

Computers may help K-8 math teachers understand students' thought processes

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Cornell CIS researchers are working on computer software that may help K-8 math teachers with grading math assignments. Researchers will present their research at the Conference on Human Factors in Computing Systems, April 21-26 in Montreal.

"I've been interested in working on techniques for automatic education and trying to make teachers' lives easier," said Erik Andersen, assistant professor of <u>computer</u> science. "One of the things teachers spend a lot of time doing is grading. But grading is more complicated than is the answer right or wrong. What the teachers are spending a lot of time doing is assigning partial credit and working individually to figure out what students are doing wrong. We envision a future in which educators spend less time trying to reconstruct what their students are thinking and more time working directly with their students."

Andersen has been working with Sumit Gulwani of Microsoft Research on "doing cool things" with programming by example. "The work is trying to reverse engineer your thought process. We build an algorithm that infers and reconstructs how the <u>student</u> is doing their homework – we are translating intent," said Andersen.

The researchers worked with a data set from Metametrics of approximately 300 students solving addition and subtraction problems and used those examples to reconstruct what the students may be doing right or wrong.



"This was technically challenging, and the solution interesting," said Andersen. "We worked to come up with an efficient data structure and algorithm that would help the system sort through an enormous space of possible things students could be thinking. We found that 13 percent of these students made clear systematic procedural mistakes, and the researchers' algorithm learned to replicate 53 percent of these mistakes in a way that seemed accurate. The key is that we are not giving the right answer to the computer – we are asking the computer to infer what the student might be doing wrong. This tool can actually show a <u>teacher</u> what the student is misunderstanding, and it can demonstrate procedural misconceptions to an educator as successfully as a human expert."

The ultimate goal for the software is to provide teachers with a grading solution that also will generate reports on overall teaching outcomes for the classroom and solution areas where teachers need to focus more energy. The software will only work with simple math like subtraction and addition but will advance to algebra and more advanced equations in the future.

More information: Automatic Diagnosis of Students' Misconceptions in K-8 Mathematics. <u>www.cs.cornell.edu/~molly/chi2018.pdf</u>

Provided by Cornell University

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