
HHH spring 2010 – American Sign Language Interpreter – From gesture to Speech

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Abstract

In this paper we describe the formatting requirements for CHI2010 Extended Abstracts and offer recommendations on writing for the worldwide SIGCHI readership.

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Introduction

Sign language conversants face difficulties in everyday life and often need to be accompanied by someone in order to translate their signs. Replacing these translators by some automatic device would really be a great improvement of life quality for those people and give them the independence they lack today.

Equipments

There are two main line of idea for building sign language interpretation devices: use gloves wired with move sensors or cameras that will record the hands motions and interpret it.

Many type of gloves already exists (some not too expensive: count \$1000 for a pair) with application regarding sign languages.



Figure 1: The acceleglove

With the increasing use of motion recognition in some domains such as cinema, 3D image reconstruction and motion recognition are fast growing and improving technologies and some of the gloves (shapeHand) are direct results of these progresses.

One issue with the use of electronic gloves is that facial features are ignored. This is quite an issue because for some signs they are of great importance. For example, the same sign, produced on the forehead or on the chin can mean dad or mom. Smile and other facial expressions also contribute to a better understanding of signs.

Also wearing glove is a bit intrusive, especially when the glove needs to be connected to a laptop or another device. (Note that certain gloves offer wireless technologies).

Other solutions exists using cameras. They offer a good solution for facial recognition as they can capture the facial motion as well as the hands motion.



Figure 2: example of device using hands motions record using a camera incorporated in a hat.

One issue with use of cameras is that the result is very dependant of the environment: poor lightning condition could interfere with the recognition process.

Solutions

In this paper, I will present a set of solution I came across during my researches stating their advantages and inconveniences as I describe them.

The solutions I will describe can be sorted in two categories:

- ❖ First person solutions
- ❖ Second person solutions

First person solution

Solutions which are said to be first person are solutions where the device that helps translate and interpret the sign language is worn by the user.



Figure 3: ShapeHand device use to produce 3D models of hands. (First person solution)

This seems the most logical approach since it is hard to expect every interlocutor of the sign language user to possess an interpreting device. Or if, the device is part of the environment (like cameras in a house) it would really limit the range of action of the device.

Also, the device being worn by the user, it is possible to incorporate some learning component in the interpreter software so that the device becomes more 'familiar' with the signs of its user.

The disadvantage of the first person solutions is that depending on the nature of the device, the solution can become fairly intrusive and be a source of uneasiness for the user.

Second person solution

In the second person solutions, the device is external from the sign user. Either the device belongs to the environment of the sign conversant (e.g. cameras surrounding him) or the device is worn by the interlocutor of the sign user interlocutor.

The advantages and disadvantage of those solutions are the opposite of the ones for first person solutions: these second person solutions are really unobtrusive for the sign user (though they can be for the interlocutor if he has to wear the device).

Another problem with second person solutions is that they can only use cameras.

Gesture recognition techniques

This is a complex part of the problem. Sign language, as any language, has a set of rules (a grammar) and words which are very complex. Most interpreters currently focus on simplified sign language (only fingerprinting, or reduced set or words/sentences).

As an example, Pr Thad Starner from Georgia Tech exposes in his research the use, of Hidden Markov Modeling to interpret signs.

Text to speech application

The interpreter produces textual output that we might be willing to transform into vocal output. This is actually really easy. Many very efficient text to speech software are already available (some online [4]).

Possible applications

The existence of those device which enables hand motion recognition open multiple incredible possibilities for application.

Some really interesting application already exist in order to learn sign language (even some iPhone application using shapeHand gloves)

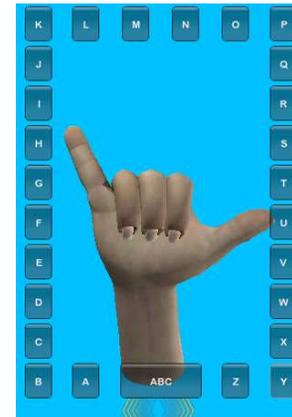


Figure 4: screenshot of iPhone application.

Some other application of these hand motion interpreter devices would be home automation for disabled people. It is quite easy to imagine a house equipped with cameras following its disabled occupant hand gesture and interpret them as orders such as open doors, turn on lights, turn on TV or other electronic equipment.

There also are some applications for electronic gloves in the medical sector: as for now, they are used for simple procedure, as the example of figure 5 which assists medical staff in Cardiopulmonary Resuscitation (CPR) procedures, but we can imagine that in a close future when those technologies reach a greater accuracy, such gloves could be used for complex procedures.



Figure 5: the CPRglove

Finally, a last application for electronic glove could be gaming controllers: How great could it be to control a virtual character like a puppet with your hand?

Conclusion

Research in the domain of motion recognition and in particularity in hand motion recognition is fairly advanced and the possibility of seeing an efficient device for interpreting sign language in a close future is more than a distant hope for sign language users in the need of independence.

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