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Sign Language Recognition System Using Hidden Markov Models

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1 Introduction

Progress of information technology is now required promote good welfare for people is. As of increasing of opportunities that deaf people participate general community, many people also have oppofunities to communicate between deaf people and hearing people are frequently. Since deaf person can not communicate via voice, people have to communicate by writing, sign language, and so on. But writing is too slow to communicate between people. On the other hand, sign language has enough communicate speed. But only a few people can understand the sign language. We can also ask interpersonal to trance late the sign languages. However, the number of interpret is too small for usual communications. from the above reason, sign language interpretation system by computers is requered.

At present, there are two useful to input sign language into computers. One is based on the image processing techniques, the other is based on the special sencer devices that are equipped on the body There devices are called wearable type device. But the methods with image processing allows testees unrestricted movement. But it is difficult to estimate the movement of finger in detail. Due to avoid these problems wearable type devices are recently attracted. Sagawa proposed a sign language recognition method useing Dynamic Programming matching(DP matching) with wearable type devices. His approach achieved more then 90% recognition rates for specified person. But, DP matching is not suitable for unspecified people. Because DP matching is affected by difference between people. On the other, Hidden Markov Models(HMM) is use for voice recognition system. Since HMM decide their parameters through the enoumou munber of learning patterns, it can achieve robust recognition against the fluctuation of data. How ever enoumou number of learning

patterns causes a large learning time. In addition, the number of learning patterns would be much more if HMM is created for every word.

In this paper, we propose that the recognize sign language with small number of learning pattern by HMM. And recognition system adapt many speaks. A word sign of language is divided in the three part, 'hand shape', 'basic movement' and 'movement plane'. In our method the part a HMM recognizes basic movement. So the number of HMM can be reduce as the number of basic movement. Cybergloves are use to get hand shape. And FASTRACK is used to get the three-dimensional position of hands. First, the basic movement are recognized by HMMs Then Make the sign language word recognition system which combined a hand shape, basic movement, movement plane is built, and that performance evaluation is done.

2 sign language phonology

The sign language is divided three element. It is hand shape, move, and movement plane. Hand shape is express, a movement moves a hand in what kind of line form, or a movement side expresses the position (for example, in such cases as the front of the body and the level surface) where an arm is moving to the point. The sign language phonology description many sign language by dividing the element of one sign language into some like this by few description signs.

3 recognition method

Old method, HMM was use for in every one sign language. But, when the number of words increases with this technique, it is decided that learning samples increase, too, and it obstructs the big difficulty of increase in the number of words. In this paper, Sign language divided into three elements first. This elements are 'hand shape' and 'movement' and 'movement plane'. That information is integrated after each element is recognized. Then, a word is recognized by using that information. The movement of the recognition object calls this a basic movement from now on by the thing which becomes the basic unit of the movement to construct a sign language word. Hand shape recognition is used by Byes. And movement plane get from the vector information that the dispersion of the data which it could get with KL method.

4 basic movement recognition

Since HMM changes the parameter by study, according to the number and the kind of sample used for study, the rate of recognition changes greatly. So, I was checked how a change in the number of learning samples influenced a recognition rate. The basic movement recognition rate of specified speaker was 70% as the result by 'line' and 'halt' and 'stop'. And a basic movement 'right-left move' was 50% But recognition of movement 'circle' or 'other' was not steadiness.

5 sign language recognition

First, it made dictionary form movement plane data and result of recognition HMM and Byes. The recognition experiment of a word was performed using the created word dictionary. A target did it with the person handled in learning of HMM, and the unknown person. A recognition rate was 57.1% with a specified speaker as that result. On the other, a recognition rate was 16.1% with an unknown person

It thinks that it is because an unknown person isn't being handled for learning of HMM at all as this cause. In other words, HMM isn't restrained the unknown person's habit. Moreover, a movement plane is also considered that using the data obtained from the KL method as it is had the large variation in data, and it became the factor of incorrect recognition.

6 conclusion

In this paper, it verified by building the recognition system which uses HMM at basic movement, uses the KL method for pick up movement plane, and uses Byes at hand shape recognizing method, unifies the information, and determines a sign-language word. Consequently, the rate of recognition of operation in HMM was bad because of the deviation of a study sample, or little, and the rate of word recognition was very bad in the unknown speaker. It was found that the study sample in HMM needs to be increased from this. Moreover, the technique not influenced by the individual needs to be examined also about a movement plane.