A Visual Debugger for Efficient Software Fault Localization

A. Riboira[1], R. Abreu[1], R. Rodrigues[1]
[1] Department of Informatics Engineering, Faculty of Engineering University of Porto, Portugal.

Locating components which are responsible for observed failures is the most expensive, error-prone phase in the software development life cycle [7]. Automated diagnosis of software faults (aka bugs) can improve the efficiency of the debugging process, and is therefore an important process for the development of dependable software.

In the past, we have presented a toolset for automatic fault localization, dubbed Zoltar, which adopts a fault localization technique based on abstractions of program traces [1,6]. The toolset [2] provides the infrastructure to automatically instrument the source code to produce runtime data, which is subsequently analyzed to return a ranked list of potential faulty locations. Using a thread-based example program as well as a large, realistic program, we show the applicability of the proposed toolset in [2].

Although its output is deemed useful [1,6], Zoltar's debugging potential has been limited by the lack of a visualization tool that provides intuitive feedback about the defect distribution over the code base, and easy access to the faulty locations. To help unleash that potential, we propose exploring two visualization techniques - treemap and sunburst - aimed at aiding the developer to acquire a broad sense of the error distribution, and find faults quickly (see Figure 1).

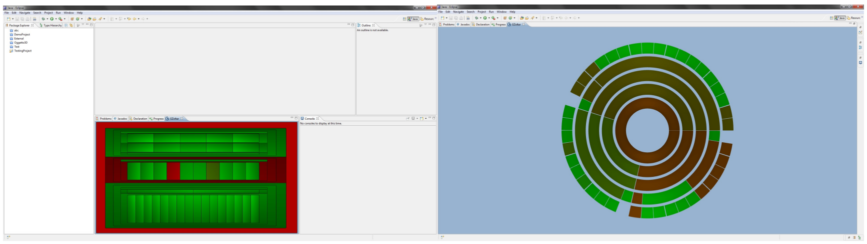

Figure 1 – Eclipse Plugin GZoltar: Treemap view (left) and Sunburst view (right).

The visualizations are implemented as an Eclipse [5] plugin, dubbed GZoltar, allowing direct access from the visualization tool to the faulty locations. Eclipse has been chosen because it is a popular integrated development environment. Compared to other visualization techniques, such as [2,4,6], our tool shows the relevant information for the debugging process in a more intuitive way. Experiments with human developers show that the technique has indeed the potential to aid in locating software faults.

References:

[1] Abreu, R.: Spectrum-based fault localization in Embedded Software, PhD thesis, Delft University of Technology, 2009.

[2] Janssen, T., Abreu, R., van Gemund, A., Zoltar: Zoltar: A Toolset for Automatic Fault Localization, ASE'09. (**Best Demo Award**)

[3] http://www.gnu.org/software/ddd/

[4] http://www.kdbg.org/

[5] http://www.eclipse.org/

[6] Jones, J., Harrold, M.J., Stasko, J.: Visualization of test information to assist fault localization. ICSE 2002.

[7] Hailpern, B. and Santhanam, P. (2002). Software debugging, testing, and verification. IBM Systems Journal, 41(1):4–12.