

Response Generation of Natural Language Processing

Mr. Kartik

Department of Computer Science and Engineering, University Institute of Engineering and Technology,
M.D University Rohtak, India

Abstract: Response generation for the natural language interface has to be seen in totality and not an exercise in isolation. Purpose of the response generation should be to built user friendly interaction. One of the most important sources for information for language generation is the mode of dialogue, and dialogue modeling has two major approaches to it. First approach relies on the determining the reasoning and logic as to the goals and intentions of the user, and the second approach relies on the functional role of the move of the user taking into account the grammar specified dialogue. Second Approach will provide less sophisticated results as it does not take into account the intention and goals of the users into consideration. On the other hand determining the intention and the goals of the users is not an easy and straightforward task as it seems because it relies on complex plan recognition. This is the reason for the most natural language application the grammar based approach is sufficient But if the end goal is to mimic the human interaction then we should move from the grammar based approach and take a serious consideration for the approach which will take into account the real intention and the goals of the users.

1 INTRODUCTION

User friendly cooperative response generation for natural language interfaces requires us to take an inclusive approach and not to rely on the information provided in isolation. We have to focus on a model to consider the ongoing dialogue and utilize this information and model to structure the cooperative interface. It has been proved by the extensive research that we can motivate the computational model of discourse from two angles or viewpoints. One is a generalization model which suggests that we should create a general model for all agents and all situations. Other standpoint suggests us to create a specific model for a specific project say natural language interface.

It will be idealistic to assume that both these models should mimic the human communication because if we will try to build any interface mimicking the human communication then that model will not only be slow but will also produce lot of errors. The purpose should be to create an interface which should provide responses which are helpful on the basis of the natural language interface and the role of the agent. These responses must also adhere to the behavioral capabilities of the natural language interfaces.

Dialogue can be distinguished between three categories, Task Dialogue, Planning Dialogue and Parameter Dialogue. Task dialogue is one where the system guides the users actions like the pump assembly task. Task Dialogue often requires the sophisticated system as it requires repeatedly consulting the user. Planning Dialogue is the one where system assists users in planning his action. Parameter Dialogue is where the system does not know the task of the user for example database access. Both Planning and Parameter Dialogue require user to identify parameters and certain entities in order to provide the useful service. The class Simple Service systems are such models which incorporate both Planning and Parameter dialogues.

Natural language interface should have three important characteristics and these are habitability , transparency and efficient. Natural language interface should be able to give information to the users as to the tasks which it can perform, which it can not perform and what are the initiatives it will respond to and what are the initiatives it will not respond to and also the underlying reason why it is so. Natural language interface should be efficient and should not slow the interaction with the back end system.

2 COMPUTATIONAL MODELS OF DISCOURSE

Problem of the discourse modeling can be best described in managing three structures which are namely the linguistic structure, the attention state and the intentional structure. Attention states requires careful examination of the components which record the objects , properties , their relation which provides clue to the attention. If we will study the role given to determine the intentional structure which is structure of the discourse purpose and the sequences of the utterance in the structure then we will come to have the two orthogonal ways for dialogue management.

1. One approach is the plan based approach or the intention based approach, the important ingredient in this approach is defining or modeling the purpose or intention of the user participating in the dialogue. Here we use linguistic structure to identify the users goals and intentions in other words his intentional state. This intention or goals are then modeled into plans in describing the actions which may be carried out in different situations. This basic formulism has been used in various ways to handle the phenomenon of human communications.
2. In the second approach the utterance provided by the users are used in the linguistic structure and in relation to the information provided earlier and then determine their functional relation. Underlying assumption for this approach is that the structure of the conversation moves can be used to model the dialogue. Utterances often occur in pairs for example answers follows the questions,

The important thing here is to identify the goals of the user without taking into account his intent. Lets understand with one example.

Passenger: Trains going from here to ortiga?

Clerk: Ottawa. Next one is at four-fifty.

Passenger: How about Sunday?

Clerk: One at seven twenty....

In the Grammar based approach there is no interpretation of the intention and the interpretation of the utterance is usually stopped once the functional role of the utterance is identified in the speech. Lets call the functions Request and Inform, We assume that the Program is modeled on the dialogue in way that if there is a request for the information then the system has to inform the user about the information asked for In our example the response will be to provide the information required and then assume the dialogue to be completed and then the second request opens for the new information dialogue. Here we are not entering into the intention of why the user is asking for the information , we are just providing the information on the basis of the request input received.

But theory of taking into account the goals and intentions of the user insists that emotions are the basis of the human communication and natural language interface will not be complete without taking into account this factor. Lets have a look at another example.

Speaker 1: The Russian Plane shot down by the US was a spy plane.

Speaker 2: With 219 people on board?

The problem is how to communicate the information in this scenario the functional based approach would probably tell the user 'yes' but this hardly corresponds to the human communication. On the other hand if we use the plan recognition technique in conjunction with disclosure rules this can be accomplished. By recognizing violations in the intentions and the plan user wanted to convey. The plan based approach has two inherent major problems. One is the identifying the primitives required to identify the users goals and intentions and second is to the efficiency. It is not easy to identify and determine the primitives required to understand the goals and intentions of the users. It is not always clear what user wanted to achieve by the communication. In a user-advisor Wizard of Oz experiment two different coders tried to derive the dialogue structure by determining the users goals and intentions. The inter rater reliability in both of them in some cases was just 72 % which means that they were not able to agree between themselves as to the goals and intentions of the user. So if it is so tough for the humans to understand clearly the goals and intention of the user, it will be a very tough task for the computer to understand the task which is required to complete. This result poses serious challenges in the development of natural language interfaces.

Second problem as we discussed is the efficiency. The central idea of plan based approach is to understand the goals and intentions of the users by listening to their tasks and then model those goals in the using the plans. But this area is more

difficult and less studied than the planning. General STRIPS- like planning is undecidable, so we need to restrict the complexity of the plan. But it is not possible to construct a polynomial-time planning algorithm for the more restricted class of problems named the SAS-PU which probably is too restricted for practical use in natural language processing. In SAS-PU, for instance one action achieves only one effect in the world and every operator has only one effect in the world. Removing the ability to recognize new plans by chaining together the preconditions and effects of other plans also provides plans that can be recognized in polynomial time. This restricts the flexibility of plan recognition, but would otherwise lead to massive increase in the size of the search space. If we can write context free grammar programs then there are many well know polynomial-time algorithms that can be used for parsing. If the grammar is small and number of categories are limited then we can also use this approach for grammar formalizing using features structuring.

For a dialogue grammar of context free program there are several polynomial-time algorithms that can be used for parsing..So if the number of categories are limited and grammar is small we can use standard algorithms to generate a natural language interface.

3 GENERATING WITHOUT PLANS

Apart from using a dialogue method there are other methods which can be used to generate user friendly natural language responses. All these model are not based on the intention model and do not require to determine the intention of the user. All these models will be discussed in this chapter briefly.

We will use the principle which is called as the Quantity Principle, this principle was determined after using a lot of experiments in natural language using simple service systems. This system will provide more information to the user than what the user has requested provided the information is relevant. The principle is based on the fact the user can read and understand the natural language at a considerable speed and is able to select the information on the basis of the relevance and if the information is in the tabular form the reader need not read much and will be able to understand the information much faster. In fact in our research it was pointed out as a good feature to have all the information in the tabular form which made it easier to understand and evaluate.

Looking into the example 1 the user asking for the information for train to Ottawa can get the information of all the trains going to Ottawa on that day in the typed format which will be far more easier for him to understand and evaluate and the clerk sitting at the window might not be able to give him this information at one go personally. More over by providing the time table for the train for the whole week will further render the next question from the user redundant.

Similar strategy can also be adopted if the user investigates about the different properties about the same set of primary facts, or object. In all such cases provided that the information is presented in the tabular form more information can be added along with the first set of answers. In both cases the system provides more information than the user has requested. The Quantity Model eliminates the need to use the sophisticated intention based strategies to determine the goals and the needs of the user. It is most applicable in cases where screen output is possible especially for multimodal generation where varieties of modalities and multiple windows can be used.

That is why it is not more suitable for the spoken interactions. Tabular presentation is less applicable in presenting meta knowledge and in those applications where organization of knowledge base has to be explained. These kinds of systems needs more advanced methods taking into account features such as communicative goals and rhetorical structures.

To a large extent this can be achieved using schemata describing various aspects of the text to be generated. One more aspect of the generation is the cost of generating the knowledge base required to provide the framework on which the response will be generated. This problem is addressed in IDAS. IDAS uses fixed set of canned rules and does not use the plan based approach because of the high cost. We can try to reduce the cost by using the control heuristics. But this strategy will work if the number of tasks to be performed is fairly small and predictable.

4 SUMMARY

User friendly natural language interaction is a very complex process and needs a constant ongoing dialogue model to generate user friendly cooperative responses. Such a dialogue model can be used in two ways one is the functional role based approach which is called as the grammar based approach and the other way is convey the intention and goals behind the moves which is called as the plan based approach.

What is important is to investigate the task carefully and then chose the right dialogue model. If the goal is to mimic the human communication then the intention based model is perfect even though it is complex. However there are certain task based systems where such a sophisticated response is not required and the information can be shown in tabular presentation. We have to keep in mind that the human computer interaction does not have to always resemble the human natural communication levels, Instead the System must be efficient and also present the user with a model of its capabilities in order to facilitate habitability and transparency.

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