REPORT

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Paper Title: Syntactic, Semantic and Sentiment Analysis: The Joint Effect on Automated Essay Evaluation

## 1. Summary

1.1 Motivation

Manual grading is time-consuming and prone to inconsistencies and inaccuracies due to human biases. Automating the essay evaluation process can provide a more uniform assessment. While research has been conducted in this area, none have focused on integrating syntax, semantics, and sentiment analysis together.

1.2 Contribution

This article proposes to use Graph-based relationships within the essay's content and polarity of opinion expressions. Semantic similarity is determined between each statement of the essays to form these Graph-based spatial relationships. By reducing the number of features, data redundancies can be diminished so that predictions are robust to the noisy data.

1.3 Methodology

This project used syntactic attributes to analyze word order and using various syntax-related features, while semantic attributes focused on measuring coherence and semantic similarity using word embeddings. Graph-based features were derived from semantic similarity, and only relevant connections were selected. Sentiment analysis was performed using a rule-based model. The system was implemented using data from the ASAP competition and evaluated using the QWK metric. Feature selection was done through univariate selection and recursive feature elimination, resulting in 23 features. For graph-based features, connections with a threshold value below 0.4 were dropped. Three supervised regression models (Support Vector Machine, Random Forest Regressor, and a three-layer Neural Network) were used.

Figure 1.1: Research domain and Heat Map of QWK values.
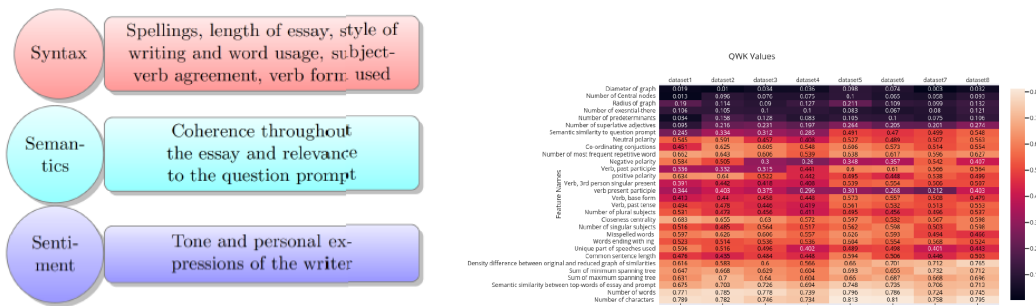
1.4 Conclusion

The system performed best when all three syntactic, semantic, and sentiment-based features were combined. The three-layer neural network achieved the highest results, outperforming other automated scoring systems with an average QWK of 0.793.

2. Limitation

2.1 First Limitation

The system lacks the study of ontology-based connections in the essay's text.

2.2 Second Limitation

The model is limited in its usage of different types of centrality based features existing in graph networks.

3. Synthesis

This proposed system aims to automate essay evaluation by considering syntax, semantic coherence, and sentiments. It incorporates graph-based relationships and polarity of opinion expressions to determine semantic similarity and obtain novel graph-based features. The algorithm provides robust predictions and reduces redundancies in the data. For future research, exploring LSTM for sequential data analysis and studying the flow of information between consecutive sentences is suggested.