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Exploring Sentiment Analysis in the 5th Grade ESL Classroom

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Katerina T. Frantzi

Exploring Sentiment Analysis in the 5th Grade ESL Classroom

Περίληψη

Ο προγραμματισμός διδάσκεται στα σχολεία από πολύ νεαρή ηλικία, συμπεριλαμβανομένης της δημοτικής εκπαίδευσης. Η ανάλυση συναισθήματος είναι μια λειτουργία που μπορεί να πραγματοποιηθεί χρησιμοποιώντας τη γλώσσα προγραμματισμού η οποία μπορεί να καθορίσει την πολικότητα ενός κειμένου ή πρότασης, είτε αυτή έχει θετική, αρνητική ή ουδέτερη σημασία, και να αναγνωρίσει συγκεκριμένα συναισθήματα εντός του εξεταζόμενου κειμένου. Η παρουσίαση της ανάλυσης συναισθήματος έλαβε χώρα σε ένα μάθημα αγγλικών της 5ης τάξης κατά τη διάρκεια μιας ώρας διδασκαλίας υπό τη μορφή ενός παιχνιδιού εντός του μαθήματος αγγλικών, όπου οι μαθητές κλήθηκαν να διατυπώσουν προτάσεις στα αγγλικά που εξετάστηκαν για την πολικότητά τους και τα συναισθήματα που μετέφεραν. Οι μαθητές συμμετείχαν στο παιχνίδι με ενθουσιασμό, δείχνοντας ότι η ανάλυση συναισθήματος μπορεί να χρησιμοποιηθεί στο μάθημα αγγλικών για να ενισχύσει την εκπαιδευτική εμπειρία.

Λέξεις-κλειδιά: Ανάλυση συναισθήματος, Πολικότητα, Συναισθήματα, Προγραμματισμός, Λειτουργία

Abstract

Programming is taught in schools from an early stage, including primary education. Sentiment analysis is a function that can be performed using programming language to determine the polarity of a text or sentence, whether it has a positive, negative, or neutral meaning, and to identify specific emotions within the text under examination. The presentation of sentiment analysis took place in a 5th-grade English class during one instructional hour in the form of a game within the English lesson, where students were asked to formulate sentences in English that were examined for their polarity and the emotions they conveyed. The students participated in the game with enthusiasm demonstrating that sentiment analysis can be used in the English lesson to enhance the learning experience.

Keywords: Sentiment analysis, Polarity, Emotions, Programming, Function

1. Introduction

Sentiment Analysis is a technique used to automatically determine the polarity of a phrase or text, indicating whether it is positive, negative, or neutral. It involves analyzing the emotional or affective aspects of language, such as frustration, pleasure, annoyance, sorrow, enthusiasm, etc. The use of programming languages in Sentiment Analysis can help the students detect the polarity of the text in an automatic way as well as detect basic emotions in the text under investigation. This analysis is often applied to evaluate people's attitudes towards specific targets or subjects. In the field of computational linguistics, Sentiment Analysis is commonly used to assess the sentiment expressed in reviews of various entities, including public services, organizations, and products. Two popular techniques for conducting Sentiment Analysis are the bag of words approach and feature extraction. With the prevalence of social media, which generates vast amounts of data, sentiment analysis has become particularly useful in extracting valuable insights from user-generated content. Research studies have shown that sentiment analysis, particularly using opinion-lexicon methods, has been widely applied to analyze social media texts. Therefore, the utilization of programming languages in sentiment analysis enables users to automatically identify the polarity of the text and also detect basic emotions within the text being investigated. In the present study, Python programming language was utilized in the ESL classroom to identify the polarity of the sentences and the emotions conveyed in them, specifically in one 5th-grade classroom. This preliminary study aimed to explore the potential of sentiment analysis as a valuable tool in the language classroom and serve as an introduction to further research in this area.

2. Sentiment Analysis Overview

2.1 Sentiment Analysis function

Sentiment Analysis has been employed in the detection of emotions in various types of texts utilizing computational techniques. Sentiment analysis refers to the process of analyzing written text to determine the author's attitude, opinion, or emotion. It provides insights into the overall sentiment of a text, whether it's a single sentence, paragraph, or entire book. By conducting sentiment analysis, researchers can identify key themes and the author's feelings towards specific characters or events in literature. It also helps understand the overall tone of the text, whether it is positive, negative, or neutral. Sentiment analysis provides a means to assess the level of sentiment, ranging from strong positivity to strong negativity. By examining sentiment in textual data, researchers gain a deeper understanding of the author's intent and the overall mood of the text.

Sentiment analysis plays a vital role in literature by allowing authors and readers to explore the emotions and attitudes portrayed by characters and the overall tone of a text. It falls under the umbrella of natural language processing, utilizing machine learning algorithms to extract subjective information from text. The objective of sentiment analysis is to determine the writer's or speaker's attitude towards a particular topic or idea. Sentiment analysis can identify the writer's sentiment towards a specific subject, the overall sentiment of a text, individual words, or phrases. It has applications in analyzing product reviews, political statements, and tracking changes in sentiment over time.

Sentiment analysis enables the analysis of writer's emotions, identification of underlying themes and ideas, and the assessment of the overall sentiment of a literary work. It provides insights into the sentiment of a book, poem, or other written materials. Additionally, it allows

the identification of sentiment within specific passages and themes. For instance, a sentiment analysis of a book may reveal a generally positive tone with some negative themes interspersed. It may also highlight emotionally charged passages. Comparing the sentiment of two literary works can uncover similarities, differences, and the overall sentiment of each. Conducting sentiment analysis involves assigning sentiment scores to words based on sentiment dictionaries.

2.2 Approaches to Sentiment Analysis

Jacobs (2019, p.7) outlines three different approaches to Sentiment Analysis in literature. These approaches include the dictionary or word list-based approach, the Vector Space Model (VSM) approach, and the hybrid approach. The first approach involves determining the valence of words based on a pre-existing lexicon. The second approach relies on Vector Space Models to calculate the semantic relatedness between words and is knowledge-based. The hybrid approach combines elements from both previous approaches, using word similarity estimation and valence computation.

Support Vector Machines (SVM) is a widely used machine learning technique in Natural Language Processing (NLP) for polarity identification in textual data. In this study, SVM will be employed for sentiment categorization along with the analysis of stylistic features. Sentiment Analysis draws upon the fields of NLP, AI, and ML, which serve as umbrella terms encompassing the methodologies used in Sentiment Analysis. A study by Balyan, McCarthy, and McNamara (2017, p.3) explored the application of machine learning and NLP methods to evaluate the explanatory behavior necessary for the comprehension of literature. The study assessed the accuracy of seven machine learning classification algorithms in predicting the ratings of student essays on literary texts.

2.3 The Aim of the Study

The aim of the present study was to explore the potential of sentiment analysis as a valuable tool in the ESL classroom. Specifically, the study focused on identifying the polarity of sentences and the emotions conveyed in them using the Python programming language. The primary objectives were to investigate whether students' reactions were predominantly negative or positive when using sentiment analysis, to assess the levels of student participation, and to determine if the tool could enhance the overall learning experience in a 5th-grade ESL classroom. In the present study, we investigated the use of Sentiment Analysis in the ESL classroom as to our knowledge, Sentiment Analysis has not been used in the ESL classroom so far. The aim was to identify whether the reactions of the students are negative or positive when using this tool, the levels of participation and whether this tool can enhance the learning experience.

2.4 Research Questions:

2.4.1 Main Research Question:

To what extent does the incorporation of sentiment analysis using Python programming language impact students' reactions, levels of participation, and overall learning experience in an ESL classroom?

2.4.2 Subsidiary Research Questions:

- How do students react to the use of sentiment analysis in the ESL classroom? Are their responses predominantly positive or negative?
- What is the level of student participation when sentiment analysis is integrated into the learning process?
- Can the use of sentiment analysis enhance the overall learning experience in the ESL classroom?

3. Methodology

The methodology of the present study was the observation. In this study, observation serves as the primary methodology to gather insights into the integration of sentiment analysis in the ESL classroom. Through careful observation of students engaging with the sentiment analysis tool, we aim to capture real-time reactions, participation levels, and the overall dynamic of the learning environment. The observational approach allows for a qualitative exploration of the students' responses, providing a nuanced understanding of their experiences with sentiment analysis. Additionally, by employing observation, the study seeks to uncover unanticipated factors that may influence the effectiveness of sentiment analysis in language learning.

3.1 Participants

The study involved one class of 5th-grade students from a primary school. The total number of participants was 17 consisting of 9 girls and 8 boys. All children were 10 years old.

3.2. Material

Prior to the study, the concept of sentiment analysis was introduced to the students during their English lessons. They were taught about the basics of sentiment analysis, including its purpose and how it can determine the polarity and emotions in a given text. Python programming language was used for sentiment analysis. A game-like activity was conducted to incorporate sentiment analysis into the learning process. The activity aimed to assess students' ability to formulate English sentences and analyze their polarity. Each student participated in the game individually or in pairs. In the game, students were asked to produce simple sentences. The constructed sentences were then collected for sentiment analysis. The sentiment analysis algorithm was designed to assess the polarity of each sentence (positive, negative, or neutral). The analysis was performed using Python programming language in the Google Colab environment (Colaboratory, Google, Mountain View, CA). In particular the package Natural Language Toolkit was used. All constructed sentences and their corresponding sentiment analysis results were recorded and saved for further analysis. The students produced 16 sentences which consisted of 102 words while the average sentiment of them was positive 0.2891649 (SD=0.240611). The polarity scores of the sentences can be seen in Table 1. Polarity scores represent the degree of sentiment expressed in a given text or sentence. They indicate whether the sentiment is positive, negative, or neutral. Polarity scores are typically numerical values that range from -1 to 1.

Table 1 Sentiment Analysis

Polarity Scores of the sentences the students produced.

1. Sentence: I like playing with my toys.
Sentiment scores: {'neg': 0.0, 'neu': 0.411, 'pos': 0.589, 'compound': 0.5106}
2. Sentence: My cat is beautiful.
Sentiment scores: {'neg': 0.0, 'neu': 0.435, 'pos': 0.565, 'compound': 0.5994}
3. Sentence: My favorite subject in school is art.
Sentiment scores: {'neg': 0.0, 'neu': 0.667, 'pos': 0.333, 'compound': 0.4588}
4. Sentence: I enjoy reading picture books.
Sentiment scores: {'neg': 0.0, 'neu': 0.484, 'pos': 0.516, 'compound': 0.4939}
5. Sentence: Yesterday, I went to the park.
Sentiment scores: {'neg': 0.0, 'neu': 1.0, 'pos': 0.0, 'compound': 0.0}
6. Sentence: I love my sister.
Sentiment scores: {'neg': 0.0, 'neu': 0.323, 'pos': 0.677, 'compound': 0.6369}
7. Sentence: I love eating ice cream.
Sentiment scores: {'neg': 0.0, 'neu': 0.417, 'pos': 0.583, 'compound': 0.6369}
8. Sentence: I like drawing pictures of animals.
Sentiment scores: {'neg': 0.0, 'neu': 0.615, 'pos': 0.385, 'compound': 0.3612}
9. Sentence: My favorite animal is a cat.
Sentiment scores: {'neg': 0.0, 'neu': 0.571, 'pos': 0.429, 'compound': 0.4588}
10. Sentence: I enjoy listening to music.
Sentiment scores: {'neg': 0.0, 'neu': 0.484, 'pos': 0.516, 'compound': 0.4939}
11. Sentence: Yesterday, I watched a funny cartoon.
Sentiment scores: {'neg': 0.0, 'neu': 0.508, 'pos': 0.492, 'compound': 0.4404}
12. Sentence: I hate school
Sentiment Scores: {'neg': 0.787, 'neu': 0.213, 'pos': 0.0, 'compound': -0.5719}
13. Sentence: I have a pet dog and I love playing with him.
Sentiment scores: {'neg': 0.0, 'neu': 0.5, 'pos': 0.5, 'compound': 0.7184}
14. Sentence: My favorite color is pink because it is pretty.
Sentiment scores: {'neg': 0.0, 'neu': 0.53, 'pos': 0.47, 'compound': 0.7351}
15. Sentence: I like to ride my bike in the park with my friends.
Sentiment scores: {'neg': 0.0, 'neu': 0.616, 'pos': 0.384, 'compound': 0.6808}
16. Sentence: I enjoy playing video games
Sentiment scores: {'neg': 0.0, 'neu': 0.286, 'pos': 0.714, 'compound': 0.6124}

Then, the emotion analysis of the sentences followed where the distribution of various emotions was examined. These emotions are anger, anticipation, disgust, fear, joy, sadness, surprise and trust (Saif & Turney, 2013, p. 440). According to the results of the emotion analysis, in the sentence: "My cat is beautiful.", the word "beautiful" depicts joy. In the sentence: "My favorite subject in school is art.", the words "favorite" and "art" depict anticipation and joy. In the sentence: "I enjoy reading picture books.", the word "enjoy" depicts joy. In the sentence: "Yesterday, I went to the park.", there are no prominent emotion-associated words detected in this sentence. In the sentence: "I love my sister.", the word "love" depicts joy. In the sentence: "I love eating ice cream.", the words "love" and "ice cream" depict joy. In the sentence: "I like drawing pictures of animals.", the word "like" depicts joy. In the sentence: "My favorite animal is a cat.", the words "favorite" and "cat" depict anticipation and joy. In the sentence: "I enjoy listening to music.", the word "enjoy" depicts joy, and "music" could be

associated with anticipation. In the sentence: "Yesterday, I watched a funny cartoon.", the word "funny" depicts joy. In the sentence: "I hate school.", the word "hate" depicts anger and disgust. In the sentence: "I have a pet dog and I love playing with him.", the words "love" and "playing" depict joy. In the sentence: "My favorite color is pink because it is pretty.", the words "favorite" and "pretty" depict anticipation and joy. In the sentence: "I like to ride my bike in the park with my friends.", the word "like" depicts joy. In the sentence: "I enjoy playing video games.", the word "enjoy" depicts joy.

4. Results & Discussion

The results of the study revealed a remarkable level of enthusiasm and willingness among the students to actively participate in the sentiment analysis activity within the ESL classroom. The findings indicated that the incorporation of sentiment analysis techniques into the learning process created an engaging and interactive environment that resonated well with the students. They eagerly constructed English sentences and demonstrated genuine interest in analyzing the sentiments and emotions conveyed by their words. This high level of student engagement suggests that sentiment analysis holds significant potential as a valuable tool for enhancing the ESL classroom experience.

By using programming languages and sentiment analysis tools, students were able to construct English sentences and analyze the sentiments and emotions conveyed by their words. This approach not only facilitated language learning but also promoted critical thinking skills. The students had to consider the emotional connotations of their sentences and understand the impact of word choice on sentiment analysis results. This engagement with sentiment analysis fostered a deeper understanding of language and provided opportunities for students to express themselves effectively. Our study found that sentiment analysis, when integrated into the ESL classroom, generated a high level of enthusiasm and willingness among the students to actively participate in the activity. This aligns with previous studies that demonstrated the positive impact of incorporating sentiment analysis in different educational contexts. In our study, we utilized a dictionary-based approach. This approach allowed students to understand and analyze the sentiment of their sentences, enhancing their language skills and critical thinking abilities.

5. Conclusion

In conclusion, the present study demonstrates the successful integration of sentiment analysis techniques into the ESL classroom, showcasing the students' high level of enthusiasm and active participation. By incorporating sentiment analysis activities, educators can create engaging learning environments that go beyond traditional language instruction, fostering critical thinking skills and emotional literacy. The findings of this study align with previous research, highlighting the potential of sentiment analysis in enhancing language learning experiences. Furthermore, this study contributes to the literature by exploring the application of sentiment analysis specifically in the context of the ESL classroom. As the present study consisted of an observational study with a small sample size, future research should continue to explore the impact of sentiment analysis in different educational settings and assess its broader implications for language learning outcomes.

6. Limitations of the Study

The study involved a single 5th-grade classroom with 17 participants. The small sample size may limit the generalizability of the findings to a broader population. Furthermore, the study relied on observational methods, specifically the analysis of student-generated sentences and their sentiment scores. This method may have limitations in capturing more nuanced aspects of the learning experience. The study focused exclusively on 5th-grade students in the ESL classroom. Generalizing the findings to other grade levels or educational contexts should be done cautiously. Additionally, the study was conducted as a preliminary exploration, and the duration of the observation was relatively short. Long-term effects and sustainability of the impact of sentiment analysis on learning were not extensively explored.

The study specifically utilized Python programming language and a dictionary-based approach for sentiment analysis. The findings may not be directly applicable to other sentiment analysis tools or approaches. The emotion analysis conducted in the study was based on a predefined set of emotions. This approach may oversimplify the complexity of human emotions expressed in language. External factors such as students' prior exposure to programming and technology, as well as teacher facilitation, were not deeply explored but could influence the outcomes.

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