A Multilingual Chat System with Image Presentation for Detecting Mistranslation

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We have designed and developed a multilingual chat system, MCHI (Multilingual Chat with Hint Images), which is based on machine translation and equipped with a presentation function of images related to the contents of the messages by utterers so that listeners are able to notice mistranslation. MCHI accepts English, French, Chinese, Japanese, Korean and Vietnamese languages. It uses the Google API to retrieve related images from the image posting site Flickr. As a result of evaluation experiment, we have observed that participants detected the mismatch of a translated message with its related image. According to the answers of participants for a questionnaire, it turned out that the usability of the MCHI system is good enough though the related images are not satisfactory.

Keywords: machine translation, image retrieval, keywords, morphological analysis

1. Introduction

Recently, importance of collaborative learning is reacknowledged, and it is realized that explaining and practicing among others inside a group enhance learners' understanding. There are many researches related to collaborative learning with chat systems [3, 4, 5, 7]. In addition, acquiring multicultural competency is very important in the globalized society. Therefore, multilingual chat systems based on automatic translation play an important role to acquire multicultural competency by collaborative learning. However, chat systems based on machine translation have the drawback that users ask less questions about the contents of conversations, and they cannot recognize mistranslation though the systems generate quite a few mistranslated parts. Hence, in this study, we develop a multilingual chat system, MCHI (Multilingual Chat with Helpful Images), which is based on machine translation and equipped with a presentation function of images related to the contents of the messages by utterers so that listeners are able to notice mistranslations.

2. Related Works

In this section, we survey the related works concerning automatic translation systems and multilingual communication systems.

There are many reports pointing out the importance of automatic or machine translation systems. For example, Aiken insists that in electronic meetings, a GSS (Group Support System) combined with automatic translation can yield an order of magnitude increase in the productivity of multilingual groups [1].

Many successful case studies are also reported. For instance, Meng et al. [6] report on ISIS (Intelligent Speech for Information Systems), which is a trilingual spoken dialog system (SDS) for the stocks domain. It allows Cantonese, Putonghua, and English. The system supports spoken language queries regarding stock market information and simulated personal portfolios. The conversational interface is multimodal, and it provides stress-free interaction.

However, ISIS addresses man-machine interaction in a specific domain. Hence, it is not clear whether we can obtain the same results when it is applied to human interaction in the generic domain.

Unfortunately, there is a research that specifies the limit of state-of-the-art machine translation. Yamashita and Ishida [8] have investigated and reported the effects of machine translation on collaborative work. In their study, eight pairs from China, Korea, and Japan worked on referential tasks in English and in their native languages using a machine translation embedded chat system. The results showed that lexical entrainment was disrupted in machine translation-mediated communication. In addition, the process of shortening referring expressions was also disrupted because the translations did not use the same terms consistently throughout the conversation.

Aiken and Park [2] used a method called RTT (round-trip translation) and implemented a system where speakers can preview their speech to check their correctness. As a result, those who used RTT estimated the accuracy of the German translations better than those who did not use it. There was a significant, positive correlation between the forward translations to German and the back translations to English, indicating that the accuracy can be predicted and comprehension can be enhanced in a bilingual meeting. However, in a multilingual environment, the time response by RTT increases linearly depending on the number of languages involved. Hence, a drawback of this approach is that RTT takes too much response time so that the users cannot chat smoothly since waiting for all of the RTT results for preview becomes a considerable cognitive load for speakers.

3. Design of MCHI System

3.1. Conditions

Based on the survey of related works, we show three conditions that our system MCHI must satisfy:

- Multilingual communication is supported.
- Response time is short enough.
- Users' cognitive load is small.

Taking these conditions into consideration, the MCHI system automatically generates a hint related to the content of a message by an utterer and sends it to listeners. Because the hint is automatically generated, there is no cognitive load for the utterer and the response time is short. The listeners are allowed to ignore the hint if they want to concentrate on the messages generated by machine translation and they do not have any additional load. In case they feel the translated message is ambiguous or strange, they check the hint to detect mistranslation, if any.

We decided to use images as hints because images can be understood at a glance, and load for listeners is small. There are several image retrieval sites and they provide quick searching reaction.

3.2. User Interface

In this section, we explain the user interface of the MCHI system along the flow of system usage.

When MCHI is invoked, the login interface shown in Figure 1 appears. The user inputs his/her nickname, selects the language to use, and, with or without images, enters the system. The current implementation of MCHI supports six languages – English, Japanese, Korean, French, Vietnamese, and Chinese. In the case of Chinese, two types of characters – simplified and traditional – are allowed.

Nickname :　　　　　[   ]　　[Login]
Language : ◉ English ○ 日本語 ○ 한국어 ○ Français ○ Việt ○ 简体 ○ 傳統
Images : ○ with ◉ without

Figure 1. Login Interface for MCHI System

If the user logs in the system correctly, the window shown in Figure 2 appears.

This window consists of five regions from (1) to (5), and they have the following functions:

(1) If the user clicks on this bar, the system terminates and the login session restarts.

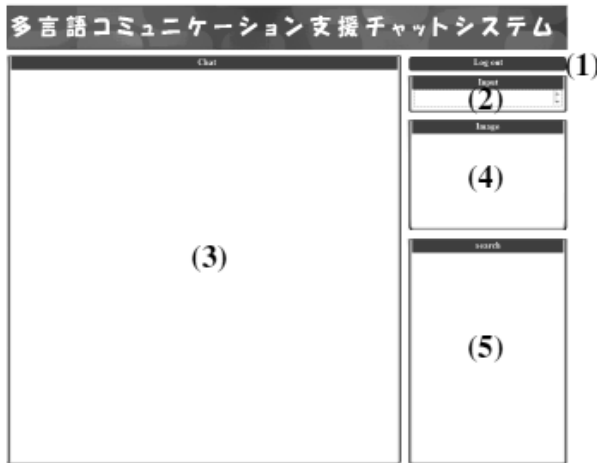(2) If the user hits the enter key after inputting a message in this region, the message is transmitted to the server.

Figure 3 shows an overview of the MCHI system. If the system cannot find three keywords in the message, three thumbnails are displayed by retrieving multiple images for a single keyword.

4. Implementation

In this section, we explain the implementation of the MCHI system. The development language of the system is php combined with Ajax (prototype.js). The development environment is XAMPP for Windows version 1.7.1, mysql 5.1.33-community, php 5.2.9, and apache 2.2.11.

4.1. Entering the System

As described in Subsection 3.2, a user can enter the MCHI system in the following manner:

1. Input of a nickname: First, to identify the user, it is necessary to assign him/her a nickname.
2. Selection of a language: Next, the system must know the language of the user to start multilingual communication.
3. Selection of the option with/without images: Then the user can turn on/off the function of presenting related images for each message to support him/her to comprehend the message.
4. Clicking on the 'log in' button: Finally, MCHI must find the latest message number so that the user should start his/her chatting after entering the system.

The above four values are processed in the login session. These values are passed to the system by the pseudo code shown in Figure 4.

4.2. Multilingual Communication

A message emitted by a user is processed as shown in Figure 5.

1. The message input by the user is transmitted to the chat server by using php.
2. Messages in English, Japanese, or Korean are morphologically analyzed by using Tree-Tagger, Yahoo API, and KLT version 2.0, respectively. Among the nouns detected by morphological analysis, the preceding three are picked up as keywords. Images related

Figure 2. Initial chat interface in MCHI system

Figure 3. Overview of MCHI system

(3) This region displays each of the messages transmitted by all of the users as well as the thumbnails of images corresponding to at most three keywords extracted from the message.

(4) This region is for viewing an enlarged image of a thumbnail. If the user clicks on one of the thumbnails displayed in the regions (3) or (5), a larger version is displayed in this region.

(5) This region is for browsing additional thumbnails. If the user clicks on one of the thumbnails displayed in the region (3), the keyword in the original language corresponding to the thumbnail is retrieved. Then the images related to that keyword are searched and at most 64 of them are displayed as thumbnails in this region.

```
<form action="chat.php" method="post">
//Input of a nickname
<th>Nickname :</th>
<td><input type="text" name="nickname">
 <input type="submit" value="Login">
 </td>

//Selection of a language
<th>Language :</th><td>
  <input type="radio" name="lang"
    value="en" checked> English
  <input type="radio" name="lang"
    value="ja">日本語
         :
  </td>

// Selection of images:
<th>Images :</th><td>
  <input type="radio"
    name="show_image"
    value="true">with
  <input type="radio"
    name="show_image"
    value="false" checked>without
  </td>

// Number of latest message
// $max_id['MAX(message_id)'] has
//   the latest message number
<input type="hidden"
  name="message_id"
  value="<?php echo
    ($max_id['MAX(message_id)']);?>">
</form>
```

Figure 4. Pseudo code for login session

to these keywords are retrieved by using the Google API.

3. The message, language code, keywords, and the URL's of images are registered to a database.

4. Each client checks whether a new message is registered to the database every second. If there is a new message, the message, language code, keywords, and the URL's of images are obtained.

5. By making use of the Google API, the obtained message is translated into the mother language of the client user.

6. A translation result is received from Google in the JSON format.

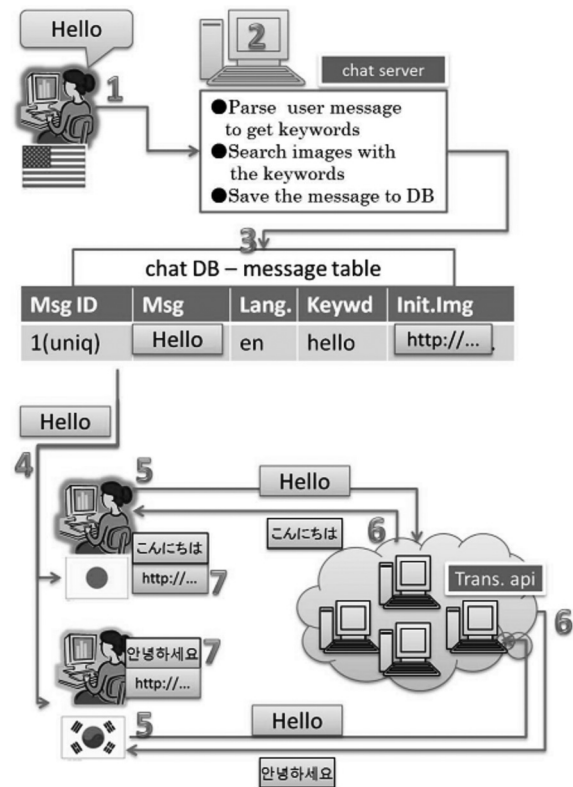7. The translated message and the related images are displayed in the window.

Figure 5. Flow of MCHI system

4.3. Image Retrieval

The MCHI system presents images in three regions. In Region (3) of Figure 2, the images related to at most three keywords obtained from a message are displayed at the right-hand side of the translated message. Region (4) in Figure 2 is a region to display an enlarged image when a thumbnail is clicked by the user. If the thumbnails presented in Region (3) in Figure 2 are not matching for the message, the user can click one of the thumbnails in Region (3) to allow Region (5) in Figure 2 to display other related images to the corresponding keyword. The user can judge if the mismatch is caused by mistranslation or retrieval of an unsuitable image by looking at the new images. At most 64 images appear in Region (5).

All of the images presented in Region (3) and (5) are retrieved from the image posting site Flickr by using the Google API. The pseudo code in Ajax is shown in Figure 6. In addition, the pseudo code shown in Figure 7 is used to display an enlarged image in Region (4).

```
//use of google library
<script type="text/javascript"
src="http://www.google.com/jsapi?key=xx">
</script>

// inclusion of search module
google.load('search', '1');

  //find images related to keyword
  function OnLoad(keyword) {
  //google image retrieval object
  imageSearch = new
    google.search.ImageSearch();
  //restrict the domain to flickr.com
  imageSearch.setSiteRestriction(
    "flickr.com");
  imageSearch.execute(keyword);
}
```

Figure 6. Pseudo code for image retrieval

```
function show_bigsize(this)
{
source = this.getAttribute("src");
<img src = source>;
}

<img src ="http://..."
  onclick:
    "javascript:show_bigsize(this)">
```

Figure 7. Pseudo code for image enlarge

5. Experiment

To measure performance of the MCHI system, we conducted an evaluation experiment. Five participants joined the experiment. Each of the languages French, Vietnamese, and English was used by one participant while Chinese was used by two participants. We prepared a Japanese-Korean conversation in the experiment with respect to monsters in Japan. In the conversation, the word 'Kappa', which is used to specify a monster in Japan is used. However, 'Kappa' also has the meaning of cucumber, and it caused mistranslation. Each participant observed the conversation translated into his/her language, and specified mismatches of translated messages and corresponding images shown in Figure 8. As a result, four out of five participants pointed out the mismatch at the mistranslated

(a) First image of Kappa

(b) Second image of Kappa

Figure 8. Images presented for 'Kappa'

message. One participant pointed out a message that is not mistranslated. From this result, we can conclude that in some cases presenting images helps users to detect mistranslation.

In addition, we allowed eight participants including three Japanese language users to chat freely by using the MCHI system (see Figure 9). There was a mistranslation in the process: a Korean sentence 'Please take photos.' was translated into a Japanese sentence whose meaning is 'Please pick up photos.' However, it was naturally understood by all of participants. After that, we surveyed participants about the system with three questions: (Q1) Was it easy to use the system? (Q2) Could you communicate well with the others? and (Q3) Did you have correct images for your messages? The answers were selected among five candidates: (1) Strongly No, (2) Relatively No, (3) Neutral, (4) Relatively Yes, and (5) Strongly Yes. The average

values of the eight answers for questions (Q1), (Q2), and (Q3) were 4.50, 3.88, and 3.38, respectively. From these values, we can conclude that the function for message input was good enough while retrieved images were not satisfactory.

(a) Free talk in Japanese Language

(b) Free talk in English Language

Figure 9. Free talk by MCHI system

6. Conclusion

In this study, we have designed and developed a multilingual chat system, MCHI. The MCHI system is based on machine translation and it also presents images related to the contents of the messages by utterers so that listeners are able to notice mistranslations. As a result of an evaluation experiment, it is reported that mistranslation is detected by the users. A drawback of the system is that retrieved images were not satisfactory.

A comparative experiment with a larger number of participants should be conducted to verify the ability of the MCHI system. Improvement of the image retrieval mechanism and increasing the number of languages supported by the system are also included in the future works. We are also interested in finding out differences of effects of mistranslations between nouns and other words.

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