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BUILDING PERSONALITY PROFILE OF NEGOTIATOR FOR ELECTRONIC NEGOTIATIONS

Abstract

In this work we propose a new mechanism for building the personality profile of a negotiator based on his behavior in past negotiations. The approach is based on the classification of speech acts contained in messages exchanged by negotiators. By assigning to each speech act its type according to our new negotiation context-dependent taxonomy, the mechanism can check the type of speech act received as the response to a particular request. The feature degree can be computed by aggregating the frequency and the strength of different types of responses in different interactions into a compound value. In this work we consider two features: cooperativeness and assertiveness, and show a method for obtaining the degrees of these features.

Keywords

Negotiator's personality profile, communication behavior, speech act taxonomy.

Introduction

In many electronic negotiations the potential players entering the interaction have no prior knowledge about their future counterpart. When the players communicate using instant messaging method the partner is neither seen nor heard by the player. The total lack of knowledge about the partner causes some discomfort for the negotiator, especially when his counterpart is anonymous. Usually the negotiator needs to have basic information about his partner, which allows him to evaluate, for instance, the partner's reliability or honesty. Therefore in this paper we propose to build a personality profile of the negotiator that could be visible for the potential negotiation partners.

Such a profile can contain levels of particular personality features such as cooperativeness and assertiveness. Displaying such an information reveals only small pieces of information important from the negotiation context viewpoint and the players may remain anonymous during their interaction. Some negotiators prefer negotiating with highly cooperative partner while others prefer a more avoiding one. Having the knowledge of the potential partners'bargaining profiles, each negotiator can select the one that meets his expectations best. Moreover, this type of knowledge can be useful for preparation of a negotiation strategy suitable for the chosen type of player.

The problem of determining the type of a player was studied by Ralph Thomas and Kenneth W. Killman [3]. The tool called "Thomas Killman conflict mode instrument" is based on a questionnaire filled out by the potential negotiator. The player is asked to choose between statements matching best his potential negotiation behaviour. Based on his selections the player is fitted into one of the five types of behaviour: competing, collaborating, compromising, avoiding and accomodating. Each of these types of behaviour is determined by the level of cooperativeness and assertiveness. In this paper we propose a new approach for solving a similar problem but without using a questionnaire. We propose to base the determination of particular features on the history of negotiator's behaviour in past negotiations. All speech acts in the messages exchanged between the two parties are classified by the negotiators according to our new negotiation context-dependent speech act taxonomy. The profiling mechanism checks the response of the message receiver to the sender's requests and, based on the types of responses, the feature degree (assertiveness, cooperativeness) is computed. By fusing the partial degrees of a feature over multiple past negotiations we obtain the final degree of a feature that can be displayed for potential future negotiation partners. The Thomas-Killman conflict mode instrument allows for creating a simple profile of a negotiator. However, the questionnaires ask the negotiator general questions about his potential behaviour and do not test it during the actual encounter. The profiling based on the negotiation thread considers only the negotiation context and the actual behaviour of the player. The speech act taxonomy was used in the Negoisst system [4]. Similarly as in the approach we propose that the user be asked to classify his message. However, this knowledge is used for clear specification of the type of speech act to avoid ambiguity but not to create a negotiator's profile.

1. The approach

To build a profile of the negotiator we use the whole description of the previous negotiation threads. Therefore, we assume all the negotiations to be conducted by means of an electronic negotiation system (ENS) in which the negotiators have individual user accounts. The ENS records all the negotiation threads in the database that can be used for all required analysis. Two types of knowledge are used for building the personality profile. The first one is the thread of speech acts communicated and the second one is the thread of offers exchanged between the players. The characteristics of the negotiator can be determined based on his behaviour during negotiation. Similarly as in the tool of Thomas Killman, in this work we consider two features of a negotiator: cooperativeness and assertiveness. The method of measuring the degree of the cooperativeness of the agent being evaluated is based on the classification of the speech acts uttered as a response to the speech act of his partner. Deriving from the existing taxonomies ([2], [5], [6]) we propose our own Negotiation Content Dependent Taxonomy – NCDT – (see Section 2) that allows to structure any single message exchange during the negotiation process and classifies it as a particular type of forward or backward communication act. Then, by analyzing each communication thread, we examine the backward communication acts (responses) and consider how they match the forward communication acts (requests). For instance, a positive response of the negotiator being evaluated to the request of his partner increases the degree of cooperativeness and a negative response of the negotiator to the request of his partner decreases the degree of cooperativeness. In the case of assertiveness the situations is analogous but the negotiator is evaluated as a sender of a speech act. If he receives positive responses to his requests then his assertiveness degree is increased. If he receives negative responses his assertiveness is decreased. This rule is based on the postulate that a communication which causes the counterpart to perform the actions desired is considered to be assertive.

2. Classification of speech acts

To classify a speech act contained in a message, we need a taxonomy of speech acts. The first speech act taxonomy was proposed by John Searle [5]. This taxonomy divides the speech acts into five types, namely: assertives, directives, commissives, expressives, declarations. The types of speech acts have the following meaning:

- **assertives** − speech acts that commit a speaker to the truth of the proposition expressed,
- **directives** − speech acts that are to cause the hearer to take a particular action, e.g. requests, commands and advice,
- **commissives** − speech acts that commit a speaker to some future action, e.g. promises and oaths,
- **expressives** − speech acts that express the speaker's attitudes and emotions towards the proposition, e.g. congratulations, excuses and thanks,
- **declarations** − speech acts that change the reality in accordance with the declaration proposed, e.g. baptisms, verdicts, or pronouncing someone husband and wife.

This taxonomy takes into consideration different types of intentions of the speaker. Another taxonomy is the Verbal Response Mode taxonomy developed while studying therapist interventions in psychotherapy [6]. This taxonomy takes into consideration three criteria: source of experience, presumption about experience and frame of reference. The taxonomy is presented in the Table 1.

Table 1

Verbal Response Mode speech act taxonomy

Source of experience	Presumption about experience	Frame of reference	VRM Mode	Description
1	2	3	4	5
Speaker	Speaker	Speaker	Disclosure (D)	Reveals thoughts, feelings, perceptions or intentions. E.g., I like pragmatics.
		Other	Edification (E)	States objective information. E.g., He hates pragmatics.
	Other	Speaker	Advisement (A)	Attempts to guide behaviour; suggestions, commands, permission, prohibition. E.g., Study pragmatics!
		Other	Confirmation (C)	Compares speaker's experience with other's; agreement, disagreement, shared experience or belief. E.g., We both like pragmatics.

Table 1 contd.

1	2	3	4	5
Other	Speaker	Speaker	Question (Q)	Requests information or guidance. E.g., Do you like pragmatics?
		Other	Acknowledgement (K)	Conveys receipt of or receptiveness to other's communication; simple acceptance, salutations. E.g., Yes.
	Other	Speaker	Interpretation (I)	Explains or labels the other; judgements or evaluations of the other's experience or behaviour. E.g., You're a good student.
		Other	Reflection (R)	Puts other's experience into words; repetitions, restatements, clarifications. E.g., You dislike pragmatics.

Source: [5].

The Searle and Stiles taxonomies give an insight into the issue of speech act classification, but they do not consider some important factors. For instance, does the speech act constitute a response to a previous utterance or not? This kind of criterion was considered in the speech act classification proposed by Mark Core and James Allen [2]. The authors divide the speech act types into two groups: forward communicative functions and backward communicative functions. The latter group contains all speech acts constituting responses to the previous speech acts of the interlocutor. The former contains all the remaining speech acts. The DAMSL Annotation Scheme has the following form:

1. Forward Communicative Functions
   − Statement
     − Assert
     − Reassert
     − Other-Statement
   − Influencing Addressee Future Action
     − Open-option
     − Directive

- Info-Request
- Action-Directive
  - Committing Speaker Future Action
    - Offer
    - Commit
  - Performative (informing)
  - Other Forward Function
2. Backward Communicative Functions
   - Agreement
     - Accept
     - Accept-Part
     - Maybe
     - Reject-Part
     - Reject
     - Hold
   - Understanding
     - Signal-Non-Understanding
     - Signal-Understanding
       - Acknowledge
       - Repeat-Rephrase
       - Completion
   - Answer
   - Information-Relation

We use this type of taxonomy to develop our own taxonomy suited to the negotiation context. The additional characteristic feature of a negotiation treated as a discourse is the usage of logical arguments. In this sense these are statements supported by an argumentation line, and its aim is to convince the negotiation partner about its truthfulness. Moreover, the partner may respond with an Accept or Reject but the Reject may be of the form of a counter-argument, treated as an opposite statement supported by an argumentation line. Apart from introducing the statement of the argument type, we structure the taxonomy in the way presented in Table 2.

Table 2

The new negotiation context dependent taxonomy – NCDT

Direction of a speech act	Intention of a speech act	The issue of discourse	Description
1	2	3	4
Forward Communicative Function	inform interlocutor	perform action	**IPA** Informing the partner about performing an action or intending to perform an action
		Give information	**IGI** Informing the partner about facts or beliefs without intention to discuss them
	request from interlocutor	perform action	**RPA** Requesting the partner to perform an action
		give information	**RGI** Requesting the partner to give information (Asking a question)
		accept belief	**RAB** Requesting the partner to accept the belief stated
Backward Communicative Function	respond to IPA	positive	Thanking the partner for the action performed
		negative	Disapproving the action performed by the partner
		not understood	Signalling not understanding the speech act
		ignored	Not responding to the signal given
	respond to IGI	positive	Thanking the partner for the information given
		negative	Disapproving the information revelation
		not understood	Signalling not understanding the speech act
		ignored	Not responding to the signal given
	respond to RPA	positive	Informing about performing the requested action
		negative	Refusing to perform the requested action
		not understood	Signalling not understanding the speech act
		ignored	Not responding to the signal given
	respond to RGI	positive	Revealing the requested Information
		negative	Refusing to reveal the requested information
		not understood	Signalling not understanding the speech act
		ignored	Not responding to the signal given

Table 2 contd.

1	2	3	4
	respond to RAB	positive	Accept the statement presented in the speech act
		negative	Deny the statement and/or give counterargument
		not understood	Signalling not understanding the speech act
		ignored	Not responding to the signal given

We will now illustrate the relationships between the different taxonomies in Table 3.

Table 3

Comparative analysis of the different types of speech act taxonomies

NCDT	DAMSL AS	Stiles	Searles
1	2	3	4
IPA	Assert, Reassert, Offer	Disclosure	Assertives, Commissives,
	Commit, Performative		Declarations
IGI	Assert, Reassert, Performative	Disclosure, Edification	Assertives, Declarations
RPA	Directive: Action-Directive	Advisement	Directives
RGI	Directive: Info-Request	Question	Directives
RAB	Assert	Disclosure, Interpretation, Reflection	Assertives
positive response to IPA	Understanding: Acknowledge	Acknowledgement	Expressives
negative response to IPA	Information-Relation	Disclosure	Assertives, Expressives
not understood IPA	Signal-Non-Understanding	Disclosure	Assertives, Expressives
positive response to IGI	Understanding: Acknowledge	Acknowledgement	Expressives
negative response to IGI	Information-Relation	Disclosure, Edification, Confirmation	Assertives, Expressives
not understood IGI	Signal-Non-Understanding	Disclosure	Assertives, Expressives
positive response to RPA	Offer, Commit	Disclosure, Confirmation	Commissives

1	2	3	4
negative response to RPA	Reject	Disclosure, Confirmation	Commissives
not understood RPA	Signal-Non-Understanding	Disclosure	Assertives, Expressives
positive response to RGI	Answer	Disclosure, Edification Confirmation	Assertives
negative response to RGI	Reject, Information--Relation, Assert	Disclosure, Confirmation	Assertives, Expressives
not understood RGI	Signal-Non--Understanding	Disclosure	Assertives, Expressives
positive response to RAB	Accept	Disclosure, Confirmation	Assertives
negative response to RAB	Reject, Assert	Disclosure, Confirmation	Assertives, Expressives
not understood RAB	Signal-Non--Understanding	Disclosure	Assertives, Expressives

Similarly to the DAMSL taxonomy, our new taxonomy splits the speech acts into forward communicative functions and backward communicative functions. This division is important in the negotiation context because the negotiation discourse is a process of exchanging messages that are usually different types of requests or different types of responses to previous requests such as: requesting information or requesting the next proposal. In the negotiation context three important issues occur quite often: gathering information during interaction, requesting proposal from the partner and attempting to convince the partner to accept certain beliefs. By considering these three issues we can distinguish three types of intentions of the requesting player. The remaining two types of intentions are: informing about performed action and giving information to the other party but not responding to the partner's question. The speech act types mentioned above constitute five types of forward communicative function speech acts. All the backward communicative function speech act types are responses to these five types. Therefore, we distinguish five groups of responsive speech act types which are further divided into four types. The four types denote four possible ways of responding to a forward communicative speech act: positive, negative, not understood, ignored. The first two are active responses to the speech act. The positive backward communicative function speech act constitutes a cooperative way of reacting to the partner's speech act. These positive responses include: accepting the partner's

statement, confirming performing the action requested by the partner, approving the partner's action, giving the requested information and thanking the partner for the activity performed or information given. The negative responses are opposite to the positive responses and include: refusing to give information or perform an action, denying the partner's claim and disapproving the belief stated.

3. The assessment of negotiators' communication behavior

As said in the Introduction we can determine the type of behaviour based on the relationship between the forward communicative function speech act of one party and the response to this speech act in the form of backward communicative function speech act of the other party. When the negotiator using forward communicative speech acts receives positive backward communicative function speech acts with high frequency and high strength, he can be considered highly assertive. At the same time, the responding party can be considered highly cooperative. When in an analogous situation the sender receives negative backward communicative function speech acts with high frequency and high strength, he can be considered lowly assertive and his partner can be considered lowly cooperative (competitive). Let us denote by $\overline{a}_{i,j}^{\alpha \to \beta} = \overline{a}^{\alpha \to \beta}(i,j)$ an atomic speech act uttered by the speaker α to the speaker β. The number i denotes the consecutive number of a message in the whole communication thread. The number j denotes the number of speech act contained in the message. The communication thread is of the following form:

$$\overline{a}_{1,1}^{\alpha \to \beta}, \overline{a}_{1,2}^{\alpha \to \beta}, ..., \overline{a}_{1,k_1}^{\alpha} \to \beta, \overline{a}_{2,1}^{\beta \to \alpha}, \overline{a}_{2,2}^{\beta \to \alpha}, ..., \overline{a}_{2,k_2}^{\beta} \to \alpha$$

In the above thread the number of speech acts contained in the consecutive message is k_i, where i is the number of the message. Each atomic speech act is encoded in the following way

$$\overline{a}_{i,j}^{\alpha \to \beta} = (n_{i,j}, t_{i,j}, d_{i,j}, \overline{r}_{i,j})$$

where:

– $n_{i,j}$ denotes the intention of the speech act ($n_{i,j} \in \{1,...,7\}$, according to Table 2 there are seven possible intentions),

– $t_{i,j}$ denotes either the issue of discourse or the type of speech act depending on the intention of the speech act ($t_{i,j} \in \{1,...,5\}$, according to Table 2 there are either 2 possible issues of discourse for the first type of intention with 3 possible issues of discourse for the second type of intention or 4 possible types of response in the case of five remaining types of intentions),

– $d_{i,j}$ is the degree of importance specified by the sender of a speech act in the case of forward communicative function or the degree of response satisfaction specified by the receiver of a speech act in the case of backward communicative function (the value of d can be specified on a finite point scale, for instance $d_{i,j} \in \{1,...,7\}$).

– $\bar{r}_{i,j}$ identifies the forward communicative function speech act to which the current speech act $\bar{a}_{i,j}^{\alpha \to \beta}$ responds. For all forward communicative function speech acts the value of $\bar{r}_{i,j}$ is $(0,0)$ which means that it does not constitute a response to any other speech act.

For the sake of further formalization we introduce functions mapping the speech acts into the particular components. These functions, defined below, will be called projections because they project the whole vector encoding a speech act onto a chosen axis (intention – p_1, issue of discourse or type – p_2, importance – p_3, matching requesting speech act – p_4):

$$p_1(\bar{a}_{i,j}^{\alpha \to \beta}) = n_{i,j} \tag{1}$$

$$p_2(\bar{a}_{i,j}^{\alpha \to \beta}) = t_{i,j} \tag{2}$$

$$p_3(\bar{a}_{i,j}^{\alpha \to \beta}) = d_{i,j} \tag{3}$$

$$p_4(\bar{a}_{i,j}^{\alpha \to \beta}) = \bar{r}_{i,j} \tag{4}$$

Let us consider a simple example of a communication thread:

$$\bar{a}_{1,1}^{\alpha \to \beta}, \bar{a}_{2,1}^{\beta \to \alpha} .$$

The above thread consists of two messages containing single speech acts which are further specified in the following way:

$$\overline{a}_{1,1}^{\alpha\to\beta} = \left(2,2,6,(0,0)\right),$$

$$\overline{a}_{2,1}^{\beta\to\alpha} = \left(6,1,4,(1,1)\right).$$

This means that the speaker α is sending one message to the speaker β containing one speech act (2,2,6,(0,0)), where the intention of the speech act is denoted by 2 meaning that it is a request and the issue of discourse is denoted by 2 that corresponds to the "give information" issue. The degree of importance specified is 6. Therefore, the message $\overline{a}_{1,1}^{\alpha\to\beta}$ is a question that is highly important to the speaker α. The speaker β is sending one message to the speaker α containing one speech act (6,1,4,(1,1)), where the intention of the speech act is denoted by 6 corresponding to the speech act "response to RGI" and the type of response is denoted by 1 meaning that it is a positive response. The degree of response satisfaction specified by the speaker α is 4, and because $\overline{r}_{2,1} = (1,1)$, this speech act responds to the speech act $\overline{a}_{1,1}^{\alpha\to\beta}$. Therefore, the message $\overline{a}_{2,1}^{\beta\to\alpha}$ is an answer to the question posed in the previous message by the speaker α.

4. Building the negotiator personality profile

The cooperativeness degree of a negotiator can be computed in the following way. All pairs of matching speech acts in terms of forward communicative speech acts with backward communicative function speech acts responding to them are considered in the computation of the degree of cooperativeness. As said before, the positive responses of the speaker β to the requests of the speaker α increase the value of cooperativeness, the negative responses decrease the value of cooperativeness (increase the value of competitiveness), the "not understood" type responses can be considered neutral (no change in value) and the responses of the type "ignored" can be considered either neutral or decreasing the value of cooperativeness. In the case of assertiveness the situation is analogous but the types of responses of the receiver influence the feature degree of the sender, while in the case of cooperativeness the types of responses of the receiver influence his own

feature degree. The four possible types of response to a request are: positive, negative, not understood, and ignored. In the compound feature degree computation the types of response contribute with different sign and strength. We will define a function m by assigning to each type of response a multiplier. The positive response can be assigned a multiplier of value 1($m(1) = 1$) meaning that the strength of response will be multiplied by this value resulting in an overall positive score of response. The negative response can be assigned a multiplier of value -1 ($m(2) = -1$) meaning that the strength of response will be multiplied by this value resulting in an overall negative score of the response. In the case of the neutral response (not understood) the multiplier value can be assigned the value 0 ($m(3) = 0$) because this type of response does not influence the features considered. The ignored type of response can be considered to be either neutral or competitive, therefore the possible multiplier value is in the range $[-1;0]$ ($m(4) \in [-1;0]$). The strength of response is computed as an aggregate of the importance degree $d_{i,j}$ of the request $\overline{a}_{i,j}^{\alpha \rightarrow \beta}$ and the response satisfaction degree $d_{k,m}$ in the responding speech act $\overline{a}_{k,m}^{\beta \rightarrow \alpha}$, and it can be a product. For a given communication thread the feature degree can be computed by summing all the feature degrees corresponding to single pairs of request and response. Let us consider the set $\varLambda_f^{\alpha}$ of all forward communicative speech acts in the whole communication thread uttered by the speaker α to the speaker β, and the set $\varLambda_f^{\beta}$ of all backward communicative speech acts in the whole communication thread uttered by the speaker β to the speaker α:

$$\varLambda_f^{\alpha} = \left\{\overline{a}_{i,j}^{\alpha \rightarrow \beta} \mid n_{i,j} = p_1\left(\overline{a}_{i,j}^{\alpha \rightarrow \beta}\right) \in [1;2]\right\},$$

$$\varLambda_f^{\beta} = \left\{\overline{a}_{i,j}^{\beta \rightarrow \alpha} \mid n_{i,j} = p_1\left(\overline{a}_{i,j}^{\beta \rightarrow \alpha}\right) \in [3;7]\right\}.$$

The degree of cooperativeness of the negotiator β and the degree of assertiveness of the negotiator α is computed in the following way:

$$\deg^{\alpha}(Assertiveness) = \deg^{\beta}(Cooperativeness) =$$
$$= \sum_{\overline{a} \in \varLambda_f^{\beta}} m\left(p_2(\overline{a})\right) \times p_3(\overline{a}) \times p_3\left(\overline{a}^{\alpha \rightarrow \beta}\left(p_4(\overline{a})\right)\right) \tag{5}$$

The assertiveness of β and the cooperativeness of α can be computed similarly analogously:

$$\deg^{\beta}\text{(Assertiveness)} = \deg^{\alpha}\text{(Cooperativeness)} =$$
$$= \sum_{\overline{a} \in \Lambda_f^{\alpha}} m\big(p_2(\overline{a})\big) \times p_3(\overline{a}) \times p_3\big(\overline{a}^{\,\beta \to \alpha}\big(p_4(\overline{a})\big)\big). \qquad (6)$$

The values $p_3(\overline{a})$ and $p_3\big(\overline{a}^{\,\beta \to \alpha}\big(p_4(\overline{a})\big)\big)$ are the degrees of importance of the backward communicative function speech act $(\overline{a})$ and its corresponding forward communicative function speech act $\overline{a}^{\,\beta \to \alpha}\big(p_4(\overline{a})\big)$. In other words, these values are importances of a request and a matching response. We can treat these values as degrees of inclusion of a speech act in a fuzzy set of important speech acts. Therefore the degree of importance of the pair "request, response" is a fuzzy conjunction of these two degrees (the product realizes the conjunction operator). The value $m\big(p_2(\overline{a})\big)$ is a multiplier determined on the basis of the type of the speech act $(\overline{a})$. As said before, if the speech act is a positive response then the multiplier is positive and if it is negative then the multiplier is negative. The degrees of a feature for different negotiations are aggregated to form the final compound value of a feature.

Conclusions and future work

In this paper we have proposed a new mechanism for building the negotiator personality (bargaining) profile on the basis of its behavior during the negotiation process. All the speech acts uttered by the negotiators are classified according to the new negotiation context-dependent taxonomy (NCDT). The degrees of personality features are determined on the basis of the types of responses of the speech acts receiver. The values of feature degrees for different interactions are fused to form the overall degree of a feature that can be displayed for future negotiation partners as a component of negotiator's bargaining profile. The parties approaching negotiations could then select the partners whose character and attitude assure the best negotiation climate and bring closer to the most satisfying agreement. The knowledge of the bargaining profiles of the parties can be also used by the electronic negotiation system to accomplish its mediation function. The ENS can analyze the profiles of the negotiating parties and, on the basis of the data of the previous negotiation

threads, suggest to them the most efficient negotiation strategies that will lead to a mutually satisfying agreement. Many arbitration procedures can be adopted to realize such a mediation function of the ENS [6].

The profiling mechanism proposed has been already included in the conceptual model of the ENS supporting all negotiation phases called NegoManage [1]. In the further study the mechanism will be implemented and tested. The mechanism will be extended to cope with different types of personality features.

Acknowledgements

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