Interactive American Sign Language Dictionary

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Abstract.

An Interactive American Sign Language (ASL) to English dictionary, the first to the best of our knowledge, is presented in this work. By means of a novel gestural interface users input the unknown sign and get the equivalent English word in an interactive way. Instrumentation and methods discussed here can be adapted to other applications whit multidimensional inputs.

1 Introduction.

To the 3 million school age deaf children living in the US, whose native language is ASL, learning English as a second language is not a matter of choice but a matter of necessity. Despite ASL was first taught 300 years ago, when Gallaudet brought the first sign language teacher from France, there is no written version of the language therefore, deaf students find difficult to write what they learn in school in their native language, they have to write class notes in English.

Probably, the very first book anybody learning a second language would buy is a dictionary. Surprisingly, the only paper dictionaries commercially available are one-way only, i.e. English to ASL. Recurring to this dictionary to find the English meaning of a known sign is as useful as looking for the meaning of the Spanish word '*búsqueda'* on an English to Spanish dictionary. On-line ASL dictionaries are not different, and the reason is the lack of two things: a standard ASL description system and an adequate input interface.

2 Description of ASL gestures.

In the first descriptive system for ASL gestures, developed by William Stokoe in early 1960's, gestures were described by three simultaneous components: hand shape, hand position and movement. Newer systems add more components to describe gestures in more detail to avoid ambiguity and take into consideration the sequential execution of gestures. In particular, the description proposed by Hernandez, which extends Stokoe's description to include the initial shape, orientation and position of the hand (initial pose), the final pose, and the movement in between, has been successfully used to describe and recognize over 200 signs performed with one hand. This description and recognition systems are used to store and retrieve gestures in the dictionary.

3 Input Interface.

The interface in comprised by an AcceleGlove and a plastic two-link arm skeleton worn by the user as shwon in **figure 1**. The AcceleGlove reads hand posture, composed of hand shape and hand orientation as a 15-byte vector, and the arm skeleton reads wrist position as a 4-bye vector with an accuracy of about 1 cm. Altogether, the interface detects up to 43 different postures, 11 different positions respect to the body, and seven movements, equivalent to over 2 million pose-movement-pose combinations.

The advantage of this glove-skeleton instrumentation over the glove-tracker approach is that the AcceleGlove, unlike other gloves (CyberGlove, DataGlove, PowerGlove) requires less circuitry and less computing power. The same is true for the skeleton if compared against IR, RF or ultrasonic trackers, and it is more stable and immune to ambient noise.

Figure 1. Input Interface

3 The Dictionary

The dictionary displays a list with all the signs with the initial pose shown in the pictures at the bottom, in real time. **Figure 2** shows an example of a search: the user presses an external switch to select an initial posture at the chest **(a)**, then moves forward, and presses another switch marking the final pose **(b)**. The dictionary translates this sign as 'LIKE'.

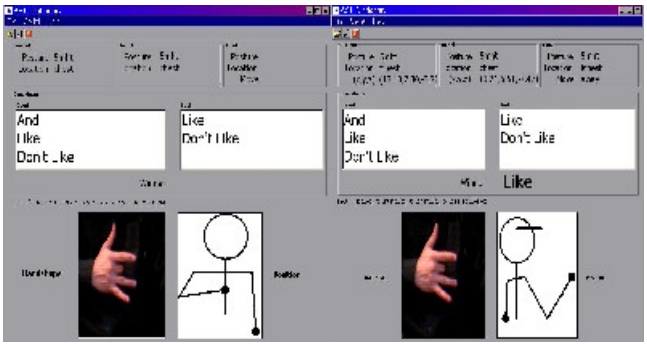

Figure 2. a) Initial pose selection b) Final pose and best match

4 Conclusion and Future Work.

This ongoing project is the seed for a broader and more versatile dictionary since applying the description system to two-handed signs, adding video clips and changing the output word to other languages (Spanish, French, etc.) is, thanks to the novel interface, promisingly straightforward. Other applications for the interface are foreseen in the field of graphics, animation and virtual reality.

References

HERNANDEZ, J. Phonetic Model for Automatic Recognition of Hand Gestures. In *Proceedings of the 4th. International Conference on Language Resources*. Lisbon, Portugal 2004.

STOKOE, W. Sign Language Structure: an Outline of the visual communication system of the American Deaf. *Studies in Linguistics. Occasional papers 8*. Linstok Press, Silver Sring MD, 1960.