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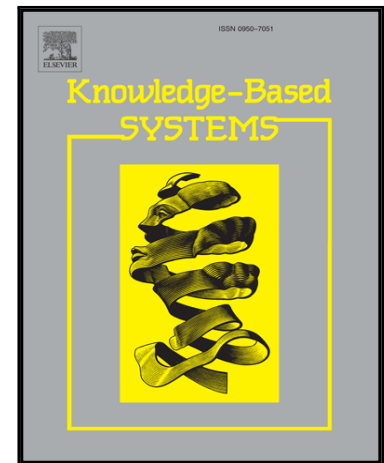
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Automated essay evaluation with semantic analysis

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Abstract

Essays are considered as the most useful tool to assess learning outcomes, guide students' learning process and to measure their progress. Manual grading of students' essays is a time-consuming process, but is nevertheless necessary. Automated essay evaluation represents a practical solution to this task, however, its main weakness is the predominant focus on vocabulary and text syntax, and limited consideration of text semantics. In this work, we propose an extension of existing automated essay evaluation systems by incorporating additional semantic coherence and consistency attributes. We design the novel coherence attributes by transforming sequential parts of an essay into the semantic space and measuring changes between them to estimate coherence of the text. The novel consistency attributes detect semantic errors using information extraction and logic reasoning. The resulting system (named SAGE - Semantic Automated Grader for Essays) provides semantic feedback for the writer and achieves significantly higher grading accuracy compared with 9 other state-of-the-art automated essay evaluation systems.

Keywords:

Automated Scoring, Essay Evaluation, Natural Language Processing, Semantic Attributes, Semantic Feedback

1. Introduction

Essays are short literary compositions on a particular subject (also referred to as prompt-specific essays), usually in prose and generally analytic, speculative, or interpretative in nature. Essays give students an opportunity to demonstrate their range of skills and knowledge, including higher-order thinking skills, such as synthesis and analysis. Automated essay evaluation (AEE) is the process of evaluating and scoring the written essays via computer programs [1]. For teachers and educational institutions, AEE represents not only a tool to assess learning outcomes, but also helps save time, effort and money without lowering the quality. AEE systems can also be used in all other application areas of text mining, where the content of the text needs to be graded or prioritized, such as: written applications, cover letters, scientific papers, e-mail classification etc.

The field has been developing since the 1960s when Ellis Batten Page and his colleagues [2] proposed the first automated essay scoring (AES) system. The system was using basic measures to approximate features of interest and thus describe the quality of an essay. By the 1990s, the progress in the field of natural language processing (NLP) encouraged researchers to apply new computational techniques to automatically extract essay writing quality measures. In the last decade, AEE became a well-established support technology in educational settings. Throughout the development of the field, several different names have been used for

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