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MODELING SENSE OF FAMILIARITY AMONG PEOPLE IN MUTUAL TEACHING AND ITS APPLICATION TO E-LEARNING SERVICE

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ABSTRACT

Sense of familiarity among people is an important factor in mutual teaching. We propose a method of modeling this sense to support social communication in campus communities. We applied this method in finding familiar tutors to assist a specific student.

Keywords: *Sense of Familiarity, Modeling, Exchange support*

1. INTRODUCTION

The 2007 White Paper on the National Lifestyle [1] writes that "weakening of the connections among people" has led to a reduction in educational power in places where education is provided, such as in homes and schools. Today, with the spread of the Internet, people have begun to exchange more frequently in the cyber world, such as through social networking services and blogs. Despite the alienating trend of today's society among neighbors and friends, the cyber system is now promoting real-life exchange among people. For instance, there are locally operated Internet-based volunteer placement services, some of which are intended to support real-world socializing by providing helping hands.

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But today's volunteer placement services are operated only on the basis of self-reported information provided by volunteers and indicating that they are willing to provide support or have the ability to support. One of the things lacking in these kinds of service today is that they fail to take into consideration human relationships at the place where support is offered. Cases of dissatisfaction are therefore occurring among support receivers: for example, service users may feeling psychologically reluctant to make a request for support when they receive support, or volunteers may leave the support receivers immediately after being offered their support assignments.

If the index of "human relationship" were to be considered in these services, then we could expect support to be offered in a friendly atmosphere. A personal relationship between the supporter and the support receiver would continue even after completion of the support, and support receivers would find it easier to ask again the next time they needed support.

We think that if this sense of familiarity were to be emphasized to a greater extent as an index of "human relationship," then exchange among people could be promoted through local volunteer placement services.

In our research, we chose as an example a group of local volunteers supporting university students' learning or campus life at university. We propose a service that provides volunteer support to support receivers without making them feel uneasy when they meet new people or supporters and yet helps them to continue a personal relationship after completion of the support. To this end, we attempted to evaluate by computer the degree of familiarity among people when supporters were sought on the web.

2. INTERNET-BASED VOLUNTEER PLACEMENT SERVICE

2.1. EXAMPLES OF PRESENT SERVICES

Described below are some locally operated community support providers intending to activate real-world exchange among people, and human relationships, by means of Internet-based volunteer placement services:

(1) Senhime Project [2]

The Senhime Project is a volunteer support coordination program operated mainly in the city of Himeji, in Hyogo prefecture. The Project provides a webpage where volunteers can state what support they can offer, support requesters can state what support they need, and neutral coordinators arrange to match the two. The Project organizer accepts "eco money" like a token in exchange for the beneficiaries' gratitude. The purpose of the Project is to expand personal ties with the help of today's information technology. What characterizes the Project is that it gives ordinary people an opportunity to take their first step toward voluntary action by publicly expressing the volunteer support they can offer. It also encourages them to participate casually in voluntary activities by using their own capabilities within their own power.

(2) Otasu Keitai [3]

Otasu Keitai, a joint project of Nippon Koei Co. Ltd., the National Institute of Advanced Industrial Science and Technology (AIST), and the Highway Industry Development Organization, provides voluntary support to the aged by means of GPS-equipped cell phones. When an elderly person needs help while he or she is out—such as help to transport shopping bags—the person can send a request for help to registered supporters in the neighborhood by pressing the button on his or her cell phone. The request for help is relayed via a coordinator to the supporters via e-mail. A supporter who received the e-mail checks the location of the requester on his or her cell phone screen and then goes to the required location to help the client. This system aims to promote communication with aged people. The service is characterized by the choice of the appropriate supporters by the coordinators on the basis of judgment of location from the physical information provided by GPS.

(3) IT Ranger [4]

Developed from our previous research, IT Ranger is a learning support service that operates through volunteer placement currently operated in the Faculty of Science and Engineering of Chuo University. With this service, students who have problems with learning in class and have no friends or classmates around who are able to offer solutions can receive support from senior students. One of the main features of this service is that when clients look for appropriate supporters, the computer generates a list of candidates ranked in order of their reliability, as evaluated by their basic information such as position or title, people who know them and people around them.

2.2. PROBLEMS WITH THE CURRENT SERVICES

The characteristics of the examples of the current services, introduced in the previous chapter, and the factor of familiarity among people—the focus of our research—are summarized together in Table 1.

Table 1: Analysis of examples of the present service

	(1)	(2)	(3)
Knowledge and capability	B	C	B
Location and conditions	C	A	C
Reliability as judged by others	C	C	A
Sense of familiarity among people	C	C	C

A: Considered

B: Considered but improvement necessary

C: Not considered

As indicated by Table 1, the existing services mainly arrange matching in terms of physical and performance aspects such as location, knowledge, and capability. IT Ranger entails matching for a psychological element—namely, the level of reliability of registered supporters, based on other people's reviews—but it still lacks the element of human relationship, namely whether a client who requested support can feel at ease with the supporter who is sent. Therefore, when it comes to the exchange between supporter and client, the present type of helping-hand placement service actually fails to support the human relationship aspect, although it certainly provides physical support. Given these identified problems, we summarized the points to be clarified in our study as follows:

• Support requesters feel uneasy about making a request, as they are going to meet their supporters for the first time.

• Support receivers feel uneasy about being supported by supporters whom they are meeting for the first time.

→ The main point of our research is that support receivers express uneasiness about the supporters when they meet each other for the first time.

If we were to give greater consideration to the individual's personality in terms of a sense of familiarity and could judge the personality with a computer, we would be able to establish a service that eliminates this psychological uneasiness. In our study, we used profile information, constructed an individual model, used the individual model to evaluate the degree of familiarity that clients felt with supporters, and attempted to apply the evaluation results to the process of searching for supporters in a mutual teaching system in a school environment by using a service such as IT Ranger. We expect that our research will help in the evolution of a conventional type of service that focuses on promoting a sense of communion among people meeting each other through support.

3. APPROACH TO OUR RESEARCH

3.1. PROFILE INFORMATION FOR EVALUATION OF FAMILIARITY

This section describes an approach to the evaluation of a sense of familiarity among people in learning through mutual teaching through a service such as IT Ranger. We focused on the psychologically proven facts that people are sensitive to things in common with other people and that people—particularly when meeting with new people—unconsciously look for the inner aspects in others that are similar to those in themselves. It has also been proven that through such psychological processes people feel closer to others and remove psychological barriers. These facts are applied to psychological counseling as an established technique. In light of this evidence, we considered that it might be possible to express the points of similarity between people numerically as an indicator of sense of familiarity, which is a wide-ranging element [6].

Because our research used as the subject a local volunteer service that supports learning in university or campus life, we expected that the more similar each individual's campus life profile was to that of another, the greater a sense of familiarity would be between the two individuals. The specific method used to establish this profile information is described in the next section.

3.2. WEIGHTED MODEL COMPOSED OF GENERALIZATION HIERARCHY AND ATTRIBUTE VALUES

3.2.1. DATA ON PROFILE INFORMATION USED IN THE EXPERIMENT

The profile information on campus life mentioned in 3.1 was composed of information made up of three elements: "domain information," "detailed information," and "attribute information." The detailed information contained concept items subordinate to the domain information and had the structure of a generalization hierarchy. The attribute information expressed three specific pieces of information: "when," "where," and "with whom?" Table 2 shows the specific data that was handled in our study. To compile the profile information items on campus life listed in this table, a questionnaire survey was conducted in advance with some twenty people, who were asked, "When, where, and with whom?" they did each item of the three categories of domain information, namely sports, entertainment, and eating. The survey results are summarized in the table 2.

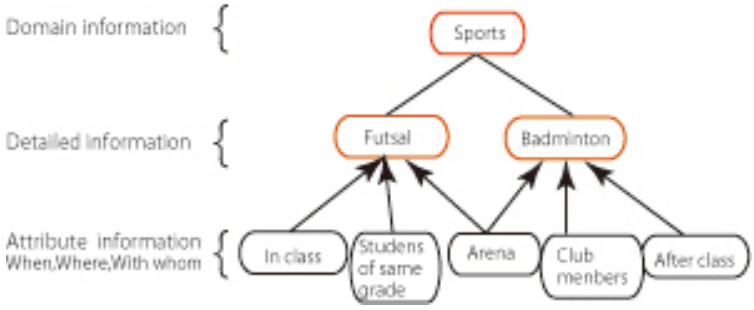
Table 2: Profile information data

Domain information	Detailed information	Attribute information	
Sports	Futsal	When	Free time
	Basketball		After classes
	Volley ball		In class
	Tennis	Where	Arena
	Badminton		Tennis court
Entertainment	Video or TV game		Suidobashi
	Karaoke		Tokyo Dome City
	Mahjong		Near Chuo University
	Bowling		Library
	Darts		Laboratory
	Book reading		School restaurant
Eating	Set meal		Classroom
	Curry and rice	With whom	Students of the same grade
	Donburi		Club or group members
	Fast food		Laboratory mates
	Bento		
	Ramen		
	Udon		
	Soba		
	Dessert		

3.2.2. SELECTION OF PROFILE INFORMATION ITEMS

This section and the next describe the method of constructing the individual model to evaluate a sense of familiarity. Each user is instructed freely to select multiple items that they often do as part of college life from the list of detailed information under each domain information category. Then a model (Fig. 1) is established.

Figure1: Detailed information selection of profile information items

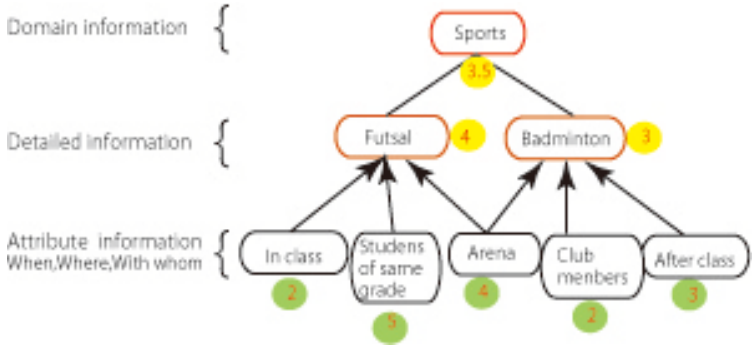


When this information is presented as in Fig. 1, points of similarity can be searched for, not only in the information on, for instance, tennis, but also in the information on its superordinate concept (sports) and the associated attribute information. In other words, similarities can be determined from a broad viewpoint.

3.2.3. WEIGHTING OF PROFILE INFORMATION ITEMS

The next step is to weight profile information items composed of the domain information, detailed information, and attribute information. Weightings are given, because even if people have things in common, how much they feel familiar with each other on these points varies from person to person. To begin with, weightings are given on a scale of 1 to 5 under the index of "frequency with which this activity is normally done" for detailed information. The domain information (a superordinate concept in the generalization hierarchy) is then given a weighting equal to the total of the weightings of the detailed information divided by the number of pieces of detailed information. Each piece of attribute information is also given a weighting based on a 1-to-5-scale evaluation under the index of "frequency of when, where and with whom this activity is normally done.

Figure2: Example of weighting of profile information items



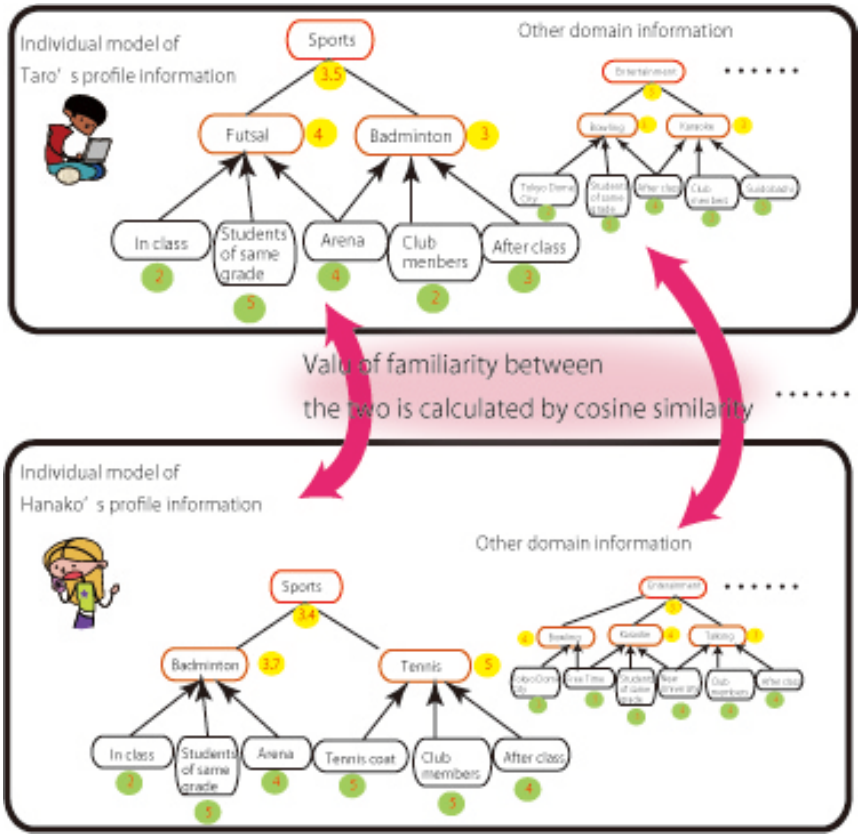
3.3. CALCULATION OF THE DEGREE OF SIMILARITY AS INDICATIVE OF IN SENSE OF FAMILIARITY

The individual model is constructed by the technique described above. The next step is to compare the model with that of another person, and to calculate the degree of similarity in the weighted values so as to judge on the computer whether the two persons are likely to share a sense of familiarity. Although there are indexes for measuring various types of similarity, for the purpose of this paper we take the evaluation value of the subject as a vector. The value calculated by cosine similarity using the following similarity formula is expressed as the value of a sense of familiarity (caluculated familiarity value) between users A and B.

$$\frac{x \bullet y}{\sqrt{\sum x_i^2 \times \sum y_j^2}}$$

x_i and y_j are the weighted values of the domain information, detailed information, and attribute information items of uses A and B. The numerator of the formula is a dot product, and the formula calculates only the weighting of profile information items present in common. The formula uses the closeness of the direction of the vector as the index of similarity, which takes a value from 0 to 1. The closer to 1, the higher the degree of similarity as an indicator in sense of familiarity. Figure 3 is a schematic illustration of the approach taken in section 3: it shows how to evaluate a sense of familiarity among two persons.

Figure3: Schematic illustration of calculation of similarity values indicating of a sense of familiarity



4. EVALUATION EXPERIMENT

4.1. PURPOSE OF EXPERIMENT

The approach described in section 3 was implemented in a system of learning through mutual teaching at university, as provided by IT Ranger (see section 2). In this system, the new person to meet and their assumed profile information were shown on a web page. To check the direction of this approach with respect to how much sense of familiarity the support receiver felt with the introduced person, the following assumption was verified:

• The value of a sense of familiarity calculated by our approach is correlated with the value evaluated by the experiment.

To ensure that our proposed approach was designed in the right way, the following experiment was conducted.

4.2. EXPERIMENTAL METHOD

Ten students at the Human Media Laboratory, Chuo University, were selected as subjects. Each subject was sequentially shown the profile information on the other nine subjects on the web, as shown in Fig. 1. No information that identified the subjects, such as name, was provided. On the basis of the understanding that each subject was presented with nine new people on the web, he or she saw the profile information sequentially and made a subjective evaluation of how much familiarity he or she felt with each new person on a scale of 1 to 5. The index of absolute evaluation used in the experiment is shown in Table 3.

Table 3: Index of evaluation used for the experiment

Evaluation	Scale
5	Felt a large amount of familiarity
4	Felt some familiarity
3	Neutral
2	Didn't feel much familiarity
1	Didn't feel any familiarity at all

4.3. EXPERIMENTAL RESULTS

The experimental evaluation values by the 10 subjects (numbered from 1 to 10) and the calculated familiarity values for each subject are collated in Table 4.

Table 4: Experimental results

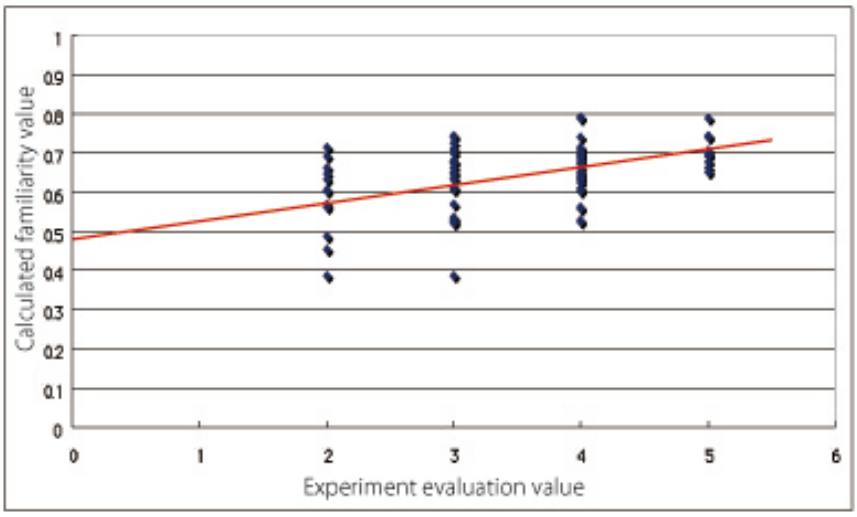
		NO1	NO2	NO3	NO4	NO5	NO6	NO7	NO8	NO9	NO10
NO1	Value A		4	4	3	3	4	3	4	4	5
	Value B		0.6814	0.6475	0.6042	0.5331	0.698	0.6724	0.6987	0.6307	0.7884
NO2	Value A	3		4	4	4	3	3	4	4	3
	Value B	0.6814		0.5561	0.56	0.5238	0.6758	0.5189	0.7115	0.693	0.7394
NO3	Value A	3	4		3	2	4	4	4	4	4
	Value B	0.6475	0.5561		0.6494	0.4547	0.6949	0.6618	0.7009	0.715	0.6885
NO4	Value A	2	2	3		4	4	2	2	2	2
	Value B	0.6042	0.56	0.6494		0.5271	0.6503	0.6603	0.6305	0.601	0.6462
NO5	Value A	3	3	2	3		4	2	2	3	3
	Value B	0.5331	0.5238	0.4547	0.5271		0.625	0.3865	0.4868	0.5365	0.5685
NO6	Value A	5	5	5	5	4		3	5	4	5
	Value B	0.698	0.6758	0.6949	0.6503	0.625		0.6106	0.7421	0.6392	0.7412
NO7	Value A	4	3	3	5	3	4		5	3	4
	Value B	0.6724	0.5189	0.6618	0.6603	0.3865	0.6106		0.7065	0.6129	0.6372
NO8	Value A	3	3	4	3	2	3	3		3	4
	Value B	0.6987	0.7115	0.7009	0.6305	0.4868	0.7421	0.7065		0.7231	0.7908
NO9	Value A	4	5	2	4	3	4	3	3		4
	Value B	0.6307	0.693	0.715	0.601	0.5365	0.6392	0.6129	0.7231		0.6906
NO10	Value A	4	4	4	3	2	4	3	4	2	
	Value B	0.7884	0.7394	0.6885	0.6462	0.5685	0.7412	0.6372	0.7908	0.6906	

Value A: Experiment evaluation value
Value B: Calculated familiarity value

4.4. RESULTS OF ANALYSIS

The experimental results for each subject are graphed in Fig. 4. The experimental evaluation value is plotted on the horizontal axis and the calculated familiarity value is on the vertical axis.

Figure4: Plot diagram of the experimental results



An approximation straight line drawn on the plotted results rose to the right (Fig. 4).

The simple correlation coefficients between the experimental and calculated values were then calculated; the results are shown in Table 5.

Table 5: Simple correlation coefficients between the experimental and calculated familiarity values

Subject No.	1	2	3	4	5	6	7	8	9	10
Correlation coefficient	0.8	-0.3	0.73	-0.2	0.91	0.77	0.61	0.76	-0.03	0.77

A positive correlation was observed for seven subjects (numbers 1, 3, 5, 6, 7, 8, and 10). No correlation was observed for three subjects (numbers, 2, 4, and 9).

4.5. DISCUSSION

For seven out of 10 subjects there was a positive correlation in the two sets of results. A test was then performed on the basis of the assumption that the experimental evaluation values and calculated familiarity values were normally distributed.

The null hypothesis and alternative hypothesis were defined as follows, and the significance of the correlation coefficient calculated from the analysis was tested.

Null hypothesis (H_0): There is no correlation between the experimental evaluation values and familiarity values calculated by the approach.

Alternative hypothesis (H_1): There is a correlation between the experimental evaluation values and familiarity values calculated by the approach.

Table 6: Significance check by the test

Subject no.	1	2	3	4	5	6	7	8	9	10
P value	0.01	0.48	0.02	0.59	0	0.01	0.07	0.01	0.94	0.01
Judgment of P < 0.05	○	×	○	×	○	○	×	○	×	○

Table 6 shows that the null hypothesis was rejected at the 5% level of significance for six subjects and that a correlation was established between the experimental evaluation values and familiarity values caluculated by the approach. The correlation coefficient for all subjects was 0.47, and the *P* value after significance testing performed in the same way was 0.0000032. Thus the null hypothesis was rejected at the 5% level of significance and a correlation was established between the experiment evaluation values and the familiarity values calculated by the approach.

The assumption made before the implementation of the experiment, i.e. "there is a correlation between the experiment evaluation values and the familiarity values calculated by the approach," is suggested to be correct.

Furthermore, we needed to consider what was needed to improve precision to yield results with a positive correlation. The experiment conducted to verify our proposed approach did not yield positive correlations for subjects 2, 4, and 7. One reason for this was the quality of the weighted evaluation values. Weighting was conducted in our approach, but it was possible that the weighting method used was not appropriate because it was based on individuals' subjective evaluations. In addition to individuals' subjective evaluation, it may be necessary to consider using evaluation by others, or physical data that can be evaluated objectively in the evaluation process, as weighting factors.

A second cause could have been the method of weighting used by the subjects. It is possible that inappropriate evaluation resulted from using the weighting of the detailed information to weight the domain information, or from weighting all items of the attribute and detailed information; such techniques may make the subjects confused.

A third cause could have been that there were insufficient profile information items based on the information in Table 2.

5. CONCLUSION, FUTURE TASKS, AND PLAN

We attempted to construct an individual model composed of a generalization hierarchy and attribute information by using profile information on campus life to evaluate rapport felt among people. We demonstrated that a relatively simple hierarchical structure such as our proposed approach was useful and promising.

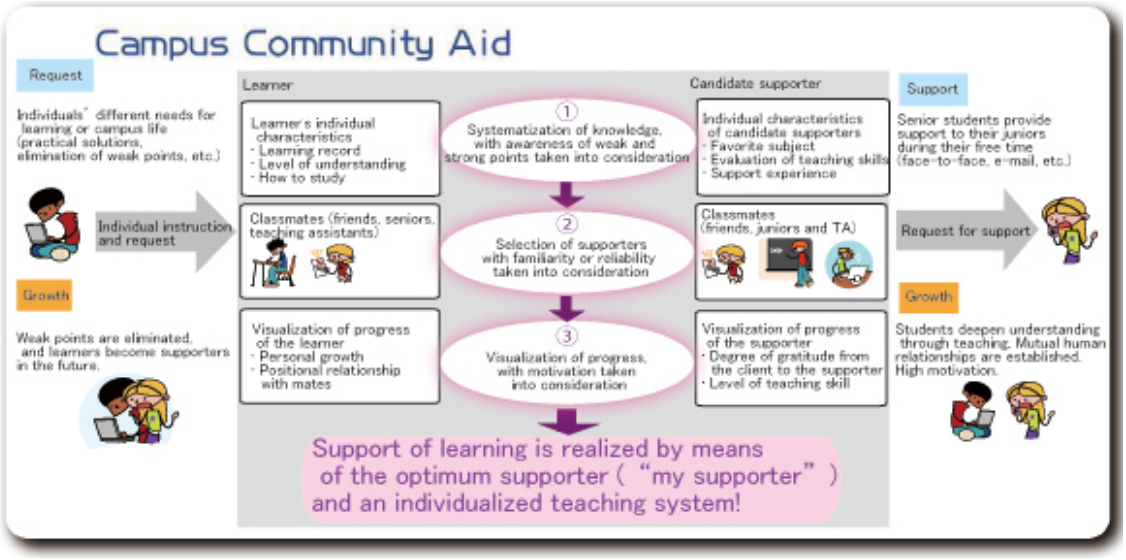
There are now three major research tasks to be tackled. We prepared the profile information on campus life and constructed a model, but the method of weighting and the indexes used to weight the evaluation values need improvement. Weighting is one way of clarifying the usefulness of the proposed approach, but for further clarification an experiment should be conducted to compare the case of having the structure of a generalization hierarchy and attribute information with the case of not having this structure to demonstrate the usefulness of our proposed technique in a convincing way.

To evaluate the degree of familiarity, a questionnaire survey was conducted in advance to gather the data that would be turned into the profile information for use in our experiment. However, in reality we could think of more data to add to the domain, detailed, and attribute information, and more data should be gathered before any future experiment.

It may not always be appropriate to input the profile information items and weighting values into the computer only once, because these data are subject to change with time. Considering this, we may need a mechanism that can cope with changes in the input data to better evaluate the degree of familiarity.

We are expanding the IT Ranger service, which we have been working on for years, by applying it to Campus Community Aide [7], a mutual teaching system currently operated among students at Chuo University on an experimental basis. An outline of this service is shown in Fig. 5. When Chuo University students face problems that can be solved only in class and not by themselves (e.g. how to meet the marking criteria for assignments given by teachers or how to study a subject), they can turn to this system and are given the names of senior students who will help them by sending an SOS to the website. Supporting senior students then help the students to solve their problems on campus or elsewhere. If the system takes account of a function that can evaluate the degree of familiarity among people, then it may be possible to eliminate the sense of unease felt by support receivers when they meet their supporters for the first time. Consequently, it may be improve the utilization rate and quality of Campus Community Aide, as well as user satisfaction.

Figure5: Conceptual illustration of Campus Community Aid, the application of our research



We are continuing to study the technique of evaluating the degree of familiarity people feel with others by using internal information in the form of profile information. Our focus remains local voluntary activities that can support learning by students in college or in their campus life.

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