Generic manager for spoken dialogue systems

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Abstract

Based on three principal elements: dialogue acts, strategy, and dialogue goal, this paper presents a management model of human-machine spoken dialogue.

1 Introduction

In the context of company's voice portal (PVE[1]) project, our analysis of use shows that the voice service is very useful for applications such as information requests, confirmation of a request, secretary works. Spoken dialogue in these situations is normally short but contains complex statements.

However, it is clearly necessary to have a generic dialogue model that increases as much as possible the independence of the task. In this paper, we propose a generic architecture for a spoken dialogue system and in more details we concentrate on the dialogue management that permits this problem to be resolved.

2 Basic principles in dialogue management

2.1 Dialogue act

Austin (1962) considers all utterance as an act of communication called a speech act. For each speech act, by combining with the illocutionary logic notion, Vanderveken (1990) defined the illocutionary force of a speech act. And then, as Caelen (1997), it is useful to retain the following illocutionary forces in the human-machine dialogue domain:

Act	Signification
F	Do or execute an action.
FF	Ask the hearer to perform an action.
FS	Communicate information.
FFS	Ask for information.
FP	Give a choice, make an invite.
FD	Oblige to do without giving an alternative

A *dialogue act* is a speech act enhanced by the illocutionary force. In our dialogue management, a dialogue act is represented by an illocutionary force that specifies what the speaker wishes to achieve, and a propositional content represented the semantic schema of statement. Each utterance can contain one or more than one dialogue act. For example, the utterance "*Jean Caelen here, I would like to book a conference's room*" may be interpreted to two dialogue acts:

$$\overset{\text{Illocutionary force}}{\overset{\downarrow}{\mathbf{FS}}}[\text{FirstName}(\mathit{jean})\&\text{LastName}(\mathit{caelen})]$$
$$\&\ \mathbf{FF}[\underbrace{\text{Action}(\mathit{reserve})\&\text{RoomName}(\underset{\overset{\uparrow}{\text{Concept}}}{\mathit{x}})}_{\text{Propositional content (p)}}]$$

We consider that the input of the dialogue manager has always dialogue acts structured like this schema.

2.2 Dialogue goal

A goal is generally a state of the task or a mental state that one wants to reach. A *dialogue goal* is the goal that is sustained during an exchange.

In our model of dialogue management, a dialogue goal is determined by the abstraction of dialogue act with the help of the dialogue plan (which is specified in the task model by elementary goals, called goal of task, and managed by the task manager). For example: with the utterance "I would like to reserve a room please" and the plan for booking a room like **RESERVED**[RoomName:Size:Material], we have the dialogue act as **FF**[Action(*reserve*)&RoomName(*x*)], and the dialogue goal as **ToRESERVE**(*new*) (*new*: new goal stated by the user).

Once the dialogue manager formed dialogue goal, it sends this goal to the task manager to know if this goal is either reached, impossible to reach, or miss information (states concerning tasks). Then, the dialogue manager must resolve itself the other states like satisfied, awaited or left.

2.3 Dialogue strategy

The dialogue strategy is the way to handle the talking turns between speakers to lead a dialogue goal. The strategy aims at choosing the best direction of fit of the goals at a given moment. It decides directly to the dialogue efficiency calculated by the speed of convergence of the dialogue acts towards the final goal. As Caelen (1997), the typology of dialogue strategy is: directive strategy, reactive strategy, constructive strategy, cooperative strategy and negotiated strategy.

3 Dialogue management

For developing spoken dialogue system, we used a generic architecture (Nguyen 2003) as figure 1:

[1] PVE - www.telecom.gouv.fr/rnrt/projets/res_01_5.htm

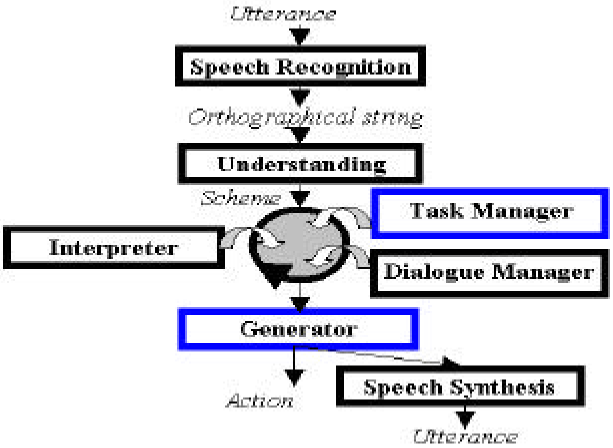

Figure 1: Generic architecture for a spoken dialogue system

In our dialogue management, the *dialogue manager* with the dialogue act passed by *Interpreter* takes generally the role of driving the dialogue cycle, determining the dialogue goal, calculating the adequate strategy, and producing the dialogue act of the machine. Our approach of the dialogue management is based on these three main elements: dialogue act, dialogue strategy, and dialogue goal.

As in the previous section, we could see that:

- The dialogue act, generated by the *Interpreter* module, is independent to the task model.

- The dialogue goal delegated to the task model.

- The dialogue strategy, specified in the dialogue manager, does not related to the task model.

So by these above reasons, our dialogue management is obviously very generic and independent to task model. This remark is very important and it gives us many advantages while building spoken dialogue systems, for example the reusability of dialogue manager, the openness of whole system

By using three elements, a spoken cycle in the dialogue manager happens as the figure 2.

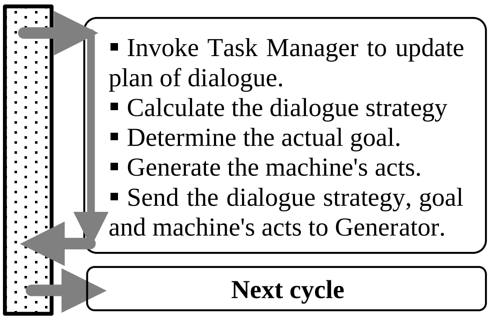
▪ Invoke Task Manager to update plan of dialogue.
▪ Calculate the dialogue strategy
▪ Determine the actual goal.
▪ Generate the machine's acts.
▪ Send the dialogue strategy, goal and machine's acts to Generator.
Next cycle

Figure 2: Handling steps in dialogue manager

4 Simulation and validation

By using the principles and the model mentioned above, we have implemented the core of our spoken dialogue system, with the dialogue manager and the task manager, which aims to replace the secretary to realize tasks concerning the reservation of a conference room.

The following example illustrates a dialogue to reserve a room: the system takes the dialogue acts of user's utterance as the input and produces the dialogues acts of the system, dialogue goal and strategy as the outputs.

	Acts	S	Goals
U1	*hello, it is jean caelen* FS[FirstName(jean)]&FS[LastName(caelen)]	D	Role *reached*
M1	FS[Role(directeur du laboratoire)] & FS[Sexe(0)] *Good morning mister director, please to hear you*		
U2	*I would like to reserve a room* FF[Action(réserver)]&FS[RoomName(x)]	C	(Role *satisfied*) Time *new*
M2	FFS[Time(x)] *For what date, please?*		
U3	*What are the possibilities?* FFS[Date(*)]	C	Room *new*
M3	FFS[RoomName(x)] *Do you have any room preference*		
U3	*No, but I need a room for twenty people* FS[Size(+20)]	C	Room *reached* Time *reached*
M3	FS[RoomName(lafayette)] & FS[Date(20030323)] & FS[Hour(480)] & FS[Duration(600)] *The Lafayette room will be available next Friday*		
U4	*That's fine and notify the pve's member* FS[RoomName(OK)]&FS[Time(OK)]& FF[Inform(x)]&FS[Members(PVE)]	R	(Time, Room, *satisfied)* Mode *new*
M4	FFS[Mode(email)] *Shall I notify them by email?*		
U5	*OK,cool, goodbye* FF[Mode(OK)]&FF[Close(OK)]	R	Mode *satisfied* Close *satisfied*
M6	FS[Close(OK)] *Goodbye*		

Table 1. Example of conference room reservation

5 Conclusion

In many actual spoken dialogue systems, the dialogue manager still depends on the task model. The biggest advantage of our dialogue management model is that it is very generic and independent in relation to the task model. Therefore, this module is completely reusable for another spoken dialogue systems.

References

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