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PREDGOVOR MULTIKONFERENCI INFORMACIJSKA DRUŽBA 2006

V svojem devetem letu ostaja multikonferenca Informacijska družba 2006 (http://is.ijs.si) ena vodilnih srednjeevropskih konferenc, ki združuje znanstvenike z različnih raziskovalnih področij povezanih z informacijsko družbo. V letu 2006 smo v multikonferenco povezali osem neodvisnih konferenc. Informacijska družba postaja vedno bolj zapleten socialni, ekonomski in tehnološki sistem, ki je pritegnil pozornost vrste specializiranih konferenc v Sloveniji in Evropi. Naša multikonferenca izstopa po širini in obsegu tem, ki jih obravnava.

Rdeča nit multikonference ostaja sinergija interdisciplinarnih pristopov, ki obravnavajo različne vidike informacijske družbe ter poglabljajo razumevanje informacijskih in komunikacijskih storitev v najširšem pomenu besede. Na multikonferenci predstavljamo, analiziramo in preverjamo nova odkritja in pripravljamo teren za njihovo praktično uporabo, saj je njen osnovni namen promocija raziskovalnih dosežkov in spodbujanje njihovega prenosa v prakso na različnih področjih informacijske družbe tako v Sloveniji kot tujini.

Na multikonferenci, ki bo trajala šest dni, bo na vzporednih konferencah predstavljenih preko 200 referatov, vključevala pa bo tudi okrogle mize in razprave. Referati so objavljeni v zbornikih multikonference, izbrani prispevki pa bodo izšli tudi v dveh posebnih številkah znanstvenih revij, od katerih je ena Informatica, ki se ponaša s 30-letno tradicijo odlične znanstvene revijei. Multikonferenco Informacijska družba 2006 sestavljajo naslednje samostojne konference:

- BIOMA 2006 – Bioinspired Optimization Methods and their Applications
- Mejne kognitivne znanosti
- Kognitivne znanosti
- Sodelovanje in informacijska družba
- Rudarjenje podatkov in podatkovna skladišča
- Vzgoja v informacijski družbi
- Inteligentni sistemi
- Jezikovne tehnologije.

Soorganizatorji in podporniki konference so različne raziskovalne institucije in združenja, med njimi tudi ACM Slovenija. Zahvaljujemo se tudi Ministrstvu za visoko šolstvo, znanost in tehnologijo za njihovo sodelovanje in podporo. V imenu organizatorjev konference pa se želimo posebej zahvaliti udeležencem za njihove dragocene prispevke in priložnost, da z nami delijo svoje izkušnje o informacijski družbi. Zahvaljujemo se tudi recenzentom za njihovo pomoč pri recenziranju.

V letu 2006 sta se programski in organizacijski odbor odločila, da bosta podelila posebno priznanje Slovencu ali Slovenki za izjemen prispevek k razvoju in promociji informacijske družbe v našem okolju. Z večino glasov je letošnje priznanje pripadlo prof. dr. Cenetu Bavcu. Čestitamo!

Viljan Mahnič, predsednik programskega odbora
Matjaž Gams, predsednik organizacijskega odbora

FOREWORD - INFORMATION SOCIETY 2006

In its 9th year, the Information Society Multiconference (http://is.ijs.si) continues as one of the leading conferences in Central Europe gathering scientific community with a wide range of research interest in information society. In 2006, we organized eight independent conferences forming the multiconference. Information society displays a complex interplay of social, economic, and technological issues that attract attention of many scientific events around Europe. The broad range of topics makes our event unique among similar conferences.

The motto of the Multiconference is synergy of different interdisciplinary approaches dealing with the challenges of information society. The major driving forces of the Multiconference are search and demand for new knowledge related to information, communication, and computer services. We present, analyze, and verify new discoveries in order to prepare the ground for their enrichment and development in practice. The main objective of the Multiconference is presentation and promotion of research results, to encourage their practical application in new ICT products and information services in Slovenia and also broader region.

The Multiconference is running in parallel sessions for six days with over 200 presentations of scientific papers. The papers are published in the conference proceedings, and in two special journal issues. One of them is Informatica with its 30 years of tradition in excellent research publications.

The Information Society 2006 Multi-Conference consists of the following conferences:

- BIOMA 2006 - Bioinspired Optimization Methods and their Applications
- Borderline Cognitive Sciences
- Cognitive Sciences
- Collaboration and Information Society
- Data Mining and Data Warehouses
- Education in Information Society
- Intelligent Systems
- Language Technologies.

The Conference is co-organized and supported by several major research institutions and societies, among them ACM Slovenia, i.e. the Slovenian chapter of ACM. We would like to express our appreciation to the Slovenian Government for cooperation and support, in particular through the Ministry of Higher Education, Science and Technology.

At the end we would like to bring your attention to a special event. In 2006, the Programme and Organizing Committees decided to award one Slovenian for his/her outstanding contribution to development and promotion of information society in our country. With the majority of votes, this honor went to Prof. Dr. Cene Bavec. Congratulations!

On behalf of the conference organizers we would like to thank all participants for their valuable contribution and their interest in this event, and particularly the reviewers for their thorough reviews.

Viljan Mahnič, President of the Programme Committee
Matjaž Gams, President of the Organizing Committee

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AGENT BASED PRESENTATION OF AFFECTIVE USER PROFILES

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ABSTRACT

This paper presents an agent based framework for delivering information about affective user profiles. The agent model is based on fuzzy decision-making techniques with the utility function defined over the affective profile attributes, personality traits and the social context. Subject-agent and psychiatrist-agent forms of interaction are covered by varying the utility function.

1 INTRODUCTION

The interest in emotions as elements of agent architectures has grown dramatically in the past 10 years. The initiators of this interest are several works that explicitly emphasize the importance of emotions [1, 2]. The conferences organized by Cañamero, the simulation of adaptive behavior conference SAB'98 [3] and AAAI'98 conference [4] have significant influence on recognizing the potential of emotions for creating intelligent systems.

Nowadays, animated agents that recognize and express emotions, provided with a personality and a social competence, and with verbal and nonverbal abilities represent a new approach to creating natural and efficient interfaces. Several projects describe embodied conversational agents, like REA [5], DFKI Persona [6] and pedagogical agents of Lester and his colleagues [7, 8].

Important aspect to enhance the believability of animated agents is a social role awareness that determines the behavioral reactions according to the social context. For example, when interacting with the patient the agent psychiatrist has to behave according to the norms and standards appropriate for the situation. The behavior is different when presenting a diagnosis to a psychiatrist or psychologist. In a particular social setting the social distance between the participants and the power that an agent role has over other roles determine the appropriate behavioral and communicative conventions.

Several agent architectures are based on the decision theory [9, 10]. Since the description of user affective state involves imprecision in this work a fuzzy decision-making paradigm is proposed to deal with this uncertainty.

This work describes the design of an intelligent agent whose behavior is determined with the utility function defined over the affective profile attributes, personality traits and the social context.. The main task of the agent is to interpret the affective profiles created with the user-modeling component. Agent presentations are formulated as informative paragraphs and are taken from the predefined knowledge base.

Next section describes the user-modeling component. Then the conceptual model of the agent for delivering information about the profiles is presented. This approach is illustrated by an example that shows the principles of fuzzy decision-making paradigm used to formalize the agent behavior. The paper ends with a brief discussion and conclusions.

2 CREATING AFFECTIVE USER PROFILE

The affective profile is built according to the standard test in psychiatry and clinical psychology Emotions Profile Index. This instrument uses the idea that personality traits are mixtures of two or more primary emotions [11]. For example, personality trait cautious includes expectancy and fear as two main emotional components, and affectionate includes acceptance and joy. EPI assesses the user affective state based on a partial ordering scheme of personality traits: adventurous, affectionate, brooding, cautious, gloomy, impulsive, obedient, quarrelsome, resentful, self-conscious, shy, and sociable.

The emotional dispositions, such as fear, anger, joy, sadness, acceptance, disgust, expectancy and surprise, represent the user affective state. One type of a user profile is shown in Figure 1.

2.1 Rule-Based Refinement of the User Profile

EPI is used for initialization of the user affective profile. The user model might be modified using fuzzy rules [12].

Emotional state is described with linguistic labels for the fuzzy variables <R,I,N,S,D,O,E,A> denoting emotional categories reproduction, incorporation, orientation, protection, deprivation, rejection, exploration and destruction, respectively.

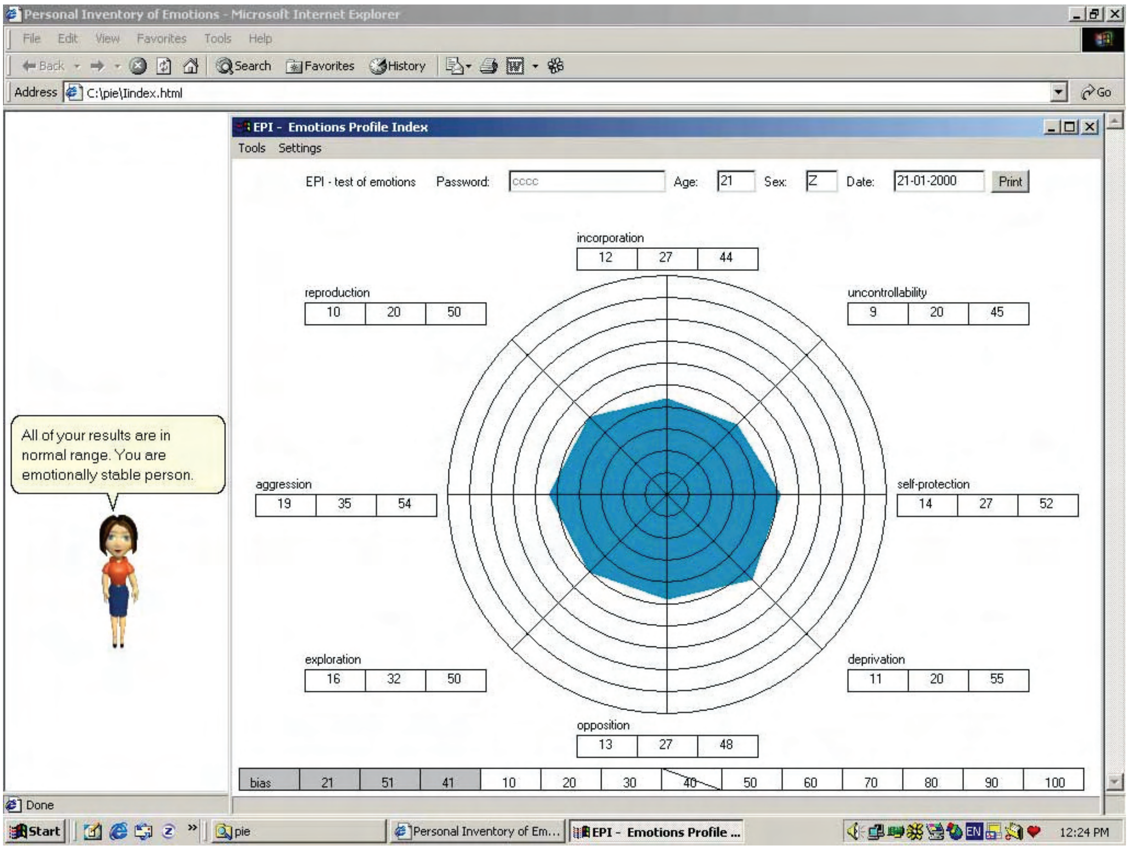

Figure 1: *Representation of affective user profile*

Fuzzy rules with the following general pattern are used for updating of the profile:

if x_1 is A_1 and ... and x_n is A_n or ... then y is B,

where A_i and B are linguistic variables from the universes of discourse U and V respectively, x_i is an instance in the universe U corresponding to membership value $\mu_{Ai}(x_i)$, y is an instance in V with membership value $\mu_B(y)$.
Condition part of the rule might, for example, include events from the application where EPI is used for the assessment of the user emotional state. Action part might specify new values for the attributes in the user model or might activate other rules.
The process of fuzzy inference is formalized with fuzzy automaton:

$$FA=(I,S,O,f,\lambda),$$

where I is a set of input linguistic variables, S is a set of automaton internal states and O is a set of output linguistic variables.
Transition function f is defined as f: SxIxS $\rightarrow$ {0,1} and output function λ as λ: SxIxO $\rightarrow$ {0,1}, where $f(s_i,i_p,s_j)=1$ if there is link from state s_i to s_j, and $f(s_i,i_p,s_j)=0$ in other cases, and $\lambda(s_i,i_p,o_p)=1$ if o_p is the output at state s_i when input is i_p and $\lambda(s_i,i_p,o_p)=0$ otherwise.

The fuzzy automaton has to be deterministic. That is, for a given input and current state there is only one next state and output. So, some constraints are imposed: function f has value 1 for exactly one next state s_j being in state s_i when the input is i_p and λ has value 1 for only one output o_k being in state s_i when the input is i_p.
To obtain next states the automaton computes max-min operations from the current state and inputs.
Let current input x has membership values

$$I=[\mu_{i1}(x),\dots,\mu_{ip}(x)],$$

for every input linguistic variable i_k and S is the current state of the automaton distributed over several states, where the degree of activation of the states is defined with value in the interval [0,1].
The next state S' is computed as fuzzy composition

$$S'=S\circ\max[\min(\mu_{i1}(x),f(s_i,i_1,s_j)),..,\min(\mu_{ip}(x),f(s_i,i_p,s_j)).$$

User affective profile might be modified to include evidence from psychiatrists. The experts might add a rule that is inconsistent with the rest of the rules. Analyzing the process of fuzzy inference using fuzzy automaton may help in detecting undesirable and ambiguous situations.

3 FORMAL MODEL OF THE AGENT

In what follows the formal model of the agent fuzzy decision-making process is represented together with the transformations of the decision-making situation under the influence of the social roles and agent personality traits. The role of the agent is associated with certain goals and behaviors to model social competence.

Let the set of feasible alternatives or actions that the agent is able to perform in state $X_i \in X$ is $S = \{S_1,...., S_n\}$.

The state X_i is the decision context. Agent actions in this model are actually conversational acts.

In general case S represents the subset of the space R^p, or with other words an alternative might be defined with p attributes.

The agent goals and motives are formalized as decision criteria. The motives determine priority of the goals. The set of agent goals and motives is

$$C = \{C_1,...., C_k\}.$$

The criteria are defined as functions

$$C_j : R^p \to R,$$

where j=1,...,k.

The image of S in R^k is the set of feasible solutions for the multi-criteria problem of selecting an alternative

$$B_S = \{B_i \in R^k \mid b_{ij} = C_j(S_i), j = 1,..,k,\ S_i \in S,\ i = 1,..,n\}.$$

Actually $B_i = \{b_{i1},..., b_{ik}\}$ are evaluations of the alternative S_i, i=1,...,n versus all the criteria.

Ordering the set of motives and goals is realized with the function that assigns weights to the criteria in different decision-making situations

$$W : X \to [0,1]^k$$

where $W(X_i) = (w_1,..., w_k),\ X_i \in X,\ i = 1,..., n$ denotes the importance of the motive or the goal j=1,...,k for the agent in a particular situation.

Using the defined terms the agent utility function for the alternative $S_i = \{s_{i1},..., s_{ik}\}$ is given with the following formula

$$U(S_i) = f(g(w_1, s_{i1}),..., g(w_k, s_{ik})),\quad i = 1,..., n$$

where $g : R\ X\ R \to R$ is a function that transforms the evaluations of the alternatives with the criteria weights, and $f : R^k \to R$ is an aggregation operator that gives the unit score of appropriateness of the alternative versus all the criteria. For example, f might be the minimum operator and g maximum t-conorm

$$g(w_j, s_{ij}) = \max\{1 - w_j, s_{ij}\},\quad i = 1,..., n,\quad j = 1,..., k.$$

In the cases where the type of aggregation is neither pure "anding" denoting complete lack of compensation nor pure "oring" denoting complete submission to any good satisfaction, OWA operators [13] might be used. OWA aggregation operators act like quantifiers, providing ways to represent aggregation where "many", "most", "few", etc. criteria are satisfied by the alternative.

The agent selects actions that maximize its performance measure and in that sense performs utility-directed action selection

$$U(S^*) = \max_i (U(S_i)),\quad i = 1,..., n.$$

Agent actions feasible in situation X_i are subset of the set Δ^* that we call the set of behavior conventions $S \subseteq \Delta^*$, where Δ is the set of all elementary actions in any situation of X, Δ^* is a set of all sequences that can be formed from the elementary actions of set Δ.

The decision-making situation is represented with the following quadruple

$$V=(X_i, S, C, U)$$

where X_i is the state or decision context, S is the set of actions feasible in particular situation or appropriate conversational acts, C are agent goals and motives that serve as decision criteria and U is the utility function.

Under the influence of the social roles the decision-making situation is transformed in

$$(X_i, S, C, U').$$

The impact of the social roles is implemented through the change of the criteria weights. The transformed utility function is

$$U'(S_i) = f(g(w_1', s_{i1}),..., g(w_k', s_{ik})),\quad i = 1,..., n.$$

Agent personality traits, as relatively stable characteristics are included in the set of decision criteria. In that sense personality traits influence the selection of the alternative and determine the linguistic style for expressing information.

4 AN EXAMPLE

To exhibit social competence, an agent ought to possess the ability to select adequate behaviors. The process of selection depends on the evaluation of the situation and on the desirability of the possible outcomes.

Two characters are defined to cover the subject-agent and psychiatrist-agent forms of interaction. First agent will assign higher importance to expressions of empathy and giving advice to subjects and the second will value more the actions offering detailed explanations of the results about the mental health of the user.

Let the affective profile under consideration belongs to a person with certain pathological manifestations and let the following alternatives from the knowledge base are activated:

- S1: This is a cautious and anxious person. The results show that this person is constantly worried of getting into troubles that she could not be able to overcome. Also this person is worried about what other people think or speak about her.
- S2: There is a possibility for phobic and obsessive-compulsive behavior.
- S3: It looks that you have some problems. Is that right? You have to visit a psychiatrist.
- S4: For further analyses you have to consult a psychiatrist. Your results show anxiety and some other pathological problems.

The agent that presents information to subjects will display the alternative S3. The alternative S4 is less suitable because of the low performance on some of the criteria. The explanation that alternative S4 offers might have negative impact on the subject.

The agent that covers psychiatrist-agent form of interaction will present detailed information about the pathological problems of the subject. This agent will display alternatives S1 and S2.

5 CONCLUSION

This work describes a human-computer interface with agents that deliver information about the affective profiles.

Agents are able to adapt their behavior by changing parameters related to the social roles, personality traits, emotions and linguistic styles. The formal model of the agent includes transformation of the decision-making situation according to the agent goals and under the affective influence.

A framework for affective user modeling is presented based on the assessment of the user emotional state. User emotional state is obtained from the partial-ordering scheme of personality traits.

The social role of an agent is associated with certain responsibilities, duties, rights and behavioral constraints, and contributes to achieving convincing behavior and to the believability of the agents.

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