Automatic Online Educational Game Content Creation by Identifying Similar Chinese Characters with Radical Extraction and Graph Matching Algorithms

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ABSTRACT

One of the difficulties in learning Chinese characters is distinguishing similar characters. This can cause misunderstanding and miscommunication in daily life. Thus, it is important for students learning the Chinese language to be able to distinguish similar characters and understand their proper usage. In this paper, the authors propose a game style framework to train students to distinguish similar characters. A major component in this framework is the search for similar Chinese characters in the system. From the authors’ prior work, they find the similar characters by the radical information and stroke correspondence determination. This paper improves the stroke correspondence determination by using the attributed relational graph (ARG) matching algorithm that considers both the stroke and spatial relationship during matching. The experimental results show that the new proposed method is more accurate in finding similar Chinese characters. Additionally, the authors have implemented online educational games to train students to distinguish similar Chinese characters and made use of the improved matching method for creating the game content automatically.

Keywords: ARG Graph Matching, Automatic Content Creation, E-Learning Game, Radical Extraction, Similar Chinese Characters

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INTRODUCTION

The evolution of computer technologies makes a big impact on traditional learning. Shih et al. (2007) and Chen et al. (2005) studied the impact of distant e-learning compared with traditional learning. Distant e-learning has many advantages over traditional learning such as no learning barrier in location, allowing more people to learn and providing an interactive learning environment. There is a great potential in adopting distant e-learning in areas with a sparse population. For example, in China, it is impractical to build schools in every village. As a result, some students have to spend a lot of time for travelling to school that may be quite far away from their home. If computers can be used for e-learning in this location, the students can save a lot of time for other learning activities. Moreover, there is a limit in the number of students whom a school can physically accommodate. Distant e-learning is a solution that gives the chance for more people to learn in their own pace without the physical limitation. In addition, distant e-learning allows certain levels of interactivity. The learners can get the immediate feedback from the e-learning system and enhance the efficiency in their learning.

E-learning has been applied in different areas such as engineering by Sziebig (2008), maritime education by Jurian (2006), etc. Some researchers study the e-learning in Chinese handwriting education. Nowadays there exist many e-learning applications to help students learn their native or a foreign language. This paper is focused on the learning of the Chinese language. Some researchers (Tan, 2002; Teo et al., 2002) provide an interactive interface for students to practice Chinese character handwriting. These e-learning methods help students improve their handwriting skill by providing them a framework to repeat some handwriting exercises just like in the traditional learning. However, they have not considered how to maintain students’ motivation to complete the tasks. Green et al. (2007) suggested that game should be introduced for learning because games bring challenges to students, stimulate their curiosity, develop their creativity and let them have fun.

One of the common problems in Chinese students’ handwriting is mixing up similar characters in the structure (e.g., 囮， 囫) or sound (e.g., 木， 目), and misusing them. Chinese characters are logographs and there are about 3000 commonly used characters. Learners have to memorize a lot of writing structures and their related meanings. It is difficult to distinguish similar Chinese characters with similar structure or sound even for people whose native language is Chinese. For training people in distinguishing similar characters, teachers often make some questions by presenting the similar characters and ask the students to find out the correct one under each case. There are some web-based games that aim to help students differentiate similar characters (The Academy of Chinese Studies & Erroneous Character Arena). These games work in a similar fashion in which they show a few choices of similar characters to the players and ask them to pick the correct one that should be used in a phrase. These games suffer from the drawback that the question-answer set is limited thus players feel bored easily and there is little replay value. On the other hand, creating a large set of question-answer pairs is time consuming if it is done manually. It is beneficial to have a system to generate the choices automatically.

RELATED WORK

To automatically generate the game content with similar Chinese characters, the system needs to search for similar characters used in idioms or words to create the choices such as (如火如荼 or 如火如茶?) and (人士 or 人仕?). In the above examples, only one of the two choices is correct and the other wrong choice has a character replaced by another similar looking character. These examples illustrate the possibility of automatic generation of the answer choices provided that there is a way to find similar Chinese characters.
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