APPLYING CASE-BASED REASONING FOR IDENTIFYING THE NEGOTIATION PROFILE OF ELECTRONIC NEGOTIATION SYSTEM USERS

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Abstract: In this paper we analyze the problem of identifying the negotiation profile of the electronic negotiation system users. Usually such a profile is identified by means of the specific questionnaire (e.g. the Thomas-Kilmann questionnaire), however it requires from the negotiator answering many troublesome questions which is tiring and may lead to unreliable results. On the other hand many behavioural and psychological studies confirm that there is a set of demographical and sociological characteristics that influence the human general behaviour. Deriving from these studies we try to determine such a profile by analyzing the general information provided by the pre-negotiation questionnaire the users fill while creating their negotiation accounts. Having the historical data of Inspire negotiation system we try to find links between a set of the data that describes the negotiators demographical features and their final negotiation profile using the notion of Gilboa and Schmeidler case-based reasoning (CBR). To determine all the parameters required for the case-based reasoning the statistical correspondence analysis on the set of the historical data is conducted in advance. The results of CBR-based profile identification are also presented and discussed.

1 INTRODUCTION

The negotiation profile of a negotiator, as we see it, is a set of negotiator's features, such as cooperativeness, selfishness, assertiveness etc., that describe negotiator's behaviour in conflict situations. It describes in fact a bargaining style of a negotiator, which is a relatively stable, personality-driven cluster of behaviours and reactions that arise in negotiating encounters (Shell, 2001). This bargaining style is, in turn, determined by negotiator's individual characteristics such as: cultural (Adair and Brett, 2004) or demographical (Jehn et al., 1997) ones or the visible personal characteristics like age and gender (Kray and Thompson, 2005). Some research confirm the impact of these characteristics on the negotiation process and outcomes (Sternberg and Dobson, 1987; Thompson, 1990; Kersten et al., 2003) as well as the impact of other factors, such as the motivation styles, abilities or enduring dispositions (Elfenbein et al., 2008). Thus it is important to be aware of one's negotiation profile, since it may influence the negotiation process and the atmosphere of the forthcoming negotiations. Having a particular negotiation profile and using the corresponding bargaining style makes the negotiators to be more or less willing to use thus-or-such negotiation strategy and tactics and consequently, to represent different attitude towards the negotiation problem and to their negotiation counterpart. Moreover, knowing the counterpart's negotiation profile may allow negotiator preparing better to the forthcoming negotiation, identifying their own strategies that fit the counterpart's position and style the best and allow to influence them most efficiently to achieve negotiator's goals.

Negotiation profile can be identified twofold. First approach is to use a psychometric instrument based on the series of questions posed to the negotiator and derive their negotiation profile by analyzing different combinations of their answers. Second approach is based on the extraction of the levels of the profile's features from the negotiation thread by analyzing the communication process between the parties. An example of the first

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approach is the Thomas-Kilmann conflict mode instrument (TKI) proposed by Kilmann and Thomas (1983). An application of such an instrument results in levels of belonging of the negotiator to five regions spanned on a plane with axes corresponding to assertiveness and cooperativeness. The second approach aims at measuring the degree of profile's features based on the types of responses given by a negotiator during the process of exchanging messages between two sides of the encounter (see Brzostowski and Wachowicz, 2010). The type of response, which may be positive, negative or neutral, is scored with positive sign for positive messages and negative sign for negative messages. The scores also depend on the degree of importance of a request and the degree of response satisfaction. The problem with the first approach is that filling the questionnaire and answering the series of question may be time consuming, tiresome and discouraging for the negotiator, while in the second approach there is no knowledge allowing for building negotiator's profile if the negotiator did not start any encounter, yet.

In this paper we address a problem of identifying the negotiation profile of the new electronic negotiation system users with no negotiation history behind them, but avoiding the specific psychometric questionnaires (like the TKI ones). The main goal of this paper is to prepare the formal mechanism that would allow for eliciting the profile from the basic descriptive information the user is giving while registering to the system (creating an user account) and filling the pre-negotiation questionnaire. To solve this problem we propose to reason from the case base that describes the historical negotiations within which both the descriptive information of the parties and their negotiation profiles were recorded. It will allow us to conduct the case-based reasoning (CBR) using the Gilboa and Schmeidler approach (1995).

The paper has 6 more sections. The research context that was the initial point for this paper is presented in Section 2. Then, in Section 3 the description of the case-based reasoning approach is given. In Section 4, the set of historical data required for the case-based reasoning is described, while in Section 5 the application of CBR main ideas for determining the negotiator's bargaining profile (based on the historical data) is shown. The issue of determining the weight parameters required for case-base reasoning is discussed in section 6. In section 7 the results of our approach are presented and discussed. We conclude with some remarks on the future work.

2 RESEARCH CONTEXT

The problem we have risen in the previous section is a part of the research we are carrying out in order to build a comprehensive electronic negotiation system that would support its users throughout the whole negotiation process, starting with the pre-negotiation preparation and ending with the post-negotiation optimization of the negotiated agreement (Brzostowski and Wachowicz, 2009). The system, called NegoManage, is designed to be a negotiating platform that would allow negotiators to define the negotiation problem, find the suitable counterpart and negotiate the contract. NegoManage is a kind of distributed system with the core deployed on the Web and responsible for supporting communication among the users and sharing the public information about them (NegoManage Communication Unit). There are also the satellite sub-systems responsible for various functionalities such as the preference elicitation subsystem, data visualization unit, reputation subsystem, etc. Some of them are also deployed on the Web, while the others need to be installed on the users desktop computers. Such a structure was chosen due to the security reasons. Some information are strategic (like the negotiators preferences) and should not be revealed to the counterparts, therefore the subsystems responsible for processing such information are deployed on the users computers (NegoManage Individual Unit) and there is no an external access to them from the level of Web based units. The general architecture of the system is presented in Figure 1.

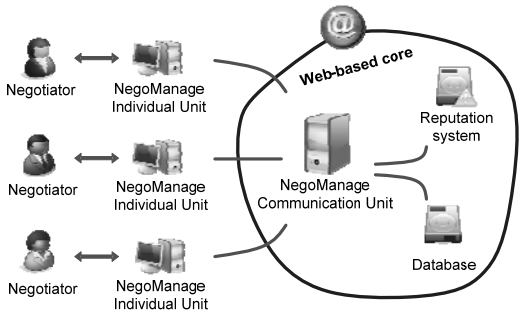

Figure 1: The architecture of the NegoManage system.

One of the key elements of NegoManage system is the reputation subsystem. According to the definition of Howison (2009) the reputation in the context of electronic interaction may described such features of the systems and users as trustworthiness, quality or any other characteristic specific to the analyzed domain. NegoManage reputation subsystem describes the negotiator's profiles using

two major negotiator's characteristic: assertiveness and cooperativeness, derived directly form the Dual Concerns Model (Blake and Mouton, 1964). As addressed in Section 1, such a profile could be elicited by means of TKI and the Wharton-TKI Bargaining Styles Grid (Shell, 2001) that allows to recalculate TKI five-characteristic scores into the two-dimension space of assertiveness and cooperativeness. However, in NegoManage system we aim to build the reputation system that reflect the true negotiation profile the system user presents during the subsequent encounters. We decided then to determine the negotiators' profiles based on the analysis of messages exchanged between the players in the process of negotiation. Deriving form the Searle's and Stile's speech act taxonomies (Searle, 1969; Stiles, 1992) we proposed a new negotiation-context depended speech act taxonomy (Brzostowski and Wachowicz, 2010), based on which the exchanged messages are classified and used later on by the profiling mechanism. The mechanism, that works according to formal algorithm, checks how the message receiver is responding to the request of message sender. Next, the mechanism determines the degrees of the negotiator's features (i.e. assertiveness and cooperativeness). The final degree of a feature is computed as an average degree of a feature for multiple past negotiations. The negotiation profile calculated this way is then displayed by the reputation subsystem to all NegoManage users and may be used by them for browsing the most appropriate (from the behavioural point of view) counterpart and for adequate preparation of the negotiation strategy in the forthcoming negotiations.

The only problem that occurs in our approach is how to identify the initial negotiation profile of the new system user, that did not conduct the negotiation in NegoManage system yet. Since we wanted to avoid using the TKI or similar solutions, such as the Kraybill Conflict Style Inventory (Kraybill, 2005) or Myers-Briggs Type Indicator (Briggs and Myers, 1980), we decided to identify such a profile based on the visible demographic characteristics and psychological description of the user that are available within their pre-negotiation questionnaires. We assume then, having derived from the results of behavioural research on negotiation and the five-factor model (Mershon and Gorsuch, 1988; Paunonen and Ashton, 2001; Herrmann, 2004; Patton and Balakrishnan, 2010), that there is any relation between some personal characteristics of the negotiators and their negotiation profiles. To find the relation and describe it formally we will apply the case-based reasoning (see Section 3). For such a reasoning the historical data of the previous negotiation experiment is needed that would provide all the information required to build both the input and output data. The case base we will use would be comprised with the Inspire electronic negotiation system data (see Section 4).

3 CASE-BASED REASONING AND CASE-BASED PROBLEM SOLVING

The idea of case-based problem solving is based on the postulate that similar problems have similar solutions (see Aamodt and Plaza, 1994; Gilboa and Schmeidler, 1995). In the classical case-based problem solving (Leake, 1996) we use the past solutions of past problems to solve a new problem. The idea of case-based problem solving is illustrated in Figure 1.

The CBR mechanism retrieves from the case base the relevant cases and adapts them to fit a new problem. In the first stage of CBR features of the current situation that are really relevant are determined. In the next stage the CBR mechanism retrieves from the most relevant prior cases or case. Then the retrieved case or cases is adapted to fit the new situation. After applying the solution suggested by CBR the new case is stored in the case base.

Our application of the CBR concept differs from the typical application. Instead of finding the solution to a new problem we use the CBR concept to predict the outcome of a new situation. We do not consider the whole CBR cycle concerning the full methodological framework of this approach (Aamodt and Plaza, 1994). Instead, we focus on the inference stage within the overall process of CBR. In our particular application context we can consider a decision problem of selecting the negotiation partner with desired conflict resolution style. The decision of selecting the negotiation partner is based on similar encounters in the past. The concept of Case-Based Decision Taking (Gilboa and Schmeidler, 1995) is used when each case may be split into three components: the decision problem (situation), the act that was chosen by the decision maker in this case and the outcome received by the decision-maker. The three abstract sets corresponding to these three component may be introduced:

1. P - the set of decision problems. In our case the decision problem is described by the

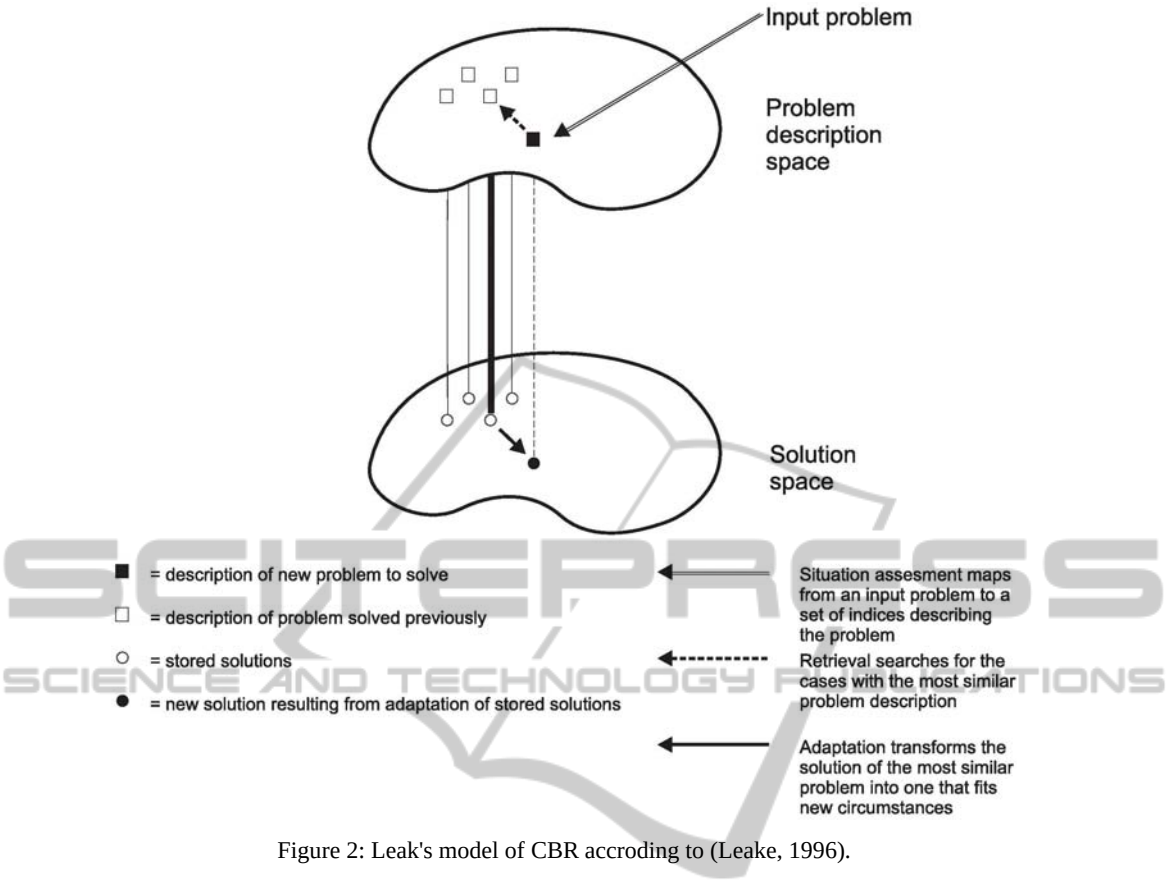

Figure 2: Leak's model of CBR accroding to (Leake, 1996).

demographic description of the negotiation partner in the past negotiation.

2. *A* - the set of possible acts. The set of potential negotiation partners. The act in this case is a choice of one of those partners.
3. *R* – the set of conceivable results. The set of resulting conflict resolution styles of the chosen negotiator partner. In other words, it is the description of encountered negotiation behaviour of the chosen partner.

The product of these three sets gives us the set of all possible cases $C = P \times A \times R$. The given case base M is a subset of the set C ($M \subset C$).

4 INSPIRE'S CASE BASE

Inspire (Kersten and Noronha, 1999) is an online system that has been used for years, mainly for training and teaching negotiations (Paradis et al., 2010). It supports negotiating parties in bilateral negotiation process: pre-negotiation preparation, actual conduct of negotiation and post-negotiation phase. In the pre-negotiation phase the Inspire users are asked to fill the questionnaire giving the basic personal information about themselves and their attitude towards the negotiation problem, process and counterpart. Then they take the Thomas-Kilmann test and have their bargaining style identified this way. Inspires provides also its users with the preference elicitation, that allow building their own negotiation offers scoring systems. In the actual negotiation phase the system supports the communication between the parties, helps them to evaluate negotiation offers and visualizes the negotiation progress. In the post-negotiation phase Inspire analyzes the compromise (if achieved) and browses for its improvements using the notion of Pareto-efficiency.

The case base required for our analysis is comprised of the data collected by Inspire system within the pre-negotiation phase. The base contains the description of the users' demographic and personal features provided by the pre-negotiation questionnaire and the TKI's conflict style regions (i.e. competing, collaborating, compromising, avoiding and accommodating) identified by means of TKI test. The set of users' personal information with the pre-defined resolution levels for the closed-form questions are shown in Table 1.

Table 1: The user's personal characteristics recorded by Inspire system.

Description	Options
Program of study (ed_field)	Arts and Fine Arts (1); Business & Management (2); Communication (3); Computer Science & Information Technology (4); Education (5); Engineering (6); Health, Medical & Nursing (7); Humanities (8); International Studies (9); Law & Criminal Justice (10); Mathematics & Statistics (11); Psychology (12); Public Affairs, Administration (13); Social & Behavioural Sciences (14); Others (15)
Level of stud (ed_level)	High School (1), Undergraduate (2), Graduate (3)
Gender (gender)	Female (1), Male (2)
Age group (age)	20 or less (1); 21-25 (2); 26-30 (3); 31-40 (4); 41-50 (5); 51 or more (6)
In which country was the user born? (c_born)	Two letters UN symbol (numerical code)
In which country does the user currently reside? (c_reside)	Two letters UN symbol
How long does the user reside in the country of residence? (l_reside)	6 months or less (1); 6 months to 1 year (2); 1 year to 2 years (3); 2 years to 4 years (4); 4 years to 7 years (5); 7 years or more (6)
First language (m_tongue)	Name (numerical code)
Did the user participate in negotiation experiments before? (p_before)	Yes (1); No (2)
Did the user use a decision support or negotiation software before? (NSS)	Yes (1); No (2)
Did the user attend negotiation course/seminar before? (course)	None (1); one (2); two or more (3)
How does the user rate her knowledge of negotiation? (knowledge)	From novice (1) to expert (7)
How does the user rate her English proficiency? (english)	From poor (1) to excellent (7)

In case-based decision theory each case consists of two components: the situation and the outcome that was experienced for this situation. For the negotiation profile identification each case would consist of demographic values as an input (description of the situation) and the bargaining style obtained as a result of TKI questionnaire as an output (description of the outcome in terms of the scores of the five regions of styles). The sample case base input and output are shown in Table 2 and Table 3.

Table 2: The case base (input) containing user description in terms of demographic variables.

Vectors of input												
age	gender	c_reside	l_reside	c_born	m_tongue	english	course	ed_level	NSS	knowledge	p_before	ed_field
2	2	1	3	16	1	6	2	3	1	2	1	2
2	1	1	6	1	1	6	1	2	1	2	2	2
2	2	1	6	1	1	5	1	2	1	2	1	2
1	2	1	6	1	1	7	2	2	1	5	2	2
3	2	1	6	1	1	4	1	2	1	4	1	2

Table 3: The case base (output) containing resulting conflict mode regions descriptions.

Vectors of output				
Competing	Collaborating	Compromising	Avoiding	Accomodating
4	3	10	7	4
5	2	9	7	5
6	6	9	5	2
9	3	10	2	4
4	5	10	6	3

5 APPLYING CBR FOR IDENTIFYING THE NEGOTIATORS BARGAINING STYLE

The case-based prediction in our application aims at estimating negotiator's conflict resolutions (bargaining) style approach. Therefore as the situations we have the negotiators demographic features and as the outcome their conflict resolution style descriptions. In other words, based on the knowledge contained in the Inspire's case base we aim at predicting the conflict resolution styles based

on its demographic characteristics. In order to use the case-based reasoning for identifying the profile of any new negotiator we have to extract from the case base the user demographic descriptions most similar to the demographic descriptions of this new negotiator (system user) first. Having selected these descriptions we can estimate the bargaining style of the new user by comparing the historical conflict resolutions styles of the similar users in terms of demographic characteristics.

Two questions arise here. First, how to form a similarity metric for comparing the situations (demographics descriptions) and second, how to adjust the conflict resolutions style descriptions of the similar negotiators to form a prediction about the conflict resolution style of the assessed novice negotiator.

Most of the demographic variables we use are nominal, and therefore the similarity metric has to be formed taking into account this feature. The situation (the user demographics) is modelled here as a vector of 12 variables. Since these variables are nominal the similairty metric comparing the situations x and y on each variable i should have a simple form:

$$S_i(x,y) = \begin{cases} 0 & x \neq y \\ 1 & x = y \end{cases}, \qquad (1)$$

meaning that if two values of a demographic variable are compared the similarity metric assings 1 to a pair of values if they are identical, and 0 if they are different. It does not make sense to fuzzify the metric since the varaible is nominal. The similarity metric comparing vectors of 12 demographic characteristics $X = (x_1, \ldots, x_{12})$ and $Y = (y_1, \ldots, y_{12})$ is in turn of the following form:

$$S(X,Y) = \sum_{i=1}^{12} w_i S_i(x_i, y_i). \qquad (2)$$

As shown in the above formula, the similarity of the demographic descriptions of two users is a weighted sum of the similarity metrics, comparing the situations on each coordinate of the demographic user descriptions. The values w_i ($i \in \{1,\ldots,12\}$) are the levels of importance of all demographic variables. These values are determined using the correspondence analysis, as we will show in Section 6.

Having extracted the most similar cases from the case base by means of the similarity metric S, we may now adjust the conflict resolution styles descriptions in the exctracted cases. This style is described by five variables, namely: competing, collaborating, compromising, avoiding and accomodating. These variables are ordinal, which allows us to use following procedure of adjustement. Let us consider one variable which describes the level of belonging to a particular conflict resolution feature (for instance competing). Let us assume that in the hypothetical situation we extracted from the case base a set K of k most similar cases. In this situation we have k cases in the form of the vectors as follows:

$$(d_1^j, d_2^j, \ldots, d_{12}^j; c_1^j, c_2^j, \ldots, c_5^j). \qquad (3)$$

where $j \in \{1,\ldots,k\}$, d_i^j corresponds to the ith demographic characteristic of the jth case ($i \in \{1,\ldots,12\}$) and c_m^j corresponds to the mth bargaining style characteristic of the jth case ($m \in \{1,\ldots,5\}$). The cases were exctracted from the case base based on their similarity to the current situation for which we want to estimate the conflict resolution style and which we denote as $\tilde{D} = (\tilde{d}_1, \tilde{d}_2, \ldots, \tilde{d}_{12})$. The similarity degree of each case j from the set K is determined by means of formula (2) and is denoted by s^j:

$$s^j = S(D^j, \tilde{D}) \text{ for each } j \in \{1,\ldots,k\}. \qquad (4)$$

Having the sequence of s^j, describing the similarities of the historical situations with the current situation, we can estimate the value of conflict resolution style variable for the current situation using the concept of Gilboa and Schmeidler (1995) case-based reasoning. According to the Gilboa and Schmeidler ideas the estimation of the bargaining style feature will be computed using the following formula:

$$\tilde{c}_m = \frac{\sum_{j=1}^{k} c_m^j s^j}{\sum_{j=1}^{k} s^j}. \qquad (5)$$

In the formula (5) the estimation of a feature is computed as the weighted sum of this feature in historical situations. The more similar the historical situation is to the current situation the higher the contribution of the feature taken from historical situation.

Let us assume, for example, that for the new negotiator we have extracted from the case base three the most similar cases with similarity degrees as follows:

$$s^1 = 0.95 \quad s^2 = 0.85 \quad s^3 = 0.7$$

Furthermore, let us assume that the bargaining style descriptions for these cases are as follows:

$$(c_1^1, c_2^1, c_3^1, c_4^1, c_5^1) = (5,8,3,10,4),$$
$$(c_1^2, c_2^2, c_3^2, c_4^2, c_5^2) = (8,3,4,11,5),$$
$$(c_1^3, c_2^3, c_3^3, c_4^3, c_5^3) = (2,5,10,7,3).$$

We use formula (5) to estimate the style's features of the new negotiator. For instance, the estimation of the competing feature (the first of five bargaining style feature) is the following:

$$\tilde{c}_1 = \frac{\sum_{j=1}^{3} c_1^j s^j}{\sum_{j=1}^{3} s^j} = \frac{5 \times 0.95 + 8 \times 0.85 + 2 \times 0.7}{2.5} = 5.18 .$$

As we can see in the above formula the first feature levels (5, 8 and 2) are simply aggregated with weights corresponding to the similarity degrees of the current situation and the three historical situations. The levels of the rest of the bargaining style features are determined similarly.

The only problem that needs to be solved to used the case-based reasoning proposed above is to find the weights describing the levels of similarity, required for formula (2). In the next section we will present how these weights may be derived from the case base using simple statistical tool – a correspondence analysis.

6 CALCULATING THE LEVELS OF IMPORTANCE OF THE DEMOGRAPHIC VARIABLES

In order to determine the levels of importance of particular demographic variables we perform a correspondence analysis (see Hill, 1974; Benzecri, 1992). Correspondence analysis is a variant of principal component analysis aimed primarily at categorical data. The method allows analyzing the data table (a contingency table) and leads to a kind of visualization of the rows and columns of this table in the form of a map. Then it allows interpreting these distances and relative positions of the points from the map. The analysis that usually precede the three-step correspondence analysis algorithm is the chi-square test that allows to verify what is the relation (association) between the variables that comprise the table, if any. In our approach, by using the correspondence analysis we will measure the level of association of a demographic variable with the bargaining style and treat this measure as a level of importance of the demographic variable. In other words, the higher the association degree of the demographic variable with the conflict resolution style the more important the demographic variable is. From the given case base we will compute the association degree using the Yule's phi-coefficient (Φ) that derives from the chi-squared test. The computation procedures is as follows.

In order to determine the Φ value we start with the computation of contingency table as shown in Table 4.

Table 4: The contingency table.

Categories of variable X	Categories of variable Y				Sum of rows
	Y_1	Y_2	...	Y_J	
X_1	n_{11}	n_{12}	...	n_{1J}	$n_{1.}$
X_2	n_{21}	n_{22}	...	n_{2J}	$n_{2.}$
...	...	...	...	...	...
X_H	n_{H1}	n_{H2}	...	n_{HJ}	$n_{H.}$
Sum of columns	$n_{.1}$	$n_{.2}$	...	$n_{.J}$	n

In our particular application context the variable X corresponds to one demographic variable (age, for instance) and the variable Y corresponds to one of the variables defining the bargaining style (for instance the competing feature). The values n_{ij} correspond to the frequencies of occurrence of cases derived from the database, falling into the ith category of the first variable and jth category of the second variable. While comparing the variable age (X) with the competing feature (Y) we need to analyze the 6 by 12 matrix, since there are 6 predefined categories of age recorder by Inspire system and there is 12 possible levels of each bargaining feature defined by TKI. Similar matrices we build for each combination of the demographic characteristic and the bargaining style feature.

Based on each contingency table we compute the value of chi-square metric:

$$\chi^2 = \sum_{h=1}^{H} \sum_{j=1}^{J} \frac{(n_{hj} - \hat{n}_{hj})^2}{\hat{n}_{hj}}, \qquad (6)$$

where n_{hj} and $\hat{n}_{hj}$ are the empirical and theoretical frequencies of the contingency table, respectively. The theoretical frequencies $\hat{n}_{hj}$ are determined from the following formula:

$$\hat{n}_{hj} = \frac{n_{h.} n_{.j}}{n}. \quad (7)$$

The chi-square metric will be used now for determining the strength of relationship between the analyzed variables. One of such a measures is Yule's phi-coefficient (there are also other similar measures, such as the Pearson's Contingency Coefficient, T-Czuprow's convergence coefficient or V-Cramer's coefficient) computed as follows:

$$\Phi = \sqrt{\frac{\chi^2}{n}}. \quad (8)$$

As mentioned before we will treat the value of Φ coefficient as a level of importance of the demographic variable in the case-based reasoning approach. For our particular Inspire's case base we obtain the values of phi-coefficients for pairs of demographic variables and conflict bargaining variables as shown in Table 5.

The last column of Table 5 is an average of the Yule's phi-coefficients for bargaining style variables (it is normalized as well). As a result of this computation we obtain levels of importance (w_i) of the demographic variables that may be used now to initiate the weights in the formula (2) and conduct the case-based reasoning for identification of the negotiation profile of any new negotiator that wants to use the negotiation support system like the NegoManage one.

7 EXPERIMENTAL EVALUATION

To evaluate the proposed approach we split the case base into two parts. Our case base consists of 228 cases. The first part of the case base is the basis for the reasoning process. The second part of the case base consists of 25 cases. We use the second part of the case base for testing the reasoning mechanism.

For each of the 25 cases in the second part of the case base we estimate the conflict resolution style description and compare it with the actual conflict resolution style description. The comparison is done by computing the distance between two vectors of five conflict resolution style variables. As said before the first vector describes the actual conflict resolution style given in the testing part of the case base, and the second vector describes the predicted conflict resolution style. We perform the reasoning on the level of similarity equal to 0.75. Table 6 shows the results of the reasoning.

As we can see in Table 2 the distances between the actual and predicted outcomes are lower than the max and min outcomes what indicates on good performance of the CBR prediction mechanism. The empty rows indicate that in the case base there was no case that would be similar enough (on the level of 0.75) to the current situation.

8 CONCLUSIONS

In this paper we proposed a novel approach for

Table 5: The Phi coefficients for different pairs of demographic variables and conflict resolution style variables.

	Competing	Collaborating	Compromising	Accomodating	Avoiding	Average	Normilized (w_i)
age	0.46	0.49	0.39	0.4	0.49	0.45	0.07
gender	0.22	0.15	0.23	0.23	0.17	0.2	0.03
c_reside	1.05	1.12	1.23	0.94	1	1.07	0.17
l_reside	0.54	0.44	0.5	0.42	0.33	0.45	0.07
c_born	1.4	1.7	1.31	1.27	1.22	1.38	0.23
english	0.5	0.52	0.48	0.51	0.53	0.51	0.08
course	0.35	0.45	0.34	0.28	0.29	0.34	0.06
ed_level	0.22	0.24	0.27	0.22	0.24	0.24	0.04
NSS	0.19	0.24	0.15	0.24	0.17	0.2	0.03
knowledge	0.5	0.44	0.48	0.46	0.47	0.47	0.08
p_before	0.18	0.25	0.14	0.14	0.21	0.18	0.03
ed_field	0.71	0.67	0.6	0.62	0.62	0.64	0.1

identifying the negotiation profile, i.e. the bargaining style of a negotiator. Instead of eliciting such a profile by means of a psychometric test, like it is usually done in many negotiation situations, in our approach we decided to use the historical information about negotiation processes stored in the INSPIRE system case base and, based on the results of some research on the behavioural aspects of negotiations, to derive the bargaining profile of the negotiator from the analysis of their personal characteristics. The case base we operated with contained the knowledge about the demographic characteristics of a negotiator and its conflict resolution style determined by means of TKI. Then, based on the postulate that similar demographics of the player yields similar conflict resolution style (which is the fundamental to the case base reasoning approach) we derive the estimation of a conflict resolution style (a profile) of a new negotiator. To support our case-based mechanism with all the data required we have also implemented the elements of the correspondence analysis, that allows finding the links between the analyzed variables that are described by means of the weak scales (in our experiment some of the personal features had been described by means of ordinal- or nominal-scale variables).

We believe the approach we proposed is more user-friendly to the negotiator than the classic TKI test (or the similar ones), since it does not enforce them to fill the tiresome and difficult psychometric questionnaires, but - what we are aware of - it needs to be verified and tested on the significantly big sample of the negotiators. The future work will

Table 6: Experimental evaluation of the CBR mechanism.

Case	Actual conflict resolution style					Predicted resolution style					Comparison		
	Competing	Collaborating	Compromising	Avoiding	Accomodating	Competing	Collaborating	Compromising	Avoiding	Accomodating	distance	maximal	minimal
1	9	5	8	3	3	6	5	9	5	4	0.1166	0.4333	0.4
2	9	5	8	2	4								
3	3	4	12	3	5	4	4	9	5	4	0.1666	0.4333	0.4
4	2	3	8	9	8	6	5	9	5	4	0.25	0.45	0.3166
5	5	4	12	2	5	5	5	9	5	4	0.1333	0.4333	0.4
6	6	7	6	7	4	8	4	9	3	3	0.2166	0.4166	0.25
7	10	5	9	3	3	4	5	10	4	5	0.1666	0.4166	0.25
8	2	8	8	3	9	5	5	7	6	7	0.2	0.4166	0.25
9	1	4	8	5	10	5	5	8	5	6	0.15	0.4	0.3
10	6	6	10	4	2	5	5	8	6	5	0.15	0.4166	0.4
11	1	3	8	9	7	5	5	8	6	5	0.1833	0.4	0.35
12	12	6	6	2	2	6	4	8	6	4	0.2833	0.3833	0.3333
13	6	2	8	7	5	6	5	8	6	4	0.0833	0.4	0.3333
14	11	4	10	2	1	8	6	7	4	4	0.2166	0.3833	0.2333
15	6	4	8	5	7	5	5	8	6	5	0.8333	0.4166	0.3166
16	11	5	7	2	3	5	5	9	5	5	0.2166	0.4333	0.3833
17	3	3	11	8	3	6	5	9	5	4	0.1833	0.4333	0.4
18	8	8	7	1	4	5	4	7	6	6	0.2333	0.3888	0.3666
19	2	6	8	5	7	5	5	8	6	5	0.1166	0.4	0.3666
20	5	3	9	3	8	5	5	8	6	5	0.15	0.4	0.3833
21	7	2	10	5	4	6	5	9	5	4	0.0833	0.4333	0.4
22	3	6	7	6	8	4	7	7	7	5	0.1	0.4166	0.1
23	7	3	12	4	2								
24	12	5	5	5	3								
25	2	7	9	3	7	7	6	9	4	2	0.2	0.3833	0.25

focus then on the implementing our approach in the NegoManage web-based core simultaneously with the electronic TK test, which will allow to verify whether the profiling mechanism that we built based on the estimates from the case-based reasoning and the correspondence analysis, is reliable enough and may be used for eliciting the true negotiation profile (i.e. the profile that is concordant with the results of the TKI) of the new electronic negotiation system user. After implementing our approach we also plan to verify the results on the alternative psychological research on negotiation (see Elfenbain et al., 2008), which may modify the way we define the situation in our case-based approach. It may appear that some other psychological characteristic may (or should) also be included in our analysis (such as the attitude towards the problem, partner and process) that would lead to the better estimation of the negotiator's profile.

Finally, we are aware of other alternative methods that may be used in negotiators' profiling, that base on the classical statistical clustering/classification approaches or apply AI solutions like neural networks, and which we rejected in our preliminary selection since they usually requires metric data. Thus our future work will also focus on analyzing the possible extensions and modifications of these rejected methods that could be used alternatively to our method and then on comparing the clustering results they would lead to with the results of our model.

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