Japanese Dialogue Corpus of Information Navigation and Attentive Listening Annotated with Extended ISO-24617-2 Dialogue Act Tags

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Abstract

Large-scale dialogue data annotated with dialogue states is necessary to model a natural conversation with machines. However, largescale conventional dialogue corpora are mainly built for specified tasks (e.g., task-oriented systems for restaurant or bus information navigation) with specially designed dialogue states. Text-chat based dialogue corpora have also been built due to the growth of social communication through the internet; however, most of them do not reflect dialogue behaviors in face-to-face conversation, including backchannelings or interruptions. In this paper, we try to build a corpus that covers a wider range of dialogue tasks than existing task-oriented systems or text-chat systems, by transcribing face-to-face dialogues held in natural conversational situations in tasks of information navigation and attentive listening. The corpus is recorded in Japanese and annotated with an extended ISO-24617-2 dialogue act tag-set, which is defined to see behaviors in natural conversation. The developed data can be used to build a dialogue model based on the ISO-24617-2 dialogue act tags.

Keywords: Dialogue corpus, dialogue act, information navigation, attentive listening

1. Introduction

Spoken dialogue systems have been modeled with abstracted classes, such as dialogue states, which are handcrafted for the assumed task of the system (Dahl et al., 1994; Williams et al., 2013; Kim et al., 2016). However, handcrafting such dialogue states is costly, making it harder to build extensible dialogue systems for a variety of domains. Two solutions are widely used to avoid this problem: building a multi-domain system (Gašić et al., 2015; Papangelis and Stylianou, 2017) and building a system with more generalized classes (Yoshino et al., 2017; Keizer and Rieser, 2017). However, the approach of building a multidomain system is an extension of using existing slot-value type dialogue states, and it is hard to apply this architecture to dialogue tasks that do not assume language understanding methods based on slot-filling, such as information navigation (Yoshino and Kawahara, 2015) or attentive listening (Yamaguchi et al., 2016; Lala et al., 2017; Tanaka et al., 2016). In comparison, general dialogue acts are more effectively used in these tasks because the approach of using them separates the functions and content of dialogue and only focuses on modeling dialogue functions. In other words, the approach of using generalized dialogue act classes does not have the problem of exponentially increasing the number of dialogue states, which is caused by combinations of dialogue content.

ISO-24617-2 (Bunt et al., 2010; Bunt et al., 2012) is defined as a standard of dialogue act classes that is based on communicative functions of utterances in dialogue. It is important to realize natural dialogue in order to use more appropriate dialogue functions (acts) that match dialogue history and the context (Mizukami et al., 2016). We previously reported that dialogue systems can be effectively managed by using a part of the ISO-24617-2 dialogue act classes (Yoshino et al., 2017). It was also indicated in this work that the dialogue policy learned in this architecture can be applied to different domains because it only models the behaviors (functions) of the system in a information navigation task.

Switchboard corpus (Godfrey et al., 1992) is also a corpus that is annotated with the discourse tag-set Discourse Annotation and Markup System of Labeling (DAMSL) (Core and Allen, 1997); however, ISO-24617-2 is designed to model dialogue behaviors in natural conversation more directly than the DAMSL tag-set. The problem with using ISO-24617-2 dialogue act classes is that there is no large scale publicly available dialogue data annotated with this annotation standard.

The task of collected dialogue data is also important. Existing dialogue are categories into two types from the viewpoint of their task: task-oriented dialogue and non-taskoriented dialogue. Task-oriented dialogue systems assume actual goals of dialogue compared with non-task-oriented dialogue systems do not define any actual goal. The problem of task-oriented dialogue is that the number of dialogue behavior observed in the conversation is limited because stereotyped expressions mainly achieve the task of the dialogue. On the other hand, free conversation that does not set any dialogue goal contains a large number of behaviors, which is hard to implement everything in dialogue systems. Information navigation and attentive listening are tasks in a good position between them; goals of these tasks are more ambiguous than task-oriented dialogue, but tasks or domains can be limited in the task definition. Thus, we focus on collecting dialogue corpora of information navigation and attentive listening in this paper.

We recorded 60 face-to-face dialogues, 20–30 minutes for each, in the tasks of information navigation and attentive

listening. Each utterance was transcribed and annotated with extended ISO-24617-2 dialogue act classes by two disciplined annotators.

2. Recording Procedure

2.1. Scenario

Information navigation is a task that involves one participant (navigator) introducing information written in documents (news, description of sightseeing places, etc...) to an other participant (user). For our recording scenario, we prepared positive and negative content for the navigator. The navigator introduced the prepared information (news) by giving a summary and details, answering the user's questions, and proactively presenting corresponding information. The user could ask any questions or request information corresponding to the introduced topic. Once the phase of information navigation was finished, the dialogue task was changed to attentive listening. The user of information navigation stated one's opinion on the topics introduced during the information navigation (speaker), and the navigator of information navigation attentively listened to their opinion by using listening techniques (listener). Participants of one dialogue repeated this procedure for each prepared information source.

We recruited 24 elderly people for the user-speaker roles, because we focus on dialogue modeling to talk with elderly people, which is caused by the culture-specific demand of Japan. For the navigator-listener roles, there were 5 professional counselors, 5 professional care-takers, and 5 students of graduate school (15 in total). Every attendee was a native Japanese speaker. Each navigator-listener talked with 4 different user-speakers; in other words, 60 dialogues that had unique combinations of participants were recorded. The gender distribution is shown in Table 1.

Table 1: Number of recorded dialogues from the viewpoint of gender

		spe	eaker
		male	female
listener	male	23	2
	female	29	6

The following instructions were given to the navigatorlistener participants.

- The navigator-listener reads two different documents (news) as dialogue topics before the dialogue. The information sources include positive and negative topics. The navigator-listener can check the documents any-time during the dialogue, but it is forbidden to show the documents to the user-speaker directly.
- The dialogue should start from a positive topic. The navigator-listener will decide to change the topic after 10 minutes is spent on one topic depending on the context of the conversation.
- The navigator-listener describes the main points of the current topic first of all and asks for the user-speaker's opinion. Self-introductions are allowed as an ice-breaking.



Figure 1: Recording room

• Digressing is allowed if it is natural in the context of the conversation because we want to balance the naturalness of dialogue and control of dialogue situation.

The following introductions were given to the user-speaker participants.

- If you have any questions on the description given by the dialogue partner, you can ask them anytime.
- After the description of the navigator-listener, you should give your opinion on the current topic.
- Digressing is allowed if it is natural in the context of the conversation.

After the recording, each participant was guided to different rooms for questionnaires. The following items were evaluated with 7-degree scores: smoothness, trustiness, familiarity, empathy, interest of the partner, distance of the partner. One yes/no question, "did you have any thing that you could not talk about with the partner," was also asked. We informed participants that the results would not be revealed to the dialogue partners.

2.2. Recording Environment

We recorded dialogues in conference rooms by using headset microphones¹ and videos² to record the upper half of the speakers bodies. The speech of both speakers was recorded on a single channel of stereo audio per speaker, though a USB-audio device³. Participants sat opposite each other across a table. The position of each piece of equipment is shown in Table 1.

We set up the recording as face-to-face because of the timing of backchanneling or interruption is a very critical factor in natural conversation. If we record the dialogue in a non-opposite situation, behaviors of users in backchanneling or interruption will be different from the face-to-face situation because dialogue participants generates their behaviors by using not only audio information but also visual information that can be observed from the dialogue partner. Frame number of each utterance in the dialogue is also annotated in the transcription phase of our data construction, which will be used to analyze generation timing.

¹Crown CM311 Headworn Condenser Microphone ²SONY HDR-CX670 and HDR-PJ675

SON I HDR-CA070 and HDR-PJ0

³Roland Quad Capture

Tag names	Tags
Sound prolongation at end of words	<h></h>
Reactive token	(R *): reaction without content words (e.g. back-channel)
Filler	(F)
Laugh	(L*)
Short pause	(P): 500 msec or longer pause
Inaudible speech	(?)
Other standards	Expressions in corpus
Correction by speaker	{correction pronunciation corrected words}
Numbers	Chinese numerals
English words	Katakana expressions
Lazy speech	Transcribe as pronounced

Table 2: Annotation standard used for transcription

Table 3:	ISO	24617-2	dialogue act	definition
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Top category	Sub-category	Tags	
General	Information seeking question, propositional q., check q., set q., choice q.,		
purpose	Information providing	viding inform, agreement, disagreement, correction, answer, confirm, disconfirm	
	Commissive	offer, promise, address request, accept request, decline request,	
		address suggest, accept suggest, decline suggest	
	Directive	suggest, request, instruct, address offer, accept offer, decline offer	
Dimension	Auto/allo-feedback	auto positive, allo positive, auto negative, allo negative, feedback elicitation	
specific	Turn management	turn accept, turn assign, turn grab, turn keep, turn release, turn take	
	Time management	stalling, pausing	
	Own/partner comm. man.	completion, correct misspeaking, signal speaking error, self correction	
	Discourse structure man.	interaction structuring	
	Social obligations man.	initial greeting, return greeting, initial self introduction,	
		return self introduction, apology, accept apology, thanking,	
		accept thanking, initial goodbye, return goodbye	

3. Annotations

3.1. Transcription

To use the data for dialogue modeling, we transcribed every utterance included in the conversation of each session. The transcription standard used is given in detail in Table 2. Annotators automatically inserted a short pause if they observed a 500 msec or longer pause and created segments of utterances according to the content of the utterances. Time stamps were annotated at the beginning and ending points of each utterance. As the result of transcription, there were 27,986 utterances, 322,684 words, and 490,705 characters in 60 dialogue sessions. Each utterance was segmented with the Japanese morphological analyzer KyTea⁴ (Neubig et al., 2011).

3.2. Dialogue Act Annotation

We annotated each utterance of recorded dialogue with the ISO 24617-2 dialogue act annotation standard (Bunt et al., 2012). The standard has hierarchical classes that are related to the decision process of dialogue acts. A summary of the original structures of defined functions and tags is shown in Table 3. There are two functions in the top hierarchy: general-purpose functions and dimension specific functions. General purpose functions, functions that classify utterances from the viewpoint of dialogue content, consist of four sub-functions: information-

- Decide a sub-function of an utterance from the subfunctions of general purpose functions. If there is no matched function, use the label "dimension specific," which means that the utterance has only the role of making the dialogue advance.
- Decide a specified category (tag) of an utterance from the tags defined for the sub-function. If "dimensionspecific" is selected, annotators select a tag from any of the functions of the dimension specific functions.
- Watch all utterances again to add additional tags from dimension specific functions, because one utterance can take several roles of dimension specific functions.

seeking functions, information-providing functions, commissive functions, and directive functions. Dimension specific functions, additional functions that have specific roles for making a conversation advance smoothly, consist of six sub-functions: auto/allo-feedback functions, turn-management functions, time-management functions, own/partner communication management functions, discourse structure management functions, and social obligations management functions. Several tags that belong to dimension specific functions can be used for one utterance if the utterance has several roles for making a dialogue advance. Fifty-five detailed classes are defined under the subfunctions. Our dialogue act annotation was processed in accordance with the following procedure to follow the structure of the definition of ISO 24617-2 dialogue acts.

⁴http://www.phontron.com/kytea/

Original tag (sub-function)	Extended classes
Inform (information-seeking)	Topic presentation
	Storytelling
	Proactive presentation
Auto positive & negative	Auto neutral
(auto/allo-feedback)	

Table 4: ISO 24617-2 dialogue act definition

To adapt the annotation standard for our purpose, modeling of information navigation and attentive listening, we added the several dialogue tags mentioned in Table 4. The "inform" tag was annotated on many utterances in the information navigation task; thus, we divided the tag into three classes according to the kinds of information being provided. "Topic presentation" is the action of providing a new topic in conversation. With these utterances, new topics are introduced or largely changed from the previous topics. "Storytelling" is an action done mainly after a "topic presentation." In storytelling, the details and main points of a provided topic are presented. "Proactive presentation" is the presenting of additional corresponding information to the current topic.

We also extended the auto/allo-feedback functions by defining a neutral state for feedback for the dialogue partner. In Japanese conversations, there are many unclear feedback responses given to partners such as ones containing modesty and compliments. The "auto neutral" tag was used for such responses for which it was hard for annotators to decide whether the responses were positive or negative.

3.3. Annotation and Feedback Loop

We had loop processing of annotation and feedback to realize accurate annotation of dialogue acts. In the first step, two annotators annotated tags in the same part of data without any comparing and fitting of annotations. We used Fleiss' kappa (Fleiss et al., 2013) to calculate the agreement of two annotators rather than Cohen's kappa, because we allowed annotators to put several dialogue acts for one utterance. In the first loop, we calculated the annotation agreement of the first step of the annotation: the decision of the sub-function in "General purpose" or others (=any functions of "Dimension specific"). The annotation agreement between two annotators was 0.768 for the decision.

The score is sufficiently high, but we took a meeting for fitting their annotation after the first annotation step. We added some case-studies of annotation in the annotation standard and tried to annotate other portion of the dialogue data. We took the loop of annotation and feedback twice. After these loops, the final annotation agreement of top-category was 0.786. We also calculated the agreement score of tags, it was 0.485, even if we have a variety of tags.

This high agreement is probably caused by the bias of the distribution of tags, which is brought by the property of tasks of the collected dialogue. Tasks of information navigation and attentive listening define roles of speaker and listener to participants explicitly. This property increases the number of backchannels of listeners, which is easy to annotate. After the annotation and feedback loops, remain-

ing data was annotated by single annotator.

. Numbers of basic tags in train		
Tag name	Numbers	
Filler	12,549	
Reactive token	22,080	
Laugh	2,256	

Table 5: Numbers of basic tags in transcription

Table (b: Numbers of sub-ful	nctions in annotated corpus	
	T	NT	

Numbers
3,066
8,527
69
74
17,186
718
974
871
163
465

4. Statistics of Corpus

The numbers of tags for the transcribed utterances are shown in Table 5. The majority of "reactive token" was backchannels in information navigation and attentive listening. The numbers of each dialogue function in the annotated corpus are shown in Table 6. The sub-function that had the largest number was "Auto/allo-feedback," which included positive and negative feedback tags for user utterances. This function is one of the most important functions for realizing information navigation or attentive listening systems. "Information seeking" and "Information providing" also often happened because summaries and opinions on the topic being talked about were often exchanged between dialogue participants.

5. Dialogue Example

We show an dialogue example in Table 7. This example shows that the dialogue is started from the information providing by the navigator about the news of Nobel prize. The user made some confirmation questions to comprehend the detail of the news in following turns. After the phase of information navigation, the dialogue was moved to the attentive listening phase. In the attentive listening phase, the user (speaker) tried to talk their opinion about the news, and the navigator (listener) listened to the talk of the user carefully. Some techniques of attentive listening, backchanneling or repeating, are used in the attentive listening phase.

6. Conclusion

We recorded natural face-to-face Japanese conversations in tasks of information navigation and attentive listening and transcribed utterances to build a dialogue corpus. Each utterance was annotated with extended ISO24617-2 dialogue act tags to use the data for dialogue modeling. We developed a dialogue act annotation standard by using feedback to the annotated results and finally achieved the high agreement of annotation results.

It is expected that the collected dialogue data contains techniques of information navigation or attentive listening of professional counselors or professional care-takers, which will contribute the dialogue modeling of each task. In the future, we plan to use the data to improve the dialogue model for both tasks.

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ID	-		<u> </u>	otated with dialogue act tags
ID	Tag	Start	End	Transcription (Translation)
LI-000001	DS-IS	2975737	293017460	本日 私 から (F えっと) 二 本 ニュース を 紹介 さ
	DS-OP			して頂きまして、それについて(Fえっと)
				お話しさして頂くって言う、
				(Today, I introduce two news, then we will discuss
				about the news.)
LI-000001-2	IP-TP	*	*	まず一つ目は(Fえっと)ノーベル賞の話なんです
LI-000001-2	11-11			は、「ひっっ」は、「たうこう」 「ひょうひょう」 しょう
				言う方が(Fえっと)(P) ノーベル賞受賞されました。
				音) / / / (F へうと)(F) / ⁻ ベル 頁 文頁 さ れ よ し た。 で 、 この お 父 さん も (F えっと) 鉱物 学 者 (F あの)
				で、このお又さんも(F へっこ) 動物 子 石(F のの) 理系の 学者 一家 (P)の 末っ子 で (F とー) とうとう
				末っ子にして悲願を達成すると言う(P)事で
				(The first news is about Nobel prize, an honorary professor
				of TITECH, professor Ohkuma won the Nobel prize. His
				father was also a researcher, and his family was research
				family. He was youngest child but achieved long-cherished
				wish of the family.)
L1-000001-3	IS-CEQ	*	*	(Fえっと)このニュースってご存じでした
				でしょうか?
				Do you already know the news?
SP-000001	AA-AP	30469792	33626875	(R ふん)
				(Backchanneling)
SP-000002	AA-AP	37591667	44030625	(R うんうん)
				(Backchanneling)
SP-000009	IS-CEQ	304958125	336606042	(P) オオスミ さんい う 方 で す ね 。
51 000009	15 CLQ	501950125	220000012	(Professor Ohkuma.)
LI-00002	IP-CO	334910658	341053515	(R はい)
LI-000002	n-co	554710050	541055515	(Yes.)
SP-000010	IP-AN	344795000	369141250	聞いたような聞かんような感じですね。
SP-000010		544795000	509141250	
11000002	AA-ANE	260005400	201051027	(I'm not sure I have heard or not.)
LI-000003	IP-PP	369885488	381051927	こういった方です。
				(This is his picture.)
SP-000011	IS-Q	422951042	435910000	これ何年位前でしたっけ?。
				(How many years ago he won the prize?)
LI-000004	IP-AN	435078005	483383447	多分 (F えっと) これ が 今年 の 話 じゃ な い か と
				僕は思う。
				(Probably, he won the prize in this year, I guess.)
LI-000004-1	IP-CO	*	*	(R はい) 今年 。
	AA-ALP			(Yes, in this year.)
SP-000012	IS-CEQ	464000000	504021875	今年、(Fあ)今年ですか、
				(Oh, in this year.)
	1	1	1	
SP-000138	IP-PP	10445199375	10629265625	で、我々の村から高校行くといってもね、
51 000150		10110177515	10027203023	なかなかそう、当時ね、私らも貧乏だったけど
				なんとか (P)(Fま) 高校だけ は行かないかんという
				気ん こ が (F)(F ま) 同校 だけ は 1 が な い がん こ い う 気持ち で 、(P)(F ま) 出 て き て 行 っ た けど も 、
				(Fあのー)なかなか、三分の一ぐらいしかね、 の 京林に たかなか、 さです
				(P) 高校 に 行 か な かっ た で す 。
				(In my generation, I was also poor, but Igo on to high school
				because believed that I should go on to, but only one-third
				of my friends go on to high schools.)
LI-000222	AA-AP	10472939456	10477368481	(R はい)
				(Backchanneling)
LI-000223	AA-AP	10533057370	10541755556	(F あー)(R はい)
				(Backchanneling)
LI-000224	IS-CEQ	10617459184	10657617914	(Fあー) 周りの同じ同世代が。(Rほー)
				(Oh, your same generation people,)
				(on, jour sume Seneration people,)

Table 7: Dialogue example annotated with dialogue act tags