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Kidding Bot: A Chatbot against Harassing Phone Calls

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Abstract. Nowadays, the majority of mobile phone users suffer from harassment calls. However, traditional way to intercept the harassment calls cannot reduce this annoying behavior. In this paper, we designed and developed Kidding bot: a chatbot to counterwork the harassment calls. When the user received the harassment calls, he could connect our Kidding bot server by call forwarding, then Kidding bot starts to talk with the harassers. Kidding bot is combined with Turing chatbot and a dual encoder specially added in sequence to sequence model. The anti-harassment telephone test result shows that Kidding bot based our model performed better than the two baselines: a single Turing chatbot and a chatbot based on Sequence-to-Sequence model.

Keywords: Kidding bot; chatbot; harassment phone; dual encoder sequence to sequence model

1. Introduction

In 2018, there were 410 million harassing calls identified by 360 Mobile Security every day, which is a staggering number [1]. Most of these callers are real estate agents, financial salesmen, suspected illegal telephone scammers and so on. It has brought great trouble to mobile phone users and wasted their time and energy. What's worse, a considerable proportion of people have suffered property losses due to phone fraud.

However, the current commonly-used methods exert limited effect on preventing and intercepting harassment calls [2]. Accordingly, we change the coping strategy from prevention and blockage to confrontation. That is why we developed this kind of anti-harassment phone chatbot: Kidding Bot, an intelligent chat system that replies nonsense utterances to harassment call. Our design goal is to drain the harassers' time and energy, sap their confidence, and make them give up consciously.

2. Related Work

Intelligent chatbot can be divided into open domain and closed domain according to the chat content. The open domain is mostly chat-like, which aims at more rounds of conversation. Chatbot in the closed field is mostly used for solving users' problems, which aims at fewer rounds of conversation.

At present, many IT giants have launched free chatbot development platforms, such as Bot Platform of Facebook [3] and LINE's LINE Business Center, etc. In China, Baidu AI, Turing chatbot, Bind.AI and Little I robot are available. In particular, Turing chatbot is currently the most intelligent robot brain in Chinese context and its understanding accuracy of Chinese semantics is as high as 90% [4]. As its mature platform and flexible application can serve as a strong guarantee for our application, we use Turing chatbot as our baseline model. With the help of Turing chatbot platform, the development of chatbot can be realized quickly and conveniently and avoid repeated development.

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In the closed domain, chatbot is mainly used to solve problems in specific fields, such as guided diagnosis chatbot. Chatbot in the closed field needs specific training corpus and it has high accuracy, which limits its application to a certain extent, but it can deal with questions and answers in some specific fields accurately [5].

3. Design Work

Kidding Bot is a special Chatbot designed to combat the harassers. It is similar to the Chatbot for small talk: the more rounds, the better performance. At the same time, Kidding Bot needs to be equipped with some knowledge of the subjects of harassment in order to engage the harasser in a sustained conversation. So the Kidding Bot adopted the combination of open domain and closed domain. Then we will introduce the workflow and structure of Kidding Bot.

3.1. Process of kidding bot

In the user interface, "Kidding Bot" button is added in between the "answer" and "reject" buttons. When using software to identify the harassment phone, such as 360 Mobile Security, phone users can choose to receive or reject a suspected harassing phone call, or choose the specially-added "Kidding Bot" to divert the phone call to the Kidding Bot server and activate anti-harassment function. The application process is shown in Fig.1.

3.2. Overall framework of the kidding bot

Since the information carrier that the chatbot could process directly is text, it needs to convert the voice messages from the phone call into text. After the text was input, Kidding Bot will generate a text reply based on the chat model. Similarly, Kidding bot also needs to convert the reply messages into voice and play it to the caller.

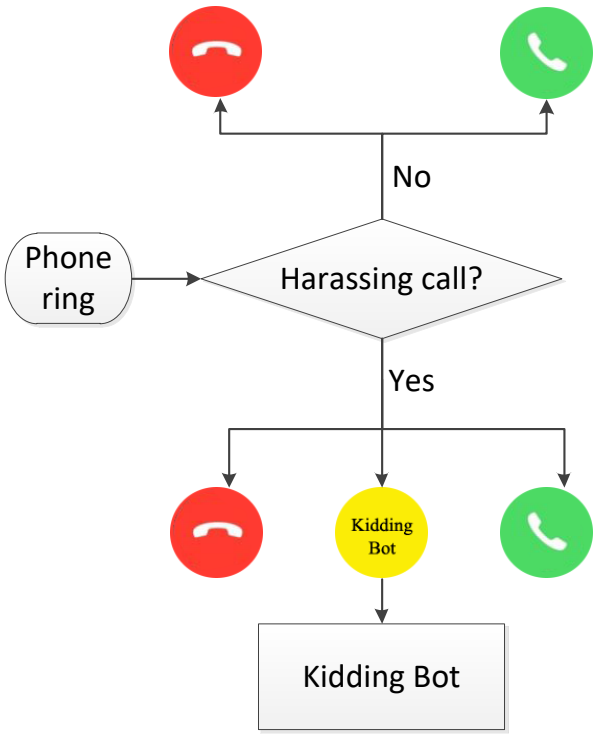

Fig. 1: The application process of the Kidding Bot

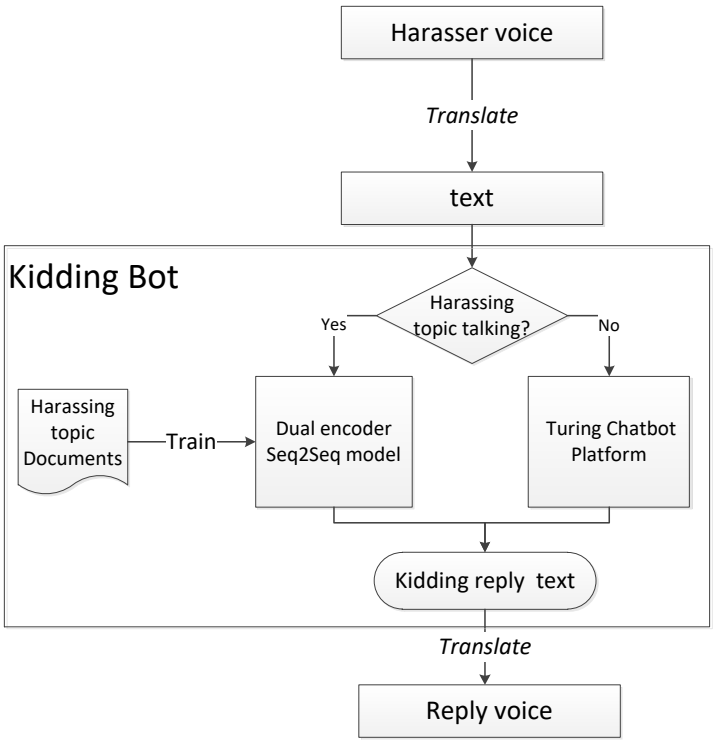

Fig. 2: Frame structure of the Kidding Bot

On the basis of deep learning, we built a special chatbot model and combined it with the Turing chatbot platform to optimize the chatbot. Its frame structure is shown in Fig.2.

3.3. Conversion between voice and text

As a normal chatbot, Kidding Bot can process only text. Baidu voice platform, which has a mature platform technology and feasible application, can help to interconvert between voice and text. Kidding bot

sets a pause for each interval in the conversation and then starts to recognize next message repeatedly, which will make the telephone chat mechanism work smoothly and effectively.

4. Baseline Models

4.1. Baseline 1

Turing Robot is an artificial intelligence company (https://www.tuling123.com/) that provides an open platform for chatbots for a wide range of developers [6]. Turing chatbot performs well in the daily chat [7], but the initiators of the harassing call tend to have a strong sense of purpose and are extremely sensitive to the responses from the receivers of the call. So the Turing chatbot could not play an anti-harassment role in some special situations. For example, in the case of a house sale, we hope the chatbot to adopt a unified answer to some questions, such as "I am interested in it", while the answer of Turing chatbot is more inclined to normal chat, such as “Do you think the house is just a house? That is also a sense of security!” According to the above-mentioned reasons, Turing chatbot failed to achieve the goal of increasing the conversation rounds as much as possible in the fight against harassment calls.

4.2. Baseline 2

In the aspect of corpus, we collect corpus related to topics including overseas study, fraud, and real estate to enhance the professionalism of chatbot including its content as well as coping ability and improve the robot corpus hit rate. Various specialized libraries can make chatbot more distinctive. What’s more, adding movie library can improve consistency of dialogues, so that the dialogues can go on smoothly.

After collecting special corpus, we divided it into question set and answer set, and also divided these Q-A patterns into train data and test data. n the training structure of Sequence-to-Sequence Model[8,9] firstly segment question (Q) and answer (A). into $\{q_1, q_2 \ldots, q_t\}$ and $\{a_1, a_2 \ldots, a_t\}$. Secondly vectorize them as input with word2vec model[10]. After input in the same RNN, the semantic relation between question and answer is captured. The matrix M is the parameter that needs to be trained.

After training the model, test data was put into the conversation generation experiment. Just as the pre-train process, we segment the question (Q) into $\{q_1, q_2 \ldots, q_t\}$ and vectorize them, put them into the modified neural network, finally the answer vector mode $A = \{a_1, a_2 \ldots, a_t\}$ is generated.

4.3. Model combined whit Turing robot & dual encoder sequence-to-sequence model

Base on the above baselines, Kidding Bot adopts the combination of Turing chatbot and a dual encoder special Sequence-to-Sequence Model to increase the number of rounds of a dialogue as much as possible. Turing chatbot are designed to provide daily talk, while neural network models are designed to provide proprietary anti-harassment functions.

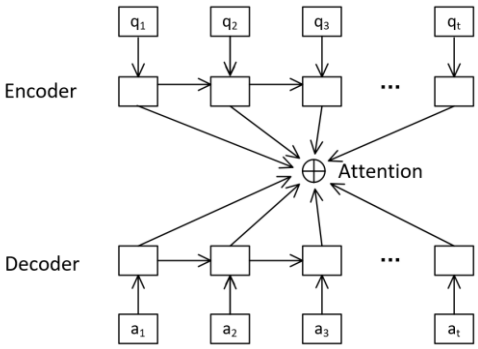

Fig. 3: Dialog generation model

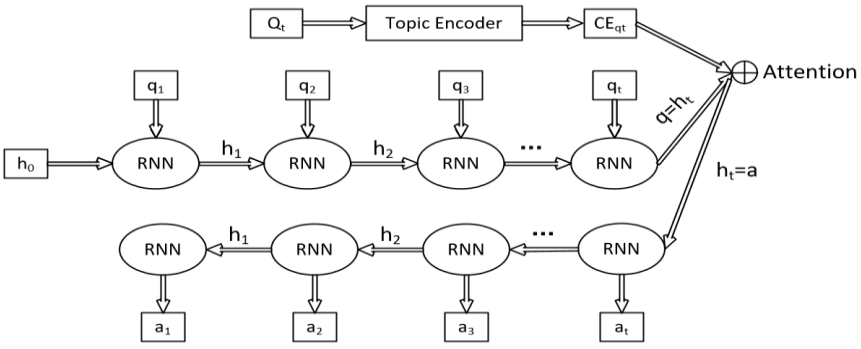

Fig. 4: Dual encoder Sequence-to-Sequence Model

In the following section, we will introduce the Dual model and how it combines with Turing chatbot. Sharatht. s. et al. proposed a model with a context encoder that performs better -- Dual model[11], which is used in chatbot of open domain. Attracted by the ideas of the Dual model, we make some improvements to the algorithm in order to adapt to the application of anti-harassing telephone chatbot——Kidding bot. We take the text content encoder as text topic encoder, as shown in fig3. For harassment topic identification, we

firstly assemble a list of harassment topics. Take the house sale harassing phone call as an example. First, we will make a list of the commonly-used or sensitive words of such harassing telephone calls and if these words are involved in the chat, the call will be considered as harassing phone call in the topic of housing sales.

On the basis of the Sequence-to-Sequence Model with attention mechanism mentioned in section 2.2, the topic-oriented encoder is added, as shown in fig4. The question Qt is semented and vectorized and then added to the encoder. The added topic model encodes the input sentences in a space that makes it easy to distinguish different conversation behavior classes, and is used to generate replies for specific topics.

The Kidding Bot we developed combines the Turing chatbot with neural network model to firstly determine whether the harasser is talking about a harassing topic, and if not, delay the harasser as long as possible with the Turing chatbot' s daily and natural chat. Or if the input sentence is recognized as the harassment topic, we'll activate the Dual model to respond to the other party, holding the conversation in the specific harassment topic.

5. Model Training and Testing

5.1. Data

The training corpus includes public data and special constructed data focus on harassing topic conversations. Open dialogue corpus includes 1.5 million question-and-answer with its sorted types from baike2018qa, which help streamline conversations. For harassing phone call dialogue data, there is no such existing corpus. So we generate it by copying and replacing. We simulate some common harassment conversations, as shown in table1.

Table 1: Training data description

Corpus	Public data	Special data
Content	Dialy dialogue	Harassing phone conversations
Resource	Open dialogue corpus includes 1.5 million question-and-answer with its sorted types from baike2018qa	We created them. For example, Q: Are you interested in houses in XXX community? A: how much is the house in XXX community? (By the method of substitution, XXX is replaced with for example the buildings' names which is collected by us to generate dialogues.)
Function	Make the conversation more fluent	Keep the dialogues focus on the subject of harassment

5.2. Dialog experiments

For test and evaluation, some common harassment phone statements were put into three models—tow baselines and our model. As shown in Table 2, Kidding Bot, combined whit Turing robot & dual encoder sequence-to-sequence model, is more durable in the harassment topic chat. Also, Kidding Bot makes it less likely to be identified by the harassers, which will result in more rounds of chat.

Table 2: Dialog experiments based on different models (Q: harasser A: chatbot)

Harassing Topic	Baseline 1	Baseline 2	Kidding Bot
Study abroad	Q: Are you considering studying abroad? A: It's too expensive. Q: There is a discount now. A: It's very cheap. I will buy more. Q: Have you taken the IELTS test? A: I got nine points. Q: Good grades. A: The result of hard work.	Q: Are you considering studying abroad? A: Yes. Q: When are you going to go abroad? A: I will consider improving my GPA at first. Q: Which country do you want to go? A: Britain and America are good. Q: Good idea. A: Anything else? Q: In foreign countries, the class size is small. A: That sounds good.	Q: Are you considering studying abroad? A: Yes. Q: When are you going to go abroad? A: After getting my IELTS score. Q: Which country do you want to go? A: I prefer Britain and America Q: Good idea. A: Anything else? Q: In foreign countries, the class size is small. A: That sounds good. I don't like the Chinese teaching style.

	Q: Which country would you like to go abroad? A: Kangaroo country.	Q: What are you going to major in? A: I like music. Q: It would be nice to go to Vienna. A: it's nice of you to think so.	Q: What are you going to major in? A: I like music. Q: It would be nice to go to Vienna. A: Yeah, I think so.

6. Summary

At present, there are few methods to deal with harassment calls, most of which use number recognition to alert users or directly block calls. However, the effect is not good that the harassment calls do not drop but increase. Kidding Bot, which is proposed in this paper, innovatively adopts confrontation methods rather than filter or interception methods. The growing sophistication of chatbot technology and the rapid development of chatbot platforms focusing on the development of chat functions make it possible to take advantage of the situation. The Turing chatbot platform can perform well the relatively natural and smooth conversations, but this kind of chatbot's universal style of conversation can be easily recognized by harassers with specific intentions. In order to maximize the number of dialogue rounds, a Topic-oriented Encoder with Sequence-to-Sequence Model is specially constructed, so that the Kidding bot could deal with the harassers well after the training of specialized harassment topic corpus. Dialog experiments have shown that the combination works better than a chatbot alone.

7. Acknowledgment

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