Interactivity for Machine Translation Mediated Communication
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ABSTRACT
Because of unavoidable translation errors in the machine translation mediated communication, different interactions have been proposed to eliminate those errors. However, there is no unique model to describe these interactions. Inspired by the human-interpreter metaphor, we propose a simple conceptual model to describe the interactivity for machine translation mediated communication. We analyzed the concrete interactions, and described a three-interaction model. Based on the proposed model, we clarified three interactivity levels. After examining several existing works of interactions, we argued that our proposal will be helpful for better understanding of interactivity for machine translation mediated communication.

Keywords: Machine translation mediated (MT-mediated) communication; Interactivity;

1. INTRODUCTION
In view of that translation errors cannot be ignored [1], interactions between machine translator and users have been increasingly used to eliminate the translation errors, such as the interactive machine translation [3], and repair support agent for multilingual communication [6]. In MT-mediated communication, the shift from transparent-channel metaphor to human-interpreter metaphor is originally introduced by [4], in which interactivity means the ability of the machine translator to take positive actions to improve grounding and the negotiation of meaning, when the multilingual communication breaks due to the translation errors. The interaction initiated by the machine translator is needed to motivate the communication participants, so that they can take repair actions [4, 5, 6] to reduce those translation errors.

Better interaction for eliminating the translation errors needs several specific considerations. First, it needs the real time ability for online communication. The translation errors should be handled online. Whether the handling is success or not, at least the participants should immediately know the status after handling. Second, the machine translator initiated interactions are needed to motivate the communication participants. The proactive and autonomous behavior from machine translator will save communication efforts from the participants. Otherwise, the participants need extra negotiation to find the miscommunication because of the translation errors.

However, such interactions have no generally accepted modeling yet. The translation errors and users can be very different, thus the interaction can be too widely scoped. It can be either user-initiated process or machine-initiated process [2]. It can be with either the sender or the receiver. Following the human-interpreter metaphor [4], we focus on the modeling the interactivity for MT-mediated communication, which represents the ability of machine translator to eliminate the translation errors, while allowing users to be in the sphere of activeness. We start from the analysis of an interaction example, and then provide our interactivity model.

2. INTERACTIVITY
2.1. A Repair Interaction Example
A concrete example is given that the English-Chinese communication breaks because of the translation errors. This message from the English sender instructs the Chinese receiver the position of two pieces in the tangram arrangement task. We show a rewrite repair interaction is used to solve this break (see Figure 1). The translation error makes the positions of the pieces unclear. The Chinese receiver cannot follow this translated position information. Then, the communication breaks. The machine translator detected this unacceptable translation, and caught that this is an imperative sentence, which starts from verb. There is a chance that the rewrite repair will help, which suggests using a declarative sentence. The English sender follows the rewrite suggestion, and responds the repair to the agent. Finally, the agent will check the quality and feedback to the sender. After repair, it turns into an acceptable translation.

![Figure 1: Interaction to handle an unacceptable translated message in the English-Chinese communication. 1) Machine translator initiates the rewrite suggestion. 2) Sender responds the repaired message. 3) Machine translator notifies the feedback of translation quality.](image-url)
2.2 Simplified Interaction Model

Following the interaction example, a simple three-phase model of this interactivity is proposed (see Figure 2). The process of interactions includes three interactions:

1. **Initiating Suggestion**: if unacceptable translation is detected, the interaction will be initiating suggestion of repair to the users.

2. **Responding Repair**: after the users received the repair suggestion and finished the repair, they will respond the repair to the machine translator.

3. **Notifying Feedback**: after the quality detection, the quality can be either unacceptable or acceptable, and the interaction will be notifying feedback to the users. It is either acceptable or unacceptable quality.

Figure 2. Three-interaction model of interactivity in machine translation mediated communication

It is obvious from the model that a built-in accuracy evaluation is important for understanding acceptable or unacceptable state of translation system. It allows the reiteration of these three phases. In reiteration, the feedback of current last interaction and the suggestion of next interaction are probably carried out at one time.

2.3 Interactivity Level

Based on the above three interactions, we clarify three interactivity levels (see Figure 3):

1. **Reactive**: it is the user-initiated repair. The machine translator feedbacks the quality after repair. It needs user’s experience in the repair.

2. **Proactive**: it is the system-initiated repair. The users listen to the suggestion and conducts the repair. It is easier for users to follow and learn how to repair.

3. **Mutual**: it is a cooperative interaction. The receiver will provide the repair, and then the sender will do repair. The machine translator will provide suggestion and activate cooperation translation. After that it feedbacks the quality.

Figure 3: Interactivity Levels: Reactive, Proactive, and Mutual

Then, about existing works of the interactions that can be applied in MT-mediated communication, we can classify them into the three levels. For example, the self-initiate repair [5], which can be applied as repair actions for MT-mediated communication, is the reactive level interaction without a specific repair suggestion from the machine translator. The repair agent is the proactive level interaction [6]. The collaborative translation [7, 8] is the mutual level interaction.

3. DISCUSSION

The simple interaction model can be very helpful to understand how to interact with participants to eliminate the translation errors. Its clear classification helps collect and prepare these three interaction types: suggestion, repair, and feedback. For example, we can select a suggestion action for the novice users from existing collected suggestions. Its typical levels helps design the process of interactions. For the bilinguals, the reactive level interactions can be effective enough, but for the monolinguals, the proactive or mutual level interactions are needed. Though it has limits in the concrete application, such as preparing the best repair action, but it will help understand existing works of the interaction, so as to help design new interactions.

4. CONCLUSION

Inspired by the proposal of human interpreter metaphor, we provide a simple model for better understand the interactivity for the MT-mediated communication. We analyzed the interactions for eliminating translation errors, described a three-interaction model. Based on this model, we described three typical interactivity levels. After that, we examined the existing works using our model and discussed the usage of our proposal.

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