

# A Proposal of a Care Worker Support System Using Structured Human Functioning Data

Chikataka Sato<sup>†</sup> Jun Sawamoto<sup>†</sup> Eiji Sugino<sup>†</sup> Norihisa Segawa<sup>†</sup>  
Hiroshi Yajima<sup>‡</sup> and Manabu Kurosawa<sup>‡</sup>

<sup>†</sup>Iwate Prefectural University 152-52 Sugo, Takizawa, Iwate-gun, Iwate, 020-0193 Japan

<sup>‡</sup>Tokyo Denki University 5 Asahi-machi, Senju, Adachi-ku, Tokyo, 120-8551 Japan  
sawamoto@iwate-pu.ac.jp

## Abstract

Care service at a care facility of aged people has a predetermined and plus adjusted-for-the-user procedure, and a procedure consists of a series of operations. The operations and procedure of actual care work are varied depending on the individual workers and some care taking actions induce unexpected accidents during the care taking. In this research, we automatically collect the operations and procedures of the care service which each care worker is performing, then accumulate into a structured human functioning database. We aim at developing a system which supports to warn a new worker of doing the work which tends to induce an accident, and recommends better procedures of care service.

## Introduction

In the care industry for aged people in Japan, there is a serious lack of human resources, it has a chronic labor shortage, and the burden of each care worker tends to increase steadily [1]. Therefore, in the care industry, even if a new employee joins a care facility, it is difficult to give him/her a sufficient off-the-job training, and the newcomer cannot but learn operations and the procedure of a service at the care spot directly in work after a short training period, and cannot utilize know-how of the senior workers in many cases [2]. Care service has a predetermined and plus adjusted-for-the-user procedure, and a procedure consists of a series of operations. It is required for a care facility of aged people to provide uniform and high quality service to the user. However, the operations and procedure of actual care work are varied depending on the individual workers and some care taking actions induce unexpected accidents during the care taking [2].

In this research, we automatically collect the operations and procedures of the care service which each care worker is performing, then accumulate into a structured human functioning database. We aim at developing a system which supports to warn a new worker of doing the work which tends to induce an accident, and recommends better procedures of care service.

## Proposed System

The action of voicing ‘Koekake’ , such as ‘Let me take your left hand’ or ‘Hold on the bar’ preceding to real actions, is recorded by speech recognition and used for the input to the system and analyzed and structured. Analysis of the actual contents of care is possible from the action of voicing in which the contents of the actually performed care are included. Extra effort for the worker of inputting data is reduced and the reliability of the data is improved compared to the off-line data input or record taking.

## Outline of the System Configuration

The outline of the proposed system is shown in Fig. 1. Each care worker is working with an Android terminal. And the system is constructed combining Android terminals and a server system. By the Android terminal, acquisition of the voice data of ‘Koekake’ is performed. And the voice data saved in each terminal is transmitted to the server once a day while a terminal is charged in the middle of the night.

In the phonological and morphological analysis module, Julius [3] and MeCab [4] were used for the conversion of voice data to text data. In the morphological analysis using MeCab, the care term dictionary was provided in order to extract care related terms required for the system (i.e., nouns and verbs) and the end of a word unification of

verbs of extracted terms is performed. Then, in order to unify synonyms which happen frequently in spoken language and to decrease the ambiguity of language, Weblio synonym dictionary [5] is used and synonyms are unified.

A set of words extracted from ‘Koekake’ corresponding to a care procedure is saved in the human functioning database in a structured manner as shown in Fig 2. And, as for the accumulated data of care procedures, analysis is performed by the comparison module of the service, and the distance of the performed care procedure from the right care procedure is measured by normalized Levenshtein distance (NLD) [6] (normalized by the number of words) to recognize the assumed right care procedure. The "right care procedure" is prepared by the facility as a data set of safe and appropriate care procedures as the guide to care workers [2].

After recognizing the right care procedure and the evaluation of the carried out care service in terms of the distance from the right one, the system produces warning/action recommendation to each user (care worker). Each user uses an Android terminal and refers to own evaluation and warning/action recommendation result.

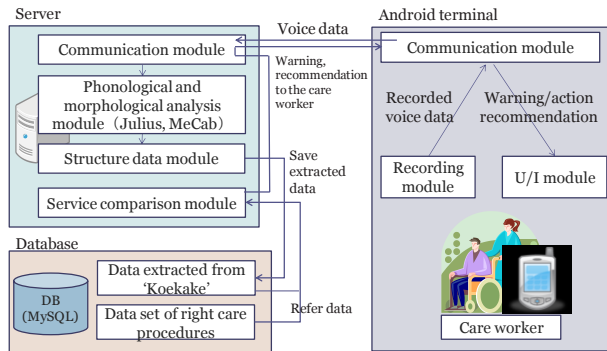


Fig. 1: Outline of the proposed system configuration

WorkerID	User name	Care type	Words extracted from a care procedure
001	Satoh	Stand up	Feet[n], Pull[v], Hands[n], Hold[v], Hands[n], Pull[v], Waist[n], Raise[v], Hands[n], Release[v]

(立上り)  
 足を引いて手を握って下さい。手を引くので腰を浮かせてください。それでは手を離します。  
 (足、引く、手、握る、手、引く、腰、浮かす、手、離す)  
 Pull your feet, and, please hold my hands. I will pull your hands, then raise your waist. Then I release your hands.

Fig. 2: A set of word data extracted from a care procedure (a case without errors)

### Preliminary Experiment and its Result

In this experiment, 100 data of 6 care types, i.e., *meal, bathing, change of clothing, body posture, stand up, transfer*, was used as the right care procedures of care service. Some accumulated incomplete or erroneous data of care procedures were prepared, and input to the comparison module of the service. We evaluated the

percentage of correctly retrieved answer (precision) as the ability of the comparison module.

### Experimental result

3 incomplete data were created for each selected right care procedure from 6 care types respectively. Experimental results were sorted in NLD. Fig. 3 shows an example of care type *stand up*. Input data is missing some care actions, and the data for right care procedure which is closest from the input data (NLD = 0.43) is retrieved. As a experimental result, among 18 test cases, 12 cases are correct (Precision = 67%). Furthermore, when the care type is given beforehand and considered, 13 cases are correct (Precision = 72%).

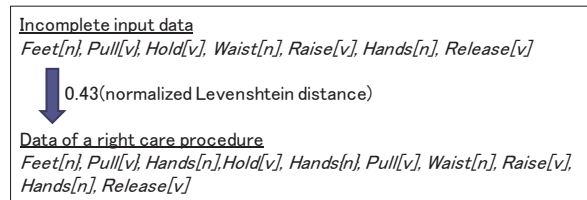


Fig. 3: An example of data matching

### Conclusion

We proposed a system which automatically collects the operations and procedures of the care services which each care worker is performing via voice data, then accumulates into a structured human functioning database. With a preliminary experiment, we confirmed the feasibility of the basic function of our method. We intend to develop the system further and evaluate the total system function from voice data of ‘Koekake’ to warning and action recommendation.

### Acknowledgement

This work was supported by JSPS KAKENHI Grant Number 24500243.

### References

[1]Torii,K.,Uchihira,N., etal. 2012.Service Space Communication by Voice Tweets in Nursing. In: Proc. of AHFE 2012.  
 [2]Ohta, H., Miyoshi, H., 2013.Ultimate Practical Care, Kodansha. (in Japanese)  
 [3]Julius. <http://julius.sourceforge.jp/>  
 [4]MeCab: Yet Another Part-of-Speech and Morphological Analyzer. <http://mecab.googlecode.com/svn/trunk/mecab/doc/index.html>  
 [5]Weblio. <http://thesaurus.weblio.jp/category/wrugj>  
 [6]Levenshtein distance. [http://en.wikipedia.org/wiki/Levenshtein\\_distance](http://en.wikipedia.org/wiki/Levenshtein_distance)