Identifying effective cohesive features for task classification in integrated reading-writing tasks

Takumi MUROI [a*], Yuichi ONO [b]
[a]*Masters' Program of Education, University of Tsukuba, Japan*
[b]*University of Tsukuba, Japan*
[*]s1920080@s.tsukuba.ac.jp

Abstract: Many language proficiency assessments have begun to include integrated writing tasks, which require test takers to read and/or listen to the passage and write a response based on the information in the passage. Especially in the research of integrated reading-writing tasks, linguistic features related to cohesion have been seen as indicators of the writing response because it has a relationship with both reading and writing skills. In this study, an integrated reading-writing task is conducted on Japanese English as a Foreign Language (EFL) students. By using machine learning methods, we investigate the relationship between the cohesiveness of the source text and the use of cohesive devices in writing responses in the task. The results of Decision Tree and Random Forest show some significant cohesive devices for the classification of the task. In future research, we will closely look into the linguistic features of each writing response and participants' writing strategy use in the task. It will provide important implications for increasing the construct validity of integrated reading-writing tasks and writing pedagogy.

Keywords: Learning analytics, Japanese EFL learners, Integrated reading-writing tasks, Cohesion, Decision Tree, Random Forest

1. Introduction

Integrated writing tasks, which acquire test takers to write an essay response based on information from reading and/or listening passage, has been used in many language proficiency assessments (Gebril & Plakans, 2009; Guo, Crossley, & McNamara, 2013). These tasks have been considered to have positive effects on language teaching and learning because they model the tasks encountered in authentic contexts in academic settings. (Cumming, Kantor, Baba, Erdosy, Eouanzoui, & Janmes, 2005).

Several studies on integrated writing tasks have focused on the linguistic features of task responses (Guo et al., 2013; Tywoniw & Crossley, 2019), and cohesion has been seen as one of the important features. It "refers to relations of meaning that exist within the text" (Halliday & Hassan, 1976; p. 4) and helps the reader to make connections between ideas in the text.

Especially in the assessment of integrated reading-writing tasks, cohesive features can be important indicators of test-takers' performances because it strongly relates to both reading and writing skills. Some studies have explored the relationship between the cohesive features of writing responses and task scores. However, there are a few studies that focus on the use and effects of cohesive devices in the reading passage, or the source text, and the responses.

This study aims to investigate the relationship between the degree of cohesiveness in the source text and the use of cohesive devices in writing responses in an integrated reading-writing task. An automated assessing tool of cohesive features was introduced, and data were analyzed with machine learning methods.

2. Method

2.1 Purpose

The research question investigated in this study is given below.

> Which cohesive devices in responses of the integrated reading-writing task are significant in the classification of cohesiveness of the source text?

2.2 An Integrated Reading-Writing Task

An integrated reading-writing task was conducted on 90 Japanese EFL students in a university in Ibaraki prefecture, Japan. The corpus data used in the analysis include 152 writing responses in the task. The corpus consists of two materials, and each one contains the source text with high/low cohesion.

Table 1. *Description of Corpus data*

	Prompt	Cohesion of source text	Number of responses
Material 1	Gap year	High	38
		Low	38
Material 2	Virtual friend	High	38
		Low	38

2.3 Linguistic Analysis

Cohesive devices in all essays were measured by using the Tool for the Automatic Analysis of Cohesion (TAACO; Crossley, et al., 2016). TAACO is a free automated natural language processing tool and incorporates over 150 cohesive devices.

2.4 Statistical Analysis

Cohesive devices used in the analysis were first assessed to ensure that they did not strongly correlate with each other. The features which strongly correlated to others (Spearman's r > .80) were not included in the later analysis. To examine cohesive features that were significant in the classification for the cohesiveness of source texts, Decision Tree and the Random Forest were adopted with Python 3.7.6.

3. Results

In the analysis of Material 1, 76 cohesive devices were included, and Figure 1 showed the results of Decision Tree. The result of Decision Tree and feature importance in Random Forest indicated that the use of connectives across an entire text and the overlapped use of verbs and function words between adjacent paragraphs played an important role in classification.

In the analysis of Material 2, 84 cohesive devices were included, and Figure 2 showed the results of Decision Tree. As the result of Decision Tree and feature importance in Random Forest, the type-token ratio of adverbs across an entire text and the overlapped use of adjectives between adjacent sentences played an important role in classification.

The final classification accuracy of each classifier is shown in Table 2 below.
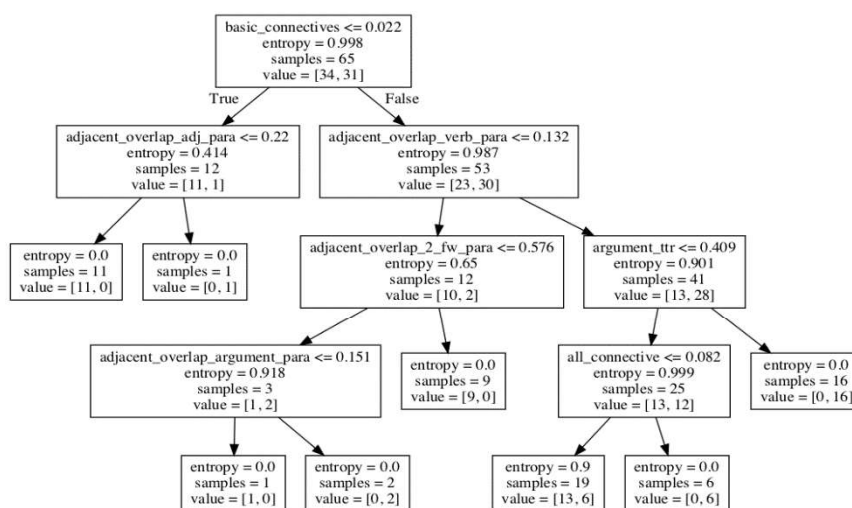
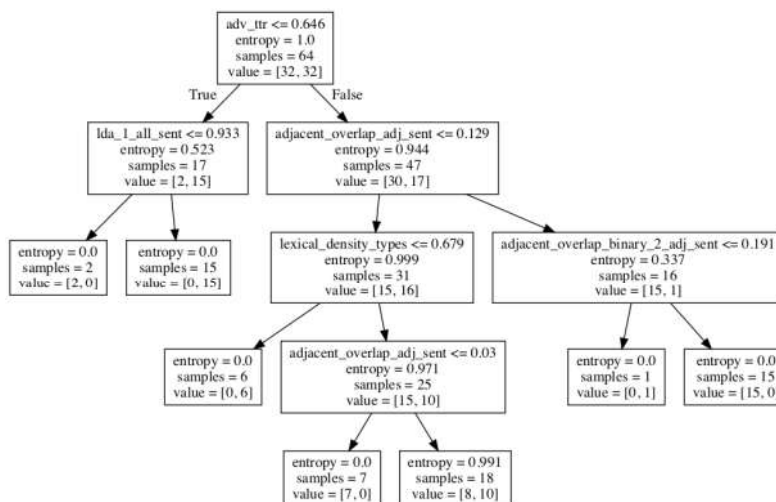*Figure 1.* The results of Decision Tree classifier (Form 1).

Figure 2. The results of Decision Tree classifier (Form 2).

Table 2. *Classifiers used and the final classification accuracy*

	Decision tree classifier	Random forest classifier
Form 1	59.0 %	72.7 %
Form 2	59.0 %	59.0 %

4. Discussion and Future Research

The result in this study implies that there were some cohesive devices which were significant for the classification of the task based on the cohesiveness of source texts. In Material 1, participants who read the high cohesive passage wrote responses which had a fewer number of connectives, and a fewer number of overlapped adjectives and verbs than those read the low cohesive text. In Material 2, participants who read the high cohesive passage wrote responses that had a variety of adverbs and a fewer number of overlapped adjectives than those read the low cohesive source text.

In future research, we will closely look into the linguistic features of each writing response and investigate the qualitative relationship between the cohesiveness of the source text and the use of cohesive devices in the response. Furthermore, participants' writing strategy use in the task will be included in the future analysis to examine how their psychological factors influence the writing performance in the integrated reading-writing task. It will provide important implications for increasing

the construct validity of the task and writing pedagogy.

References

Crossley, S. A., Kyle, K., & McNamara, D. S. (2016). The tool for the automatic analysis of text cohesion (TAACO): Automatic assessment of local, global, and text cohesion. Behavior Research Methods 48(4), 1227–1237.

Cumming, A., Kantor, R., Baba, K., Erdosy, U., Eouanzoui, K., & James, M. (2005). Differences in written discourse in independent and integrated prototype tasks for next generation TOEFL. Assessing Writing, 10(1), 5–43.

Gebril, A., & Plakans, L. (2009). Investigating source use, discourse features, and process in integrated writing tests. Spaan Fellow Working Papers in Second or Foreign Language Assessment, 7(1), 47–84.

Guo, L., Crossley, S. A., & McNamara, D. S. (2013). Predicting human judgments of essay quality in both integrated and independent second language writing samples: A comparison study. Assessing Writing, 18(3), 218–238.

Halliday, M. A. K. & Hasan, R. (1976). Cohesion in English. London: Longman.