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Author(s)	鈴木, 信勝
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# Recognition Method For Sign Language With Motion Trajectory

Nobukatsu Suzuki

School of Information Science,  
Japan Advanced Institute of Science and Technology

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## 1 Introduction

Availability of information technology to promote the welfare of the people is extremely required. Because of increasing opportunities that deaf people attend general community, communications between deaf people and hearing people are frequently required. There are some method within non-verbal communication. In those, sign language is one of the important and common communication method. Although, sign language interpreters are needed to communicate with peoples can not use sign language and the deaf peoples, the interpreters does not have enough. Therefore, in order to solve these problem, study of about sign language recognition using computer is imperative. To take producing sign language learning support system into consideration, it is more serviceable rather recognizing element which constructs sign language word than simply recognizing a word. On study field of sign language recognition, recognition methods are classified into two method types with regard to data sampling device. There are image processing techniques using cameras. On the other hand, it is useful that techniques with sensing output data by fixed special sensor device to the parts of the body. These devices are named wearable type devices. Though the methods using image processing does not need restraining the body of testees, yet it is considerably difficult that to recognize fingers in detail. Due to avoid occlusion problem and become easy to calibrate data , techniques using wearable type devices are more facile than techniques using image processing. Within some studies using wearable type devices as former researches, a recognition method applying Dynamic Programming matching(DP matching) has studied. The recognition method applying the DP-matching has achieved high recognition rate for specified sign language speaker. An examination about for many sign language speakers, however, still has not reported, and

number of target words is limited to fewer as compared with recognition method for specified speaker. Thus, adapting to many speakers recognition method must be considered.

In this thesis, we propose that a recognition method applying harmonic analysis to adapt many speakers. We use to capture motion of sign language speakers that a 3-dimensions position input device and finger shape input device of both hand are adopted to Fastak and CyberGlove respectively. First, we examine a case that applying the DP matching to sign language recognition method for specified speaker and many speakers. Next, we propose and discuss a sign language recognition method using harmonic analysis with Fast Fourier Transform (FFT) for many speakers. In addition, we estimate that the sign word recognition and the motion trajectory recognition using harmonic analysis.

## **2 Hand motion trajectory based on the sign language phonology**

There are morphology and phonology about sign language as same as voice linguistics. A Sign language used in Japan is named Japanese sign language. The sign language is share a lot of certain similarities in Japanese. Japanese sign language, however, differs from Japanese in that composition of morphologic and phonologic. From linguistic point of view, a phonological representation method has been proposed. It have been publishing that 660 words in total based on the representation method. In this thesis, we investigate the motion trajectory of sign language based on the phonological representation.

## **3 Recognition method and examination for sign language**

One of characteristics of the sign language is that the pattern is time sequential and locally non-linear expand and contract. First, we have confirm that the method applying DP matching for specified speaker and many speakers. Next, we examine the method applying harmonic analysis which we proposed for many speakers. Finally, we discuss that applying harmonic analysis for motion trajectory.

**Recognition method applying the DP matching** As far as specified speaker is concerned, applying the DP matching recognition method achieves very higher recognition rate in former studies. In consequence we examine a case for many speakers, unfavorable results are achieved.

The reason why the method applying the DP matching was failed is that DP matching does not regard deviation of pattern. On the points as recognition rate and computational complexity, moreover, we encounter difficulties when we specify a parameter named as adjustment window size. The purpose of the parameter is to avoid unsuitable corresponding on time sequential pattern, but smaller adjustment window avoids adaptability of the DP matching on the other side. Those conditions are related to a trade-off and then

depend on target pattern. Especially, it is conspicuous with many speakers recognition. The increasing of adjustment window size and sample time sequential length occurs that concerning more computation time.

We examined that 330 target words and for specified speaker each four testnees ,we have confirmed extremely excellent recognition rate. At an examination about many speakers applying the DP matching,we have proved that the DP matching is unavailable for same the conditions. Concerning those tread-off, the increasing of sample data size incurs increasing more long computation time, and does not contribute to the recognition rate.

**Recognition method applying the harmonic analyzing** At the aforesaid examination, it is reason that recognition method applying DP matching can not prepare standard dictionary pattern for many speakers. To surmount the many speakers problem , it is necessary to import the deviation of pattern into gesture as sign language recognition. In spite of that it is necessary that strict primary correspondence of elements of pattern to calculate deviation of pattern, it is greatly difficult at the time domain. To approach the sign language recognition with the deviation problem, we propose a sign language method applying FFT and harmonic analyzing to translate pattern from the time domain to the frequency domain.

**Word recognition method applying the harmonic analyzing** We estimated the method applying the harmonic analyzing for 330 sign words and many four testness, which is similar to the examination using DP matching. We have achieved a recognition rate adapting for many speakers. Furthermore,it produces good recognition rate that an examination using standard dictionary which sampled from 3 testnees. Under the condition that same computation time, besides, the method applying the harmonic analyzing has achieved overwhelming more effect than using DP matching.

**Motion type detection method applying the harmonic analyzing** To detect motion type, we analyzed information of sign language phonology from vested the phonological representation at first. On those results, we prepared that many word groups which classified according to phonologic elements which construct word. And then, we created standard dictionary pattern and examined with focusing attention on that whether to be detected right groups. On condition that 34 target words and 13 classified groups, result was not more than result of many speakers word recognition rate .

## 4 Conclusion

In this paper, we proposed the sign language recognition method for many many speakers apply harmonic analysis with FFT analyzing. And, we discussed a advantage of applying harmonic analysis compared with applying DP matching. In an examination for many speakers, we showed result of the recognition rate, and reduced computation time than example of using DP matching. Additionally,in motion type detection we researched. The

detection rate of detecting motion type examination reach has gone no further than over half. In future work, we must to more closely investigate the relationship between the motion trajectory and the sign language phonologic elements.