Object-Oriented Graphical-Template Composition Framework for Information Visualization

Shi Wei† Yuzuru Tanaka‡

Meme Media Laboratory, Graduate School of Information Science and Technology,

Hokkaido University†‡

1. INTRODUCTION

Nowadays, many people need to deal with a large amount of information. To complete this work, they often need the help of information visualization. With the increasing amount of information, information visualization is becoming more and more important. In numerous visualization forms, 2D chart is a widely-used and easily-comprehensive visualization. With the development of the visualization technology, a lot of visualization systems are developed to help users to create 2D charts. Using these systems, we often find that we need to be good at programming to create a customized chart. A novice user can only use existing templates to create charts, while this kind of charts doesn't totally satisfy users' requirements. In order to solve this problem, we will propose a framework to help users to create customized charts without any programming.

2. OBJECT-ORIENTED GRAPHICAL-TEMPLATE COMPOSITION FRAMEWORK

In this section, we will explain the visualization mechanism used in this framework, and give the solutions to two fundamental problems of this mechanism. The framework will be implemented based on Webble System, a web version of the 2D meme media architecture [1].

2.1 Visualization mechanism

To visualize information, the user needs to choose a template first. The template will be copied (the number of copies is equal to the number of records in the original data). Then, the visual properties of each copy will be modified according to the data. However, there are still two problems to be solved: how to define a complex template to users and how to associate each record with a template copy.

2.2 Template composition method

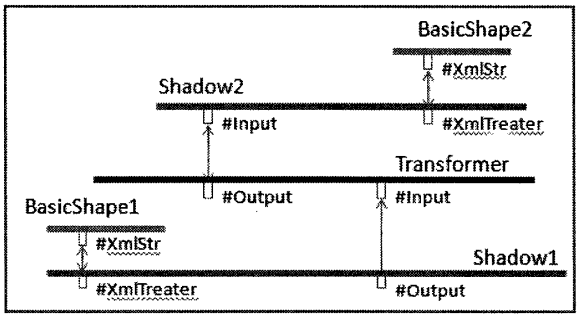

Figure1. How to define constrains between shape components

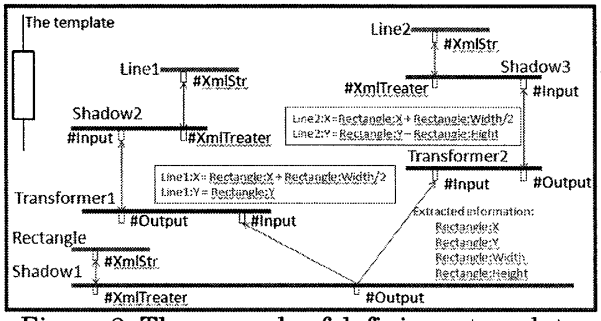

Figure 2. The example of defining a template

Obviously, it is very difficult to provide all the possible templates. Therefore we need to provide a method to help users create their own templates by combining basic primitive shape components together. To make the shape components of a template interoperate with each other, users need to define the geometrical constraints between them.

Figure 1 shows how to define such constrains between two primitive components in the meme media architecture using Shadows and

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Meme Media Laboratory, Hokkaido University
N13W8, Kita-ku, Sapporo, 060-8628, Japan

Transformers. The Shadow1 is used to extract visual property information of BasicShape1. The extracted information will be sent to the Transformer. The information will be transformed according to the rules defined in the Transformer. The transformed result will be sent to Shadow2, and it will modify the properties of the BasicShape2 according to this information. Figure 2 is an example of using this method to create a template which is used to represent the information of stocks' prices.

2.3 Retrieving object-oriented data

After choosing or creating a template, the user needs to associate the attributes of the record type with template's properties. However, the retrieved record type usually has a different structure from the data type of a template. In our framework, the structure is represented by a tree, and tree-structure converting method is provided to bridge the gap between two structures. In this method, hierarchical structures are manipulated by changing tree-nodes positions. Many other operators are also provided as tree nodes. Every converting operation will generate a piece of NHibernate code. After the conversion, the whole NHibernate code will be obtained to be used to retrieve the object-oriented data from the source database.

2.4 An example of manipulating tree structures

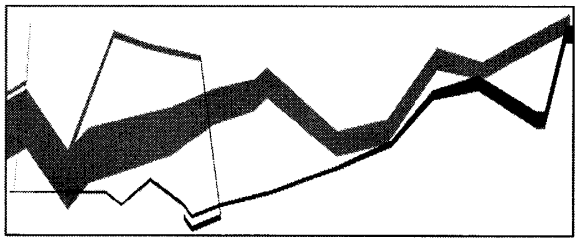

Figure 3. The route map of Napoleon's March

Figure 3 is a route map used to represent the information of Napoleon's March to Russia. This chart was created by Charles Minard in 1896[2]. To recreate this chart in this framework, a polygon shape component is used as define a template. As show in Figure 3, the data type used by the template is defined as a hierarchical structure, while the original data type is organized as a flat data table. In order to make the original data be used by the template, we must convert the structures of these two data type. The converting process is shown in Figure 4.

3. ACHIEVEMENT

In this framework, we have provided a template composition method and a method to retrieve object-oriented data that can be directly utilized by the template. Using this framework, end-users can create complex 2D charts without any programming.

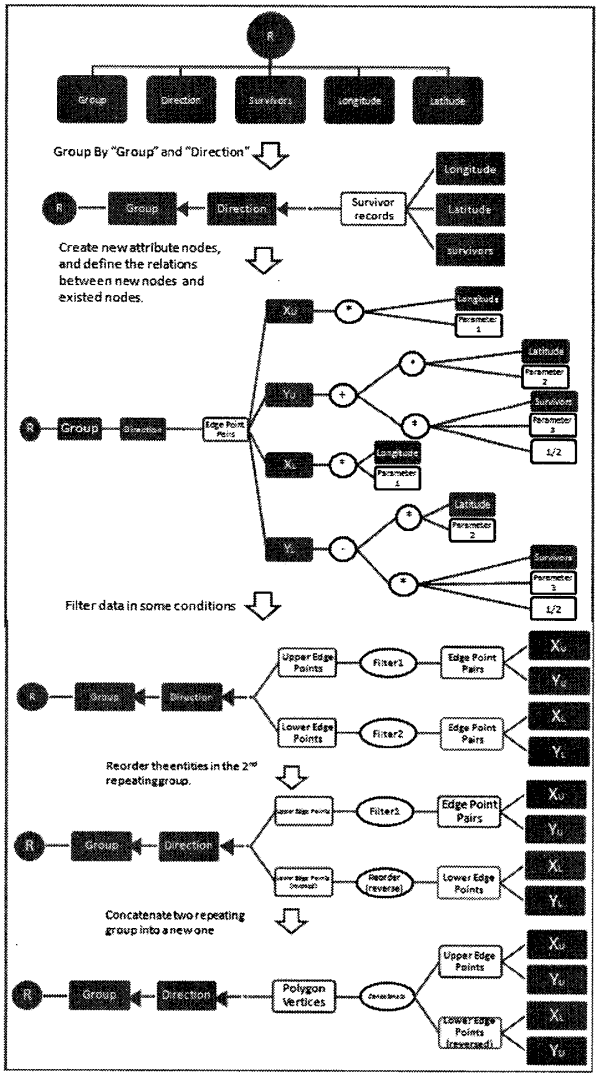

Figure 4. Tree structure converting process for the Napoleon's March chart

REFERENCES

[1]Yuzuru Tanaka, Meme Media and Meme Market Architectures: Knowledge Media for Editing, Distributing, and Managing Intellectual Resources, IEEE Press, 2003.

[2]Leland Wilkinson, The Grammar of Graphics, Spring, 2005.