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Chapter XIII

Multimedia Dictionary and Synthesis of Sign Language

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INTRODUCTION

Deaf people, as a marginal community, may have severe problems in communicating with hearing people. Usually, they have a lot of problems even with such—for hearing people—simple tasks as understanding the written language. However, deaf people are very skilled in using a sign language, which is their native language. A sign language is a set of signs or hand gestures. A gesture in a sign language equals a word in a written language. Similarly, a sentence in a written language equals a sequence of gestures in a sign language.

In the distant past deaf people were discriminated and believed to be incapable of learning and thinking independently. Only after the year 1500 were the first attempts made to educate deaf children. An important breakthrough was the realization that hearing is not a prerequisite for understanding ideas. One of the most important early educators of the deaf and the first promoter of sign language was Charles Michel De L'Epée (1712-1789) in France. He founded the fist public school for deaf people. His teachings about sign language quickly spread all over the world.

Like spoken languages, different sign languages and dialects evolved around the world. According to the National Association of the Deaf, the American Sign Language (ASL) is the third most frequently used language in the United States, after English and Spanish. ASL has more than 4,400 distinct signs. The Slovenian sign language (SSL), which is used in Slovenia and also serves as a case study sign language in this chapter, contains approximately 4,000 different gestures for common words. Signs require one or both hands for signing. Facial expressions which accompany signing are also important since they can modify the basic meaning of a hand gesture. To communicate proper nouns and obscure words, sign languages employ finger spelling. Since the majority of signing is with full words, signed conversation can proceed with the same pace as spoken conversation.

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So far, sign language dictionaries, textbooks and manuals relied on illustrations using drawings or photographs which were augmented by text descriptions. Multimedia technology seems an ideal medium for presentation, reference and learning of such gestural knowledge since it can also incorporate video material. An overview of computer-aided learning systems for education of hearing-impaired people can be found in Alonso et al. (1995).

The most basic version of a multimedia dictionary of a sign language consists of words accompanied by video clips showing the corresponding gesture. Sound recordings of spoken words can be added, as well as illustrations and examples of sentences demonstrating the usage of a word.

Such a multimedia sign language dictionary can serve multiple functions. Primarily, it supports the learning process of sign language in special educational institutions for the deaf as well as enables normal hearing people, who are in daily contact with deaf people, to learn to communicate with them in the sign language. Another goal of a sign language dictionary is to standardize a given sign language. Since communities of deaf people are often isolated from each other, there is a great tendency to develop local dialects which are then not easily understood by other communities of deaf people. A dictionary can unify the meaning of signs and at the same time define a standard way of performing a sign. A dictionary can also somewhat fill the gap in the number of qualified sign language instructors.

We developed a multimedia dictionary of the Slovenian Sign Language (SSL) to address the needs in Slovenia. Using the same methods and the same framework, we could easily produce dictionaries for other sign languages.

In the first half of the chapter, we give some background on how our sign language dictionary evolved, describe its structure and give examples of its user interface. Based on our sign language dictionary, we developed a method of synthesizing the sign language, which makes possible a translation of written texts or, in connection with a speech recognition system, of spoken words to the sign language. This sign language synthesis method is described in the second half of the chapter.

BACKGROUND

We presented our first concept of a multimedia sign language dictionary for the deaf on CD-ROM in 1995 (Jakliˇc et al., 1995a; 1995b). This was to our knowledge one of the first concepts for a multimedia dictionary of sign language which we demonstrated at the New Talent Pavilion, MILIA'95, in Cannes, France. A similar approach was used for the American Sign Language dictionaries on CD-ROM (Sternberg, 1994; PC, 1995).

A pilot application of our sign language dictionary consisting of less than 100 words was made in 1996 (Krapež, 1996) and the final application in 1999 which includes also synthesis of sign language sentences (Krapež and Solina, 1999).The final version of the Slovenian Sign Language dictionary includes 2,500 most frequent words that are used by the deaf people in every day conversations. The CD ROM-based dictionary of the Slovenian Sign Language of the deaf was selected among the top 15 products in the Student Europrix'99 MultiMediaArt Competition (EuroPrix, 1999).

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