Title: Toward automatic inference of causal structure in student essays
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Strand of work: Tools

Published Abstract
With an increasing focus on science and technology in education comes an awareness that students must be able to understand and integrate scientific explanations from multiple sources. As part of a larger project aimed at deepening our understanding of student processes for integrating multiple sources of information, we are developing machine learning and natural language processing techniques for evaluating students' argumentative essays. In previous work, we have focused on identifying conceptual elements of the essays. In this paper, we present a method for inferring the causal structure of student essays. We used a standard parser to derive grammatical dependencies of the essay and converted them to logic statements. Then a simple inference mechanism was used to identify concepts linked to syntactic connectors by these dependencies.The results suggest that we will soon be able to provide explicit feedback that enables teachers and students to improve comprehension.

Purpose
Scoring of essays is critical for both researchers and teachers to understand what students are and are not getting out of their reading. Unfortunately, it takes a great deal of time and effort to score an essay deeply enough to provide meaningful feedback. Automatic scoring of essays will help researchers by reducing the time required, and freeing them to deeper analyses. For teachers, it can provide important information about which students are succeeding and which are struggling.

Setting
The machine learning techniques used in this work were trained on sets of essays in different scientific domains collected from middle- through high-school students as part of the READI project. The training essays were scored by project researchers to provide evidence needed for the automatic scoring methods.

General Statement of findings
For identifying isolated ideas from source texts, the machine learning techniques are approaching the reliability of human raters. For identifying causal connections, the work is just starting and has surpassed previous attempts to infer causal relations in text, but still lags significantly behind human raters. This is the focus of our current efforts.

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