Dialogue Acts Annotation Scheme within Arabic discussions

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Abstract

Building discourse structure in human discussions needs a task of dialogue act annotation. In this paper, we propose dialogue act taxonomy in Arabic language. The proposed scheme is based mainly on the argumentative function that occurs frequently in debate conversations expressing opinions, ideas and arguments. To validate the reliability of our classification, we measure the agreement between two human annotators. Results show an average kappa score of 0.84 which expresses high reliability. To automatically generate annotated corpora, we developed an annotation tool that supports our dialogue act taxonomy for Arabic language.

1. Introduction

Dialogue Act (DA) annotation is a hot research topic in both human-to-human and human–computer speech communication. This task performed mainly in understanding the role of a user's utterance in the dialogue (Sridhar et al., 2009).
This field attracted researchers in linguistics (Austin, 1962; Searle, 1969) and computational linguistics (Core and Allen., 1997; Traum, 1999) since long time. Recent research on spoken dialogue processing has investigated computational dialogue act models of human-human and human-computer conversations (Stolcke et al., 2000).
The annotation task is fundamental to many studies in human discussions analysis as they reflect shallow discourse structures of language that can be investigated to build an argumentative structure of discussions.
Thus, the main goal of annotating DA in our work is to build adjacency pairs that reflect the DA sequences in Arabic discussions such as question/answer, opinion/reject, confirmation request/confirmation, etc.
These pairs are then investigated to generate an argumentative structure of the discourse that can help user to answer complex queries as "who rejected the proposal of M. X?".
The argumentative information level is based mainly on exchanging information, raising issues, expressing opinions, making suggestions, providing arguments, negotiating alternatives, and making decisions.
Thus tracking argumentative information is of central importance for building memories, browsing and summarizing discussions content.
To facilitate extracting argumentative data, it is useful to automatically annotate participant interaction characteristics specifically by identifying agreement and disagreement in order to understand social dynamics.
Annotating debate programs acts can be also a motivating task when a user needs information about a past discussion that he missed, or wants to recollect discussion dynamics (topic discussed, agreements, disagreements, arguments, etc).
In this perspective, we propose a dialogue act taxonomy including mainly argumentative actions related to acceptations, rejects, etc, in Arabic debate programs.

This paper is structured in four sections. First, we focus on the role of DA in building conversation structures. The next section

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exposes previous works in Dialogue Acts annotation research field and summarizes the main annotations schemes. In the third section, we experiment, with an empirical study, Arabic discussions and we propose our own DA taxonomy. Finally, we illustrate our annotation scheme by developing an annotating tool that generates annotated structures which can be used later as the basis of machine learning algorithms.

2. Argumentative Discourse Structure

Dialogue acts play a vital role in the identification of discourse structure.
In this context, (Grosz and Sidner, 1986) claim about task structure influencing dialogue structure. It seems likely that there are structures higher than a single utterance, yet more fine grained than a complete dialogue. Several researchers identify structures within dialogue at levels higher than individual utterances or speaker turns, but below the level of complete discourse description. There has been some significant exploration of the use of sequences of Dialogue Acts, at a number of levels of granularity.
The simplest dialogue sequence model is the use of adjacency pairs (Schegloff et al., 1973) which are functional links between pairs of utterances such as question/answer, opinion request/opinion, etc.
Within the adjacency pairs model, the importance of tracking a deeper structured representation based on argumentation theory has been recognized in (Pallota et al., 2004; Galley et al., 2004; Hillard, et al., 2003). These models help in constructing the argumentative information needed to express participants' intentions and to answer real user queries.

A simple but expressive model of an argumentative structure is the "Issue Based Information Systems" (IBIS) model, proposed by (Kunz and Rittel, 1970) and adopted as a foundational theory in some computer-supported collaborative argumentation systems. Thus, this model captures and highlights the essential lines of a discussion in terms of what issues have been discussed and what alternatives have been proposed and accepted by the participants.
In our context, the argumentative structure of discussions can be helpful in browsing topics discussed, decisions made, agreements and disagreements between participants.

3. DA Annotation Schemes overview

In order to standardize annotation tags, a proliferation of labelling schemes has been developed, often started from the topology suggested by Searle (Searle, 1969).
The granularity of DA annotation labels varies considerably from domain-specific to open-domain annotation task.

The MapTask project (Anderson et al., 1991), outlining task-oriented dialogues, is a collection of human conversations in which two people negotiate an agreed route on separate maps.
The MapTask labeling scheme uses 12 DA labels divided into two main categories: initiating and response moves.

Later, the Verbmobil project developed in Germany (1993-2000) aimed at the construction of an automatic speech to speech translation system for the languages German, American English and Japanese (Wahlster, 2000). A set of 43 DA is generated in a first phase (Jekat et al., 1995). These acts were organised in a hierarchy. There was a second phase of the Verbmobil project (Alexandersson et al., 1998), which expanded the dialogues from meeting scheduling to comprehensive travel planning. This domain change results a new hierarchy cluster of 18 top-level DA.

These schemas were all designed for specific-purpose application domains. They contained overlapping sets of communicative functions and made use of often mutually inconsistent terminology.

In the 1990s, a general-purpose schema called DAMSL: Dialogue Act Markup using Several Layers (Allen and Core., 1997; Core et al., 1998) is developed for multidimensional dialogue act annotation. With its focus on multidimensionality and domain-independence, this represented an important step forward in dialogue act annotation.
This annotation scheme leads to considering specific dimensions such as: communicative status, information level, forward-looking function and backward-looking function.
Several extensions of the DAMSL schema have been constructed for specific purposes, such as Switchboard-DAMSL (Jurafsky et al., 1997).

The comprehensive DIT++ schema (Bunt, 2006; Bunt, 2009) combines the

multidimensional DIT schema, developed earlier (Bunt, 1994) with concepts from these various alternative schemas, and provides precise and mutually consistent definitions for its communicative functions and dimensions.
There are 11 dimensions of the DIT++ tag-set, with around 95 communicative functions, around 42 of which, like switchboard are for general purpose functions, whereas others cover elements of feedback, interaction management and the control of social obligations.

These annotation schemes have been used to mark-up several dialogue corpora in different languages such as English, German and Spanish.
However, very few works were developed for Arabic. To our knowledge, there is only one work achieved at Memphis University (Shala et al., 2010) that proposes speech acts classification model including the following set of predefined categories: *assertion, declaration, denial, expressive evaluation, greeting, indirect request, question, promise/denial, response to question,* and *short response*.
This tag set includes general-purpose actions that can be applied to independent domain corpora.
Nevertheless, these acts are incomplete to build discourse structure and are unable to describe argumentative structure.
In fact, this taxonomy cannot annotate argumentative actions related to exchanging opinions, arguments, acceptations, rejects, etc.

4. Empirical Study

4.1. Experimental data

The corpus used to perform the experiments is a set of transcriptions of debate programs taken from "AL JAZEERA"[1] Arabic channel. It consists of human-human discussions about generic topics. The choice of this corpus is argued by the strong and intense argumentation hold in its content mainly conveyed by exchanging opinions, acceptations, rejects, etc.
The study corpus has been manually annotated at the dialogue act level by two human experts. Each discussion turn was manually segmented into utterances. Each discussion contains about 400 utterances with an average duration of 2 hours. Each utterance was assigned one label.

[1] www.aljazeera.net

4.2. Arabic taxonomy

In Arabic language, semantics "علم المعاني" include *statement* "الخبر" and *construction* "الإنشاء"

- *Statement* الخبر

In general, a sentence or phrase that is a statement can be said to be true or false.
A statement makes a claim about the world, and tries to change the belief of the listener. It generally refers to assertions, declarations following the representative class of Searle's taxonomy.

- *Construction* الإنشاء

Opposed to statement, construction includes actions that do not support to be true or false.
Two main categories are defined under the constructions: "الإنشاء الطلبي" and "الإنشاء الغير طلبي" referring respectively to *request* and *non request construction*.
Request construction can be expressed into questions, orders, etc, whereas non request category refers generally to exclamation, praising or complaint.
Actions included into these two subcategories are summarized in table 1.

Request Construction	**الإنشاء الطلبي**
Question	الإستفهام
Call	النداء
Polite Request	الإلتماس
Incitation	التحضيض
Order	الأمر
Discourage	النهي
Promise	الوعد
Hope	الترجّي
Wish	التمني
Invocation	الدعاء
Warning	التحذير
Non Request Construction	**الإنشاء الغير طلبي**
Exclamation	التّعجب
Praise	المدح
Complaint	الذّم

Table 1. Construction taxonomy

4.3. Our Dialogue Act taxonomy

Starting from tags used in previous annotation schemes, we propose a dialogue acts taxonomy that enables the labelling of argumentative acts that are fundamental in generating argumentative structure of human

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conversations. Thus, our empirical analysis leads to identifying five main groups of dialogue acts: *Social Obligation Management*, *Turn Management*, *Argumentative*, *Request*, *Answer* and *Statement*. We eliminate the non request category cause of its very few occurrence in the studied corpus.

The given categories can be applied for other languages and can be common across annotation schemes especially those tracking argumentative data.

Our taxonomy, following the same partition, is detailed in the next sections.

- *Social Obligation Management*

This category includes conventional acts such as opening, closing and greetings, in addition to the expressive acts following Searle's classification as thanking, apology, regret, etc.

- *Turn Management*

Turn management acts are used to elicit and provide feedback in order to perform turn speaking management in the discussion.

- *Request*

This category includes different request categories (confirmation request, explanation request, etc) and takes different forms (question, order, hope, wish, etc). This class includes initiatives often called forward-looking acts.
Request utterances can express several kinds of demands such as confirmation request, explanation request, justification request and opinion request. These tags are generally associated respectively to the following acts: confirmation, explanation, justification and opinion acts.

- *Argumentation*

Argumentation is mainly based on exchanging opinions, accepting or rejecting others ideas. It's the fact to convince others by giving arguments, explanations, examples …
Thus, *argumentative acts* represent the core acts in the discussion that express argumentative actions.

- *Answer*

Answers consist of general-purpose acts that reply to questions. This category often represents the backward-looking function. It is generally paired with the question label.

- *Statement*

Statement label describes non opinion statement that can state an event or an assertion.

- *Other*

includes non-interpretable and non-classifiable utterances.

4.4. Kappa Ratio

A first step in determining the quality of a set of annotations is to evaluate the agreement between annotators.
The current standard metric used for measuring inter-annotator agreement in classification tasks is the Cohen kappa statistic (Carletta, 1996). This metric can be used effectively only on break classifications when the number of segments is unconstrained. Also, this metric does not adequately accommodate near-miss topic break assignments and other desired tolerances for slightly differing segmentations.
In this section, we present the results of evaluating inter-annotators agreement.
First, we take discussions that have been segmented identically. Then, we appoint two human experts to annotate separately the tokenized conversations while following our classification taxonomy guidelines.
The agreement between annotators is calculated using the kappa measure. We obtain an average score of 0.84. This inter-annotator agreement ratio expresses high reliability between human annotators. The main inter-class differences are between Argumentative and Turn Management labels. For instance the word *"نعم"* (*yes*) in the example below can express an acceptation, a confirmation or just a backchannel action to continue the discussion.

Annotation 1:

Act1: لا نعتقد بأن تونس مهيأة لنظام عسكري أصلا

We don't believe that Tunisia is really ready to a military regime.

<Class="Argumentation", DA="opinion">

Act2: نعم

yes.

<Class="Argumentation", DA="Acceptation">

Annotation 2:

Act1: لا نعتقد بأن تونس مهيأة لنظام عسكري أصلا

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Social Obligation Management		
Opening	اداب الافتتاح	Dialogue beginning
Closing	اداب الإقفال	Dialogue ending
Greeting	تحية	Addressee's salutation
Polite Formula	إلتماس	Showing regard for others, in manners, speech, behaviour, etc.
Introduce	تقديم	Self-introduction, speakers and topics introduction.
Thanking	شكر	Gratitude feeling
Apology	اعتذار	Regret having made an error in understanding, evaluating or executing an utterance
Regret	تأسف	Feeling of sorry and disappointment.
Turn Management		
Acknowledgement	قبول	Agreement with previous utterance or addressee understanding feedback.
Calm	تهدئة	Calming down speakers to control the situation.
Clarify Request	طلب توضيح	Asking addressee for reformulation/repetition of previous utterance for clarification.
Clarify	توضيح	Reply to a clarification request
Feedback	تذكير	Remind addressees about what was evoked in previous utterances
Out of topic	أسلوب الحكيم	A way to change the topic and to bypass the addressee's question
Non understanding signal	علامة عدم فهم	Expressing non understanding of the previous utterance
Request		
Question	استفهام	Asking for information from the addressee and requiring a reply.
Order	أمر	Direct request obliging addressee to do something
Promise	وعد	Potentially promising for achieving a certain goal
Hope	ترجّي	feeling that something desired may happen
Wish	تمني	Longing for something with expectation of its fulfillment
Invocation	دعاء	Prayer that implies to call upon God
Warning	تحذير	Desisting from a specified undesirable action
Argumentation		
Opinion	إبداء الرأي	Subjective belief that may be supported by arguments
Appreciation	استحسان	Favorable judgment or opinion
Disapproval	استهجان	Feeling of disliking something or what someone is doing
Accept	موافقة	Affirmative answer expressing agreement with addressee
Partial Accept	موافقة جزئية	Expressing partial agreement with addressee
Reject	رفض	Refusal to accept addressee's opinion, judgment or proposal
Partial Reject	رفض جزئي	Partial disagreement with addressee opinion, judgment or proposal
Argument	حجّة	Attempt to persuade someone of something, by giving reasons or evidence for accepting a particular conclusion.
Justification	تعليل	Defending by reasoning an action or a belief
Explanation	تفسير	Making something comprehensible by describing the relevant structure or operation or circumstances
Confirmation	توكيد	Additional proof that something which was believed is correct
Conclusion	استنتاج	Decision or opinion or judgment reached after consideration
Answer		Reply to a question
Statement		Affirming or asserting or stating something

Table 3. Our Dialogue Act Taxonomy

We don't believe that Tunisia is really ready to a military regime.

<Class="Argumentation", DA="opinion">

Act2: نعم

yes.

<Class="Turn Management", DA="Acknowledgement">

In order to detail the intra-class reliability, we calculate the kappa score within each class (see Table 2).

Class	Kappa
Request	0.96
Social Obligation Management	0.90
Turn Management	0.82
Argumentative	0.66

Table 2. Kappa per class

Most categories seem to be labelled fairly reliably such as *Social Obligation Management* reaching a kappa ratio of 0.9 and *Turn Management* category with kappa = 0.82.

However, experienced annotators scored a kappa of 0.66 for the *Argumentative* dimension. This rate decline can be justified by the difficulty of annotating argumentative tags. Major experts' annotation differences are focused on ambiguities in labelling opinion tags, in detecting arguments.

Besides, an utterance can refer to more than one action such as <argument, explanation>, <opinion, argument>. In these cases, human annotations could be different given that experts should assign only one label to each utterance.

Annotators' disagreement when annotating argumentative dialogue acts can be explained by the lack of linguistic markers. For instance, "explanation", and "justification" acts can be ambiguous for annotation especially when they are used without specific cue words such as "يعني" (*"that means"*), generally used for explanation, and "لأن" ("*because*") often followed by a justification.

Moreover, the word "يعني" (*"that means"*) used mostly as an explanation cue word can be a trivial expression often used in spoken dialogue as detailed in the following example.

Annotation 1:

يعني جميل أن يكون الإنسان منحازا للشعب

That means it is great when a human is aligned with people.

< Class="Argumentation", DA="Explanation">

Annotation 2:

يعني جميل أن يكون الإنسان منحازا للشعب

That means it is great when a human is aligned with people.

< Class="Argumentation", DA="Appreciation">

In order to construct a training corpus for machine learning classification, we intend to reach a minimum of kappa score of 0.6.

5. ActAAr Annotation Tool

Dialogue acts annotation task requires a considerable effort from human annotators. Therefore, many annotating tools have been developed to offer more interaction with annotated corpora.

In fact there are numerous tools for general annotation tasks such as GATE and MATE and other tools for dialogue act annotation like XDML and DAT.

GATE system (Cunningham et al., 2002) is one of the most commonly used systems. It supports manual annotation, information extraction, semi-automatic semantic annotation, etc.

MATE [2]workbench (Klein, 1999) is a multimodal annotation tool. It can be used with different annotation schemes in XML format. It also allows the corpus designer to write rule based transformations using a language very similar to XSLT.

XDML (eXtensible Dialogue Markup Language Tool) was designed for annotating transcribed dialogues according to semantic, functional and stylistic characteristics. It was developed within the AMITIES[3] project.

DAT is a Perl/Tk tool for dialogue act tagging which processes files in SGML format. It was developed in the DAMSL[4] project. It directly supports dialogue structures (turns and utterances) and includes data from different modalities.

As presented above, these tools are not suitable for dialogue act annotation in Arabic language. Besides, DAT and XDML tools were

2 http://mate.nis.sdu.dk

3 http://www.dcs.shef.ac.uk/nlp/amities/amitiesdemos.htm

4 http://www.cs.rochester.edu/research/speech/damsl/

developed for specific purposes within annotation projects.

GATE and MATE tools are not simple for use by human annotators as they need more proficiency and effort to be used to their annotation guidelines.

Therefore, we have developed an annotation tool named ActAAr (**Act**s **A**nnotation in **Ar**abic) which is simple to use and supports our dialogue act taxonomy.

In fact, our tool is a java application for dialogue acts annotation in Arabic discussions. It uses the taxonomy detailed in table 3.
Indeed, the expected input format is plain text discussions files. The loaded file is then automatically segmented into turns. After the user's annotation, the output structure is saved in an XML labeled file tokenized into functional units (turns and utterances). For each utterance, the output tag includes the DA's label and class.
The annotation process is done by the two following tasks:

1- Select the utterance: the user selects the text by using the mouse from the dialogue shown in the left side of the screen.
2- Select the relevant dialogue act: the user chooses the appropriate class from the list shown. Then he selects one dialogue act from the selected class by a simple mouse-right-click.

When these two tasks are carried out, the program adds the following tag: *<utterance ID="n1" DA="d1" Class="c1" >* under the corresponding turn (see figure 1).

```
<Turn ID ="79" Speaker="غسان بن جدو">
<Utterance ID="50" DA=" Question" Class="
Request ">
أين؟
</utterance>
<Turn ID ="80" Speaker="راشد الغنوشي">
<Utterance ID="51" DA=" Answer" Class="
Answer ">
موجودة في الدستور
</Utterance>
</Turn>
<Turn ID ="81" Speaker="غسان بن جدو ">
<Utterance ID="52" DA="Acknowledgement"
Class =" Turn_Management">
طيب
</Utterance>
<Utterance ID="53" DA="Polite_formula"
Class=" Social_Obligation_Management">
عفوا شيخ راشد
</Utterance>
<Utterance ID="54" DA="
Explanation_Request" Class=" Request">
يعني هل أفهم من ذلك الآن عندما نقول بهذه الطريقة إنك الآن
تدعو إلى تعديل الدستور أو إلغاء الدستور أو ماذا؟
</Utterance>
</Turn>
<Turn ID ="82" Speaker="غسان بن جدو ">
<Utterance ID="55" DA="Explanation" Class
=" Argumentative">
أنا أدعو بأكثر من ذلك أدعو إلى تفكيك منظومة الاستبداد
</Utterance>
<Utterance ID="56" DA="Conclusion" Class
=" Argumentative">
ولذلك أنا أدعو أهل الانتفاضة أدعو شعب تونس إلى تعلم اليقظة
وتعلم الحضور
</Utterance>
</Turn>
```

Figure 1. An annotated corpus sample

6. Conclusion and future work

In this paper we have proposed a Dialogue Acts scheme for argumentative annotation of Arabic discussions. We evaluated the reliability of this scheme by manually annotating a corpus of debate programs transcriptions and assessing the inter-annotator agreement using the Kappa measure. From the obtained results, we can conclude that the proposed taxonomy is fairly reliable and at the current stage needs to be refined in order to obtain better agreement. However, we noticed that some disagreement might be due to our under-constrained guidelines that do not provide clear criteria for discriminating between possible categories.
As a future work, we intend to improve the annotation guidelines by providing a set of mark-up labels and the rules for their application. These guidelines will be the basic reference for human annotators to generate coherent annotations of discussions.
From a practical point of view, we intend to integrate navigation and research modules that extract statistics from annotated corpora (DA frequency in the corpus, acts per class, adjacency pairs, etc.).
Finally, we will use our annotation tool to generate a large number of annotated structures which can be used later as a basis of a machine learning algorithm in automatic annotation task.

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