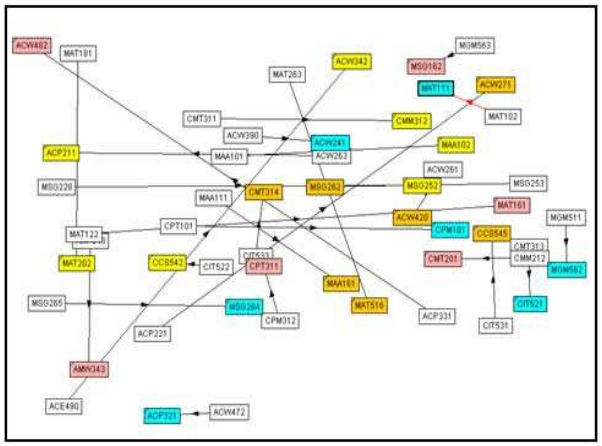
Figure 5 Topological graph views

Figure 5 illustrates Nodes with courses the arrow links the constraints with slots which is not available to allocate examination. The colour coded nodes explains the courses which has to be running concurrently in the semester. This will be affecting the constraint dataset with the slot is not available for the period allocation. The white color square with a slash (/) has not related with the time slot so it is not connected with the graph links.

VI. DISCUSSION

Preprocessing phase, the hypothesis/approach consists of developing graph visualization techniques and tools to effectively analysis the dimensions values within nominal raw data. The techniques enable the users to visualize the information in a graphical pattern to interact with the information spaces in a sensitive way, these visual representations make it easy for users to distinguish prominent aspects of their data quickly and involve the user to explore the data.

This exploration requires the user be able to interact with the data and understand trends and patterns and engage in the analytical reasoning process. It is a challenge to create well-constructed visual representations. However, most visual analytics problems deal with abstract information so the researcher is left to select the best representation for the information. We believe that this will help the visual modelers to understand the nature of data then apply into the timetable scheduler for producing time tables involving visualization as a good communication medium.

VII. CONCLUSION

In this paper, we presented five different grouping of interaction techniques based on the user benefits over the problem domain. This novel approach involves InfoVis as an important medium to make a bridge between the user and the scheduling systems. However, the categories are fit for the purpose on the examination timetabling data set which has not fully automated systems. The benefit of these interactions will provide the novel user guidance for preparing the timetable and it ease the timetable scheduler using these categories, it would be useful and meaningful to lend a hand towards information visualization interaction techniques adapted to the examination timetabling systems.

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