Chapter 3.26
A Sign Language Teaching System Using Sign Language Recognition and Generation Methods

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ABSTRACT

We have developed a sign language teaching system that uses sign language recognition and generation methods to overcome three problems with current learning materials: a lack of information about non-manual gestures (facial expressions, glances, head movements, etc.), display of gestures from only one or two points of view, and a lack of feedback about the correctness of the learner's gestures. Experimental evaluation by 24 non-hearing-impaired people demonstrated that the system is effective for learning sign language.

INTRODUCTION

Sign language is widely recognized in Japan as an important method of communication for hearing-impaired people. To support the daily life of hearing-impaired people, the number of hearing people who can communicate using sign language has to be increased.

While there are many materials for learning sign language, including textbooks, videotapes and PC software, these materials have three problems. First, they contain little information

about non-manual gestures. In sign language, non-manual gestures, such as facial expressions, glances and head movements, are as important as manual gestures. Second, the learners can see the gestures from only one or two points of view. Many learners want to see them from various points of view. Third, the learners get no feedback on the correctness of their own gestures. Learners not only have to study sign language by observing and studying signed gestures, but they also have to practice. The materials should thus give them feedback about correctness of their gestures.

Our group previously developed a sign language recognition method that recognizes Japanese sign language (JSL) gestures and translates them into Japanese text (Sagawa et al., 1998; Sagawa & Takeuchi, 2000; Sagawa et al., 2001). Our group also developed a sign language generation method that translates Japanese text into JSL and displays it as a three-dimensional computer graphics (3DCG) animation (Sakiyama et al., 1994; Sakiyama et al., 1996). The sign language recognition method calculates the similarity between the inputted sign language gesture and the gesture data stored in a system. It can also be used to evaluate the correctness of an inputted sign language gesture. The 3DCG animation generated by the sign language generation method enables the gesture to be freely viewed from different perspectives and the size of the CG character in the animation to be freely changed. These features facilitate the learning of sign language.

We have now developed a sign language teaching system that uses the sign language recognition and generation methods to enable effective sign language study. Experimental evaluation by 24 non-hearing-impaired people demonstrated that the developed system is effective for learning sign language.

BACKGROUND

It is now widely recognized in Japan that sign language is an effective method of communication for hearing-impaired people, particularly as they participate more actively in society. Hearing-impaired people often communicate with hearing people through a sign language interpreter because most hearing people cannot understand sign language. However, interpreter support is not always available because the number of interpreters is limited and their services are in great demand. Hearing-impaired people also communicate with hearing people by writing the text on paper and by reading the lip motion of the person talking to them. However, they often have trouble understanding written or spoken language because there are not only differences in the means of expression but also in the grammar between sign language and spoken or written language. Therefore, many hearing-impaired people encounter communication problems in their daily lives.

To facilitate communication between hearing-impaired and hearing people, we have developed a system to automatically translate between Japanese sign language and Japanese language. It uses sign language recognition and generation methods we previously developed. The sign language recognition method translates gestures inputted into a computer through a glove-based input device into Japanese sentences. The gesture primitives, such as the hand shape, the palm direction, the linear motion, and the circular motion are detected from the inputted data. The template of a sign language word has been described as a set of gesture primitives, and a word is recognized by integrating the detected primitives based on the template (Sagawa et al., 1998). The meanings of the recognized sign language words are identified, and a Japanese sentence is created by adding appropriate Japanese postpositional particles (Sagawa & Takeuchi, 2000). We have also