

Sifu: Interactive Crowd-Assisted Language Learning

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Abstract

This paper introduces SIFU, a system that recruits in real time native speakers as online volunteer tutors to help answer questions from Chinese language learners in reading news articles. SIFU integrates the strengths of two effective online language learning methods: reading online news and communicating with online native speakers. SIFU recruits volunteers from an online social network rather than recruits workers from Amazon Mechanical Turk. Initial experiments showed that the proposed approach is able to effectively recruit online volunteer tutors, adequately answer the learners' questions, and efficiently obtain an answer for the learner. Our field deployment illustrates that SIFU is very useful in assisting Chinese learners in reading Chinese news articles and online volunteer tutors are willing to help Chinese learners when they are on social network service.

Introduction

It is widely agreed among educators that reading a variety of articles and communicating with native speakers are the most effective ways to learn a foreign language (Lee 1998; Seneff, Wang, and Chao 2007). With the large volumes of texts available on the web, a language learner can acquire new vocabularies and sentence structures by reading articles online. However, the language learner may have trouble finding help nearby when she encounters a problem in reading the article. On the other hand, a language learner can improve her conversational skill and understanding of local culture by chatting with a native speaker. However, the language learner may have trouble finding the right topics to initiate a conversation with the partner. Our research aims to provide just-in-time help to the language learners while they are reading articles online by recruiting native speakers to answer questions from the learners. The question-and-answer process may cover topics beyond the original contents from the articles, thus enhancing the experience of communicating with the native speakers.

This paper introduces an interactive crowd-assisted language learning tool SIFU, named after the Chinese term for

a master¹. SIFU recruits native speakers of Mandarin Chinese as volunteer tutors to help Chinese learners in reading articles online with answering questions in nearly real-time. After a Chinese learner inputs the article he/she would like to learn into the system, he/she may consult with online volunteer tutors about the questions in the article or the content yet to be understood. The online volunteer tutors of SIFU are recruited instantly from PTT², a Bulletin Board System accessible via a text-only terminal interface in Chinese. The proposed method integrates the advantages of reading articles and conducting conversations, thereby bringing language learning to a higher level of efficiency.

Related Work

Since the advent of ESP Game (von Ahn and Dabbish 2004), Game With a Purpose brought a possible solution to large-scale data collection (von Ahn 2006). By playing game, players not only have fun but also contribute new data to the knowledge base. Following this idea, additional games have been developed to collect tags for music (Law et al. 2007), image ROI (von Ahn, Liu, and Blum 2006), and commonsense knowledge (von Ahn, Kedia, and Blum 2006; Lieberman, Smith, and Teeters 2007).

The "Social Search Engine" Aardvark (Horowitz and Kamvar 2010) enables a user to ask question to his/her social network. The time for getting an answer from Aardvark ranges from a few minutes to a day. Research in (Morris, Teevan, and Panovich 2010) analyzed how people ask and answer questions on their online social networks. While answers were often observed to come back within a few minutes, response time varied quite a lot.

VizWiz (Bigham et al. 2010) is designed to help blind people access visual information in nearly real-time by recruiting workers from Amazon Mechanical Turk³, a Web-based marketplace for outsourcing tasks such as labeling image data sets, determining political sentiments in blog snippets to human workers for a small pay.

An interactive tutoring system should focus on minimizing the response time to most questions while maintaining high quality in their answers.

¹<http://en.wikipedia.org/wiki/Sifu>

²PTT bulletin system, [telnet://ptt.cc](http://ptt.cc)

³Amazon Mechanical Turk. <http://www.mturk.com>

Sifu

SIFU is a web-based application designed to assist language learners in understanding the contents of online articles in Mandarin Chinese.



Figure 1: SIFU article-learning interface, including: a) article title, b) article content, c) number of online tutors, d) Q&A screen, e) question input field and submit button

This section presents the three main functions of SIFU: learner-provided learning content, interactive online tutoring and bad answer replacement.

Learner-provided Learning Content

When a language learner finds an online article in Mandarin Chinese of interest, the learner can copy-paste the article onto the system via the SIFU article-entering interface. The learner will then be guided to the SIFU article-learning interface as shown in Figure 1. The article to read is shown on the left side of the page, while an instant messaging Q&A interface appears on the right.

Interactive Online Tutoring

After the learner entered an article, the system start searching for online tutors immediately. SIFU displays the number of recruited volunteer tutors at the upper right corner of the Q&A screen. As soon as the number of online tutors is greater than one, the Q&A process begins. SIFU converts the article into webpage form, and sends its web address to the tutors for them to answer the questions in the context of the article. The learner can either enter a question in the input field or select a question from a drop-down menu. The question is sent to all tutors when the “Submit” button is clicked. SIFU displays the Q&A history with different colors for questions and answers respectively.

Bad Answer Replacement

If the answer provided by some tutor is deemed a bad answer, the language learner may report it on the Q&A screen. Upon receiving such reports, SIFU will flag the online volunteer tutor who gave the bad answer, and proceed to find a replacement answer. First, SIFU checks if there are additional answers to the question. If yes, select one to replace

the answer. Otherwise, SIFU repeats the question to the online volunteer tutors (except the one flagged with the bad answer). The bad answer is replaced once a new answer is received. It is assumed that the language learner can identify irrelevant answers (e.g. “”, “None of my business.”) as bad.

Recruiting Online Tutors

This section focuses on how to effectively recruit online volunteer tutors, adequately answer the learners’ questions, and efficiently obtain an answer for the learner. We first discuss our choice of platform, and present our method in two parts: recruiting online volunteer tutors, and organizing online volunteer tutors.

PTT vs. Mechanical Turk

PTT⁴ is the chosen platform of Chinese commonsense collection and recruiting online tutors for SIFU, as it has the largest social network in Taiwan (over 3,000,000 log-ins per day on the average).

PTT is a Bulletin Board System that is accessible via a text-only terminal interface in Chinese. The primary purpose of PTT is to provide users with an environment for information-sharing, yet it also provides games for entertainment, and functions for social interaction between users. PTT supports instance messaging feature for users to communicate with each other. SIFU acts as a virtual PTT user to communicate with online PTT users via instant messaging. PTT users are assumed to have the basis knowledge to answer questions in Mandarin Chinese, as it is the biggest social network service in Taiwan, with an average of 100,000 online users. Based on nonofficial statistics, the majority of PTT users are college-educated or beyond.

SIFU chooses to crowdsourcing on PTT instead of Amazon Mechanical Turk for the following reasons.

1. Recruiting workers from Amazon Mechanical Turk costs money while recruiting volunteers from PTT is free of charge. It is demonstrated that SIFU is able to recruit many willing individuals to assist Chinese learners in social network service.
2. Answering SIFU questions in real time involves a big context (the news article to read) and uncertainty of when questions may arise. It is therefore difficult to package the tasks for Mechanical Turk, as either the same Turkers have to wait for additional questions on the article indefinitely, or new Turkers have to read the article before answering any question. A higher pay is required. In contrast, volunteers on PTT will read the article, engage in their own work and only answer a question when requested.
3. Due to the limited skills of a beginner in language learning, the questions raised can sometimes be imprecise or incorrect. Such questions may be difficult to answer on Mechanical Turk. Through interactions with the SIFU users, the volunteers on PTT may clarify and gain a better insight behind the questions in order to provide adequate answers.

⁴PTT Bulletin Board System. [telnet://ptt.cc](http://ptt.cc)

Recruiting online volunteer tutors

In our previous experiment, we asked a question to 211 PTT users directly and got 36 answers. The quality of answers is poor, only 15 (42%) answers are correct. In order to improve the answer quality, we design a recruiting process to recruit them appropriately. SIFU will utilize PTT user list with minimum idle time provide by BBS, and recruit the top 30 users on the list simultaneously. The process of a recruiting online volunteer tutor mainly comprises three steps: greeting, requesting for online volunteer tutoring and providing teaching materials.

1. Greeting: To ensure the personal availability of the PTT user, SIFU will send a greeting message (ex. hi) first. After the response of the PTT user is received, the system moves into the next step.
2. Requesting for online volunteer tutoring: In order to ensure a serious attitude towards answering questions from a online volunteer tutor, SIFU will first inform the tutor about foreign Chinese learners then the system will send a request if the user would like to assist Chinese learners with their questions. The response of the PTT user will be analyzed by keyword matching. If the PTT user shows willingness, he/she is turned into an online volunteer tutor and is guided into the next step.
3. Providing teaching materials: SIFU will send the address of the article to the online volunteer tutor, and ask him/her to read the article before the Chinese learner comes up with a question. After the step is finished, the online volunteer tutor is prepared and may begin to answer the questions.

There are circumstances that PTT users consider the brief introduction of SIFU as pranks in recruiting online tutor. In order to confront the problem, SIFU must include detailed information on the virtual PTT user in user profile to build the trusting ground.

Organizing online volunteer tutors

Once enough online volunteer tutors are found, SIFU properly organizes the online volunteer tutors to ensure answer quality and fast question response time. SIFU classifies the online volunteer tutors into four categories: new tutor, active tutor, busy tutor and bad tutor (Figure 2).

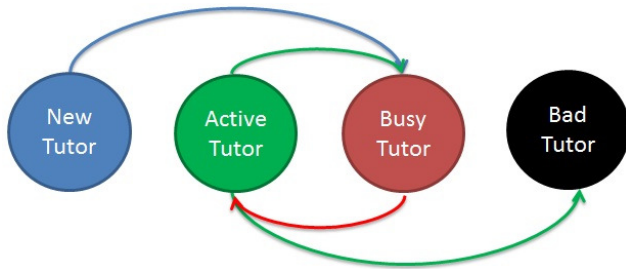


Figure 2: The state transition diagram of online tutors.

1. New tutor is someone who is just recruited and has not been asked any question.

2. Active tutor is someone who has answered questions and is now available for answering.
3. Busy tutor is someone who has been asked but has not given an answer. Once a busy tutor answers a question, he/s he will be automatically turned into an active tutor.
4. Bad tutor is someone whose answers have been reported as bad answers. Bad tutor will never be asked again to avoid obtaining another bad answer.

When a learner asks a question, the priority target is an active tutor. If there are no active tutors, the questions then will be directed to a new tutor. When the number of new tutors are below a constant (SIFU sets it as 5), the mechanism of recruiting online volunteer tutors will be launched.

SIFU sets a waiting time (10 seconds) for each question for each tutor to minimize question response time. If the tutor fails to answer the question by the waiting time, SIFU will send the question to the next available tutor. The process continues until the first answer is given. When a question receives multiple answers, except for the first one, which will be delivered directly to the learner, the rest will be stored for replacement if a bad answer is reported.

After all learners are off-line, the system will thank all the tutors and say good-bye to them after the SIFU set time of 10 minutes. SIFU will record every contacted PTT users and recruited online volunteer tutors. Active tutors are set to be primary recruited targets for the next recruitment process. It can also avoid disturbing unwilling PTT users and recruiting bad tutors.

User Study and Evaluation

Nine Chinese learners were asked to use SIFU and to fill out the questionnaire after using it. Out of the nine Chinese learners aged from 23 to 39 (with one female), eight are English native speakers, one is Japanese native speaker, and they all have been learning Chinese for more than a year. Before the experiment, we introduced to them of the operation of the system. After the process was understood, they were asked to find a online Chinese news article, and use the SIFU to learn the article. The reason for allowing the users to choose a Chinese news article by themselves in User Study was the attempt to appeal to the practical situations in daily lives. Another questionnaire survey was conducted on the online volunteer tutors for the analysis of their ability to assist Chinese learners with their questions and their willingness to provide help. The following discussion is divided into three parts: system effectiveness analysis, Chinese learner questionnaire survey, and online volunteer tutor questionnaire survey.

System Effectiveness Analysis

SIFU encountered 928 PTT users in recruiting online volunteer tutors. Among them 352 (38%) responded after the greeting, which showed of the appeared-online users on PTT, approximately 38% were actual users. These users could respond instant messages, while the remaining 61% of users were idle, and couldn't give immediate responses. Of the 352 responded users, 195 users (55%) showed willingness of becoming online volunteer tutors. 80 users (23%)

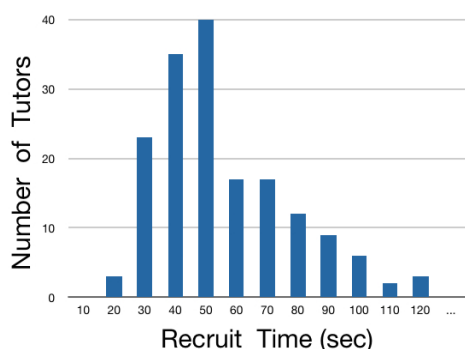


Figure 3: A histogram of the recruiting time for 195 online volunteer tutors.

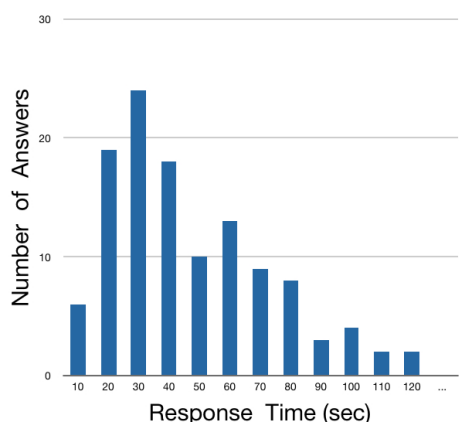


Figure 4: A histogram of the answering time for 127 answers .

responded directly with busy or no, and refused to become online volunteer tutors. The remaining 77 users (22%) gave no response after requesting for online volunteer tutors. The average time for recruiting the first tutor was 37.3 seconds (SD=10.4), which was the average waiting time for a Chinese learner before asking questions, after he/she pasted the news article. The average recruiting time for each tutor was 67.7 (SD=48.0) (Figure 3).

Of the nine news articles, 43 questions were raised by Chinese learners, and 127 answers were given, which amounted to an average of 2.9 answers for each question (SD=1.2). The first answer was received across all questions in an average of 36.7 seconds (SD=21.6). The average answering time for online volunteer tutors was 53.7 seconds (SD=50.7) (Figure 4). We ran a one-way ANOVA and found significant effects of SIFU's question answering mechanism on answering time ($F_{1,168}=4.57$, $p=0.034<0.05$). Two Chinese native speakers were recruited with college or higher education to evaluate the quality of these answers. There were 115 correct answers (91%) and 12 incorrect answers (9%). Of the incorrect answers, there were 10 answers (83%) that were irrelevant to the question or meaningless word

streams.

Chinese Learner Questionnaire Survey

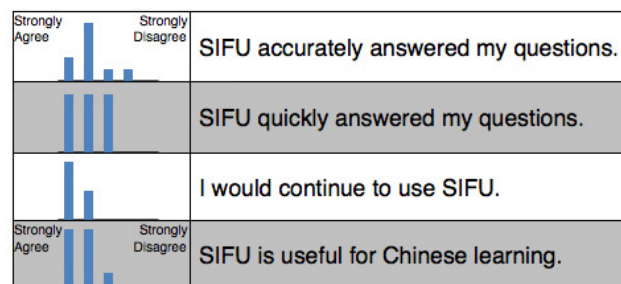


Figure 5: Answers to Likert scale questions on Chinese learner questionnaire survey

Nine Chinese learners filled out the questionnaire according to their experience with the experiment (Figure 5). All of them agreed that SIFU showed significant help in their Chinese learning, and online volunteer tutors were able to instantly answer their questions and assist them to understand the articles. A Chinese learner stated that SIFU could help him understand some local news and perspectives (ex. Is it easy to get a job recently?) . Seven Chinese learners reported their immediate willingness of using SIFU for Chinese learning with a reasonable fee.

Online Volunteer Tutor Questionnaire Survey

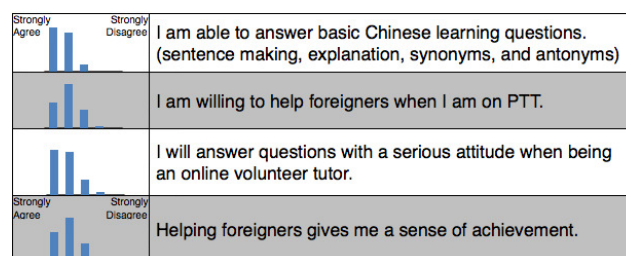


Figure 6: Answers to Likert scale questions on online volunteer tutor questionnaire survey

35 of 195 online volunteer tutors were randomly chosen to fill out the questionnaire on their experience of being online volunteer tutors (Figure 6). It was reported that most online volunteer tutors were excited about this unprecedented service on PTT. It was shown that helping foreigners learn Chinese was a wonderful activity, and it gave them a sense of achievement. It is suggested by some tutors that similar system for English learning should be established. One tutor advised that the time of PTT users being online volunteer tutors and the number of questions asked should be kept under control, so as not to bore PTT users, which could ensure the lasting functioning of this service.

Conclusion

We have presented SIFU, a web-base application for interactive language learning. Observations from our experiments are summarized below.

- SIFU recruits native speakers of Madarin Chinese as volunteer tutors to help Chinese learners in reading articles online with answering questions in nearly real-time.
- We developed an effective way to recruit volunteers from PTT
- SIFU demonstrated that quality answers can be obtained from the volunteers within a short time period (typically < 1 minute).
- SIFU has been rated by language learners as a useful tool for learning Mandarin Chinese.

Future directions for SIFU include improving the sustainability and scalability of recruiting online tutors, and extending the service to support learning of additional languages.

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