

Designing an Interactive and Visual Environment for Term Paper Grading Support System in Higher Education

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Abstract: The author has already developed and evaluated a term paper grading assistance map. The map was designed to visualize scores graded for term papers assigned to a class at the university level or the equivalent. The map is a new visualization technique to show the amount of words and word use. This paper introduces prototype system of an assistance map using singular value decomposition technique for grading term papers and proposed five core ideas to improve that system's use.

Keywords: Visualization, Natural Language Processing, Term Paper Scoring, Higher Education, Human-Computer Interaction

1. Introduction

Contemporary university education strives to nurture in students a wide range of abilities regarding writing, including comprehension/explication and production of essays. In recent years the physical burden placed on university instructors related to the grading of “term papers” submitted by students has clearly been increasing (Tsubakimoto et al. [1]), which in turn has created a need for seeking improved methods for the grading of term papers at universities. Concerning grading methods for term papers submitted in large numbers as well, Deerwester et al. [2] have been testing the use of Latent Semantic Analysis (hereafter “LSA”), not only for grading written term papers, but also for the guidelines for their production and comprehension/explication, and several important related experiments have also been carried out in Japanese. LSA is a type of vector space method which makes possible the expression through multidimensional vector spaces of not just terms and documents, but also topics and sentences. Through the application of LSA it is possible to create clusters from the frequency of similar items in document content, which in turn promises to make the grading of large volumes of term papers more efficient.

The significance of visualization of the degree of similarities within documents lies in the fact that the text grader can display, in an easily understood form, large amounts of usable information, and thus makes possible quick access to these items (Landauer et al.[3]).

2. Designing Interactive Environment for Term Paper Grading

2.1. Past Studies

Tsubakimoto et al. [4] used the visualization method developed by Deerwester et al. [2] to create a two-dimensional map visualizing report contents and scores (hereafter “D map”), and investigated the possibility of its application to term paper grading assistance. However, the visualization information previously handled by Tsubakimoto et al. [5] concerning term papers written in Japanese by Japanese university students was limited in terms of question forms and holistic evaluation criteria because the students were made to use selected keywords, and therefore the knowledge gained from the results was confined to a limited

range. Consequently, there was inadequate verification of the effects on visualization results when other question forms or evaluation criteria were employed.

2.2. Visualizing Term Papers and its Scores

The author developed the term paper-grading assistance map shaped as a circular cone (see **Figure 1**). First, the author visualized the pre-graded term papers by colored dots: red indicates grade A; orange indicates B; green indicates C; and blue indicates D. Second, the authors visualized the important words for the theme of term papers on the left arc. Actually, there are noteworthy aspects in Deerwester et al. [2]'s map; (1) If the document leaves from the original point of the map, the word quantity which included in the document becomes many, (2) The document is arranged according to the direction of the word which from original point face to the arc.

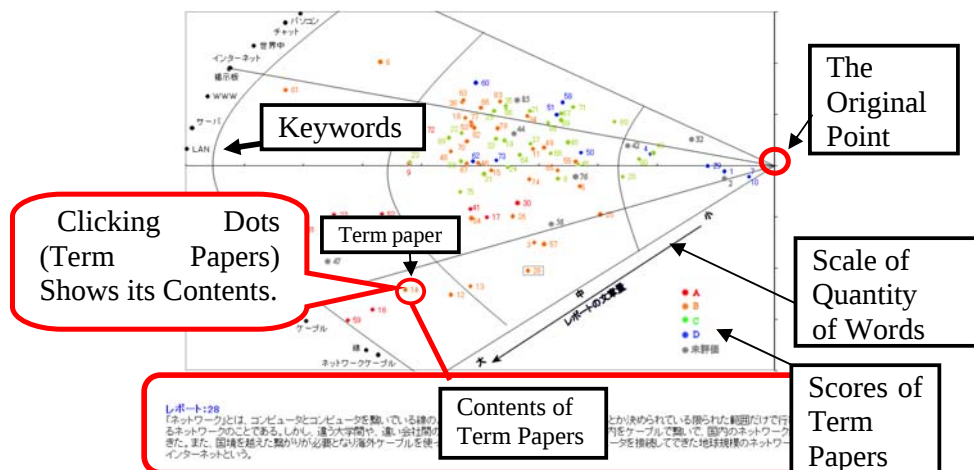


Fig.1 Term Paper Grading Assistance Map (Prototype) []

The author set data of 245 words in matrix X as 100 times frequency and showed all words maintaining every angle from the original point to the left arc automatically. Second, the author selected the 15 most important words and plotted them on the map. These words were as follows: personal computer; chat; all over the world; internet; BBS; WWW; server; LAN; protocol; client; network; computer; cable; line; network cable. Third, the author suggested the scale showing length of each term paper. Kaplan et al. [6] pointed out the holistic score of essays could be predicted by the number of words included in each essay. Therefore, the author estimates something effectiveness about this scale to help term paper grading by human raters. Last, the users can read the contents of the term papers by clicking dots on the map.

2.3. Purpose of This Research

This system is important because it can give users a substantially more efficient and accurate way of grading term papers. This system can significantly reduce the stress of grading [4], save time [4], and remove the error caused by the recency effect [5]. This system is applicable to any level (high schools, universities, etc.) and could be modified so that papers of various languages could be used. The ease, precision, and effectiveness of this system translates into a cost-saving procedure for employers who desire their teachers to spend less time grading and more time performing other tasks, such as research and teaching. In this research, the author focuses on a more practical and useful implementation

of this system based on the prototype system. The prototype's functions were limited because it was developed for an educational experiment, not for practical use. If evaluators want to use the prototype for their practical grading work, they must use extra tools or software, such as Microsoft Excel, to record each term paper's grade.

Therefore, the author proposes the development of a term paper grading support system for more practical use. Some specified ideas are as follows:

- The system will visualize classification results based on calculated similarities among contents of term papers via SVD and tentative grades added automatically by the system on the D map.
- The system will add grades to each term paper and plot those grades on the D map. Human evaluators will be asked to re-grade only those specific papers which require re-grading.
- Human evaluators will be able to re-grade and accommodate their grades for term papers as many times as they want. This function indicates interactivity between human evaluators and the system.
- When human evaluators refresh their D map, the system will show the re-graded information for the term papers. However, the system does not recalculate similarities among contents of term papers, but just change the sign (color) of grades.
- After finishing grades, evaluators will be able to acquire a data table containing grades corresponding to students who wrote the term papers. The accessible data format will be CSV by Microsoft Excel or plain text.

The author is preparing to start developing these features now. After testing the effectiveness of this system, the author is contemplating free public release of this system.

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