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New approach to fixing spreadsheet errors could save billions

MINNEAPOLIS - Computer scientists at Oregon State University have created a new, much simpler approach to fixing errors in spreadsheets, a system that is easy to use and might help businesses around the world reduce mistakes and save billions of dollars.

The advances - which allow a non-specialist to identify and fix a problem by selecting from a short list of change suggestions – were announced today at the International Conference on Software Engineering in Minneapolis, Minn. The new system, called "GoalDebug," is being licensed to a spinoff company in Oregon.

Spreadsheets, a standard bookkeeping and accounting tool used by businesses to track everything from payroll to accounts receivable, are one of the most common of all computer software programs. In the U.S. it has been estimated that 11 million people create about 100 million spreadsheets a year, which in turn might be managed by up to 60 million users. But they are notoriously prone to errors, experts say.

"Most users of spreadsheets are overconfident, they believe that the data is correct," said Martin Erwig, an associate professor of computer science in the OSU College of Engineering. "But it has been observed that up to 90 percent of the spreadsheets being used have non-trivial errors in them. In fact, one auditor has said he never inspected a single spreadsheet during his entire career that was completely accurate."

Sometimes the result is a paycheck delayed or a few dollars misplaced. But often the costs or financial misrepresentations are far more serious, and companies have lost millions or billions of dollars, Erwig said, occasionally drawing notice and ridicule in the national press. The overall problem for business and industry is sufficiently large that OSU's work has already drawn the attention of some large financial institutions.

Part of the problem, Erwig said, is that spreadsheet use and development is so common that it is frequently being done by people with very limited training or interest in computer software programming. These "end users" of computer software don't have the background to investigate codes, programs or formulas, they just want the program to work, and often erroneously assume that it does.

"There are dozens of places an error can be made," Erwig said. "A person can click their mouse in the wrong spot, a simple mechanical error. They could use a plus instead of a minus, add a row at the end of a data area instead of in the middle, and get a completely different result. And these errors can be awfully difficult to spot, especially with large spreadsheets that have thousands of cells."

What the new OSU systems do is try to identify the ways that humans commonly make mistakes and then suggest what the correct approach might have been. For instance, if someone sees a figure in a spreadsheet that seems suspicious or is clearly incorrect, they can plug in the correct number, and the OSU system can suggest several programming mistakes that might have created the error - which the user can then sort through and use to identify the problem. A study performed by Robin Abraham, a recent OSU doctoral graduate, has shown that in 80 percent of the cases, the needed change is among the top five suggestions produced by the system, and in 72 percent of the cases it is among the top two suggestions.

"With this approach, people still have ultimate control over the spreadsheet programs," Erwig said. "What we do is give them a prioritized list of where the problem most likely is. They can literally start at the top of the list, see if that's what went wrong, and if not, move down to the

second option on the list."

OSU's GoalDebug system, which stands for "Goal Directed Debugging of Spreadsheets," gives end users a chance to explore, apply, refine, or reject suggested changes. This much simpler and systematic approach allows people with comparatively little training in computer programming to identify and repair errors, Erwig said, by looking at a short list of possible problems instead of combing through hundreds or thousands of cells.

Software engineers spend 70-80 percent of their time testing and debugging programs, a recent study concluded - and even for these professionals, finding and fixing errors took an average of 17 hours.

"Spreadsheet debugging problems are huge," Erwig said. "We believe there will be a significant demand for these products, a large market."

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This work, he said, is one part of the EUSES Consortium - End Users Shaping Effective Software - that OSU leads, in collaboration with Cambridge University, Carnegie Mellon University, Drexel University, IBM, Pennsylvania State University, and the University of Nebraska. The consortium, directed by OSU computer science professor Margaret Burnett, in funded in part by the National Science Foundation, and is part of a national effort to help the users of computer software - often non-specialists without extensive formal training - better identify and solve problems.

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