Enhancing Visualization in Big Data by Using 3D Motion Interaction

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The problem of analyzing big data is not just how to visualize but also how to interact. Most of bug tracking systems contain large amount of information and they do not provide end users an easy way to analyze bug information because it lacks of good interaction system. We present a big data interacting System called Bugarium that implemented 3D Motion Controller and data-driven documents to ease both interaction and visualization on a large-scale bug repositories. Bugarium leads to a significant increase in terms of using 3D motion controller to operate big data in software visualization.

1. Introduction

Big data can be turned into big insights. But most of the time big data causes complexity and confusion in visualization. To visualize a large amount of bug information has always been a big challenge in software engineering. Many researches[1)2)3)4)] have tried to solve this visualization problem by developing many tools.

According to the research[5)], using only mouse and keyboard are sometimes slow users down while navigating through a large-scale data system. we realized that to perfectly visualize big data we need both good data representation and good interaction method.

2. The Struggle to Interact with Big Data

In this paper, we propose Bugarium, which is a tool that implemented 3D motion controller that allows users to use hands and fingers to interact with big data in visualization.

Normally interface of bugzilla represents bug information in textual representations. Many researches that we already mentioned in Section 1 only focused on how to make meaning out of a big data by developed visualization-based data discovery tool.

In Figure 2 on the left, we show the relationships between 1197 committers and 1599 bug reports of Eclipse JDT core project in 2008 using force-directed graph which is one of the most famous visualizing graph to represent multi-relations data structure on a 30 inches display which has the resolution of 2560x1600. Even we have a good visualization technique to represent big data but it is still hard to navigate through the data by using only mouse.

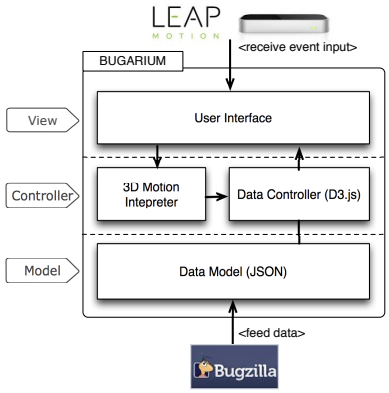

Fig.1 The structure of Bugarium

The primary challenge in our research is to ease interaction of a visualization-based data discovery tool and seeks to derive more values from big data.

3. BUGARIUM

3.1 System Architecture

Figure 1 presents an overview of Bugarium architecture. The system is composed of three layers: view, controller and model. Each layer serves different purposes and works independently from each other.

View layer displays outputs and receives motion inputs from user via Leap Motion[⋆1], which is a device designed to be placed on a physical desktop and detect motions from users.

The middle layer is controller. It has 2 parallel components which are 3D motion interpreter and data controller run together.

Once user interacts with the data in view layer,

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⋆1 http://www.leapmotion.com/

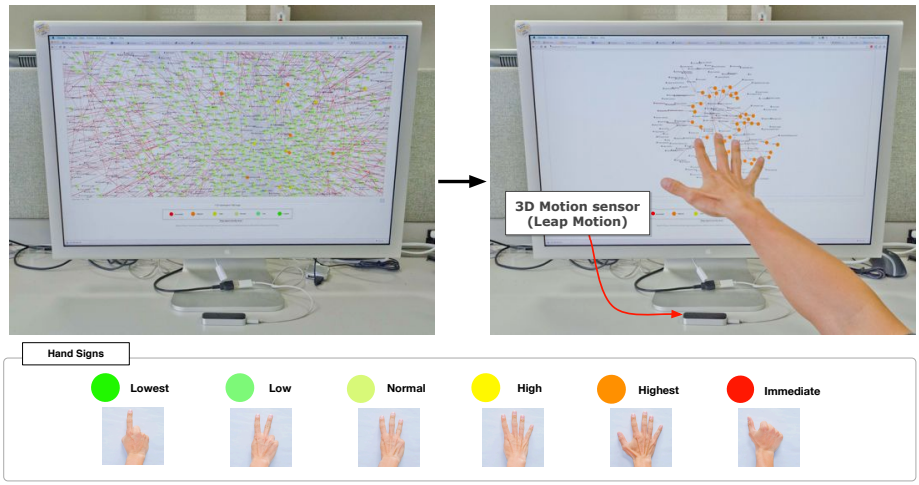

Fig.2 Show selection method using motion interaction to select bug reports based on their priority.

user interface will pass 3D motion data which received from Leap Motion to 3D motion interpreter to interpret and send it to data controller. Data controller communicate with data layer to get provided JSON data structure that fed from bugzilla. Data controller uses D3.js[⋆1], which is a JavaScript library for manipulating documents based on data to bring data back to user with powerful visualization components.

3.2 User Interaction with LEAP MOTION

Leap Motion allows users to swipe, zoom-in and out, select, grab or even using the basic hand signs to interact with the data. In Figure 2 shows how user can categorize bug reports by selecting priority of the reports using hand signs.

In Figure 2 on the left shows the big picture of the relationships between Eclipse JDT core bug reports and committers in 2008 which have more than 3000 nodes liking together. What if you would like to view bug reports which have highest priority? The problem is even Bugarium has shown a proper graph to represent the multiple relations in bugs but it is not easy to visualize at all when having such a big data.

Normally to select bug reports based on the priority using bugzilla, users need to click on the selection box to select the level of priority. Or even other visualizing tools need to provide interface option for users to use a mouse to click on it. But Bugarium allows you to use just the basic hand signs to select bug reports based on the priority without any additional interface component such as checkbox or drop down menu.

4. Conclusions

We have pointed out that to solve problems on a big data by just delivery users visualization tools and techniques are not enough. In this paper, we propose a system called Bugarium, which combines visualization and interaction methods together by using data-driven documents and 3D motion controller to help users fully manipulate data on a large-scale bug repositories. Bugarium enhance big data visualization by allowing users to use both hands and figure to interact with the data.

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⋆1 http://d3js.org/