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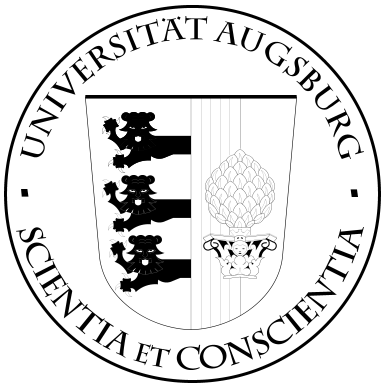

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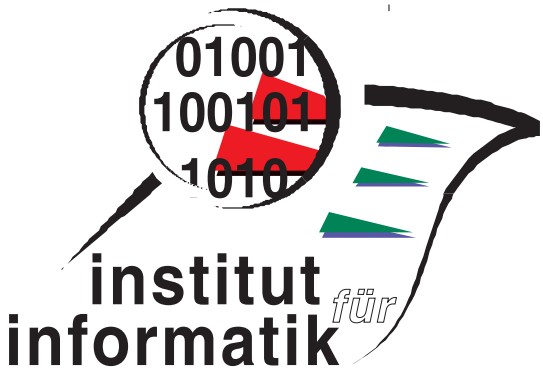

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Experiences with an Emotional Sales Agent

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Abstract. With COSIMA^{B2B} we demonstrate a prototype of a complex and visionary e-procurement application. The embodied character agent named COSIMA is able to respect a customer's preferences and deals with him or her via natural speech. She expresses various emotions via mimic, gesture, combined with speech output, and COSIMA is even able to consider the customer's emotions via mimic recognition. As first observations show, this is a very promising approach to improve the bargaining with the customer or the recommendation of products.

1 Introduction

Intelligent computers, which understand the user, seem like a pie in the sky. In order to understand the user we need intuitive user interfaces and the intelligent technology behind, which is able to act in a situated and personalized way.

The complex and visionary e-procurement application COSIMA^{B2B} is the result of an interdisciplinary effort between research of emotion detection via mimic and intelligent databases under additional usage of technology from the fields of natural language communication and embodied character agents. In cooperation with three industrial partners (seller-side: SSI Schäfer[1]; buyer-side: MAN Roland Druckmaschinen AG[2]; content provider: Fachverlag Walch[3]) we modeled a realistic use case scenario which takes the involved emotions into consideration. Equipped with real product data, based on the IT-product standards BMEcat and eCl@ss[4], our emotional sales agent COSIMA was exhibited at the computer fair *Systems 2003*[5] in Munich. There we shot a video of each visitor for a sociological analysis and meanwhile we are able, besides to demonstrate COSIMA^{B2B}, to give experiences about the user acceptance of a computer system with emotional activity in a real world application.

[1] www.ssi-schaefer.com
[2] www.man-roland.com
[3] www.walch.de
[4] www.bmecat.org and www.eclass.de
[5] www.systems-world.com

2 COSIMA^{B2B} – an Emotional Sales Agent for E-Procurement

COSIMA^{B2B} is a prototype of an emotional sales agent named COSIMA which is able to automate a cost intensive e-procurement process. We will give a short tour excerpt of the functionality of the prototype and will briefly describe the involved technologies.

COSIMA welcomes a customer by name and helps him or her when putting together a shopping cart of desired products by respecting the customer's explicit search preferences and also the customer's long-term search preferences. We intuitively model preferences in an "I like A better than B" semantics as strict partial orders ([5]), which have been proven to be a very suitable basis for efficient usage of preferences within database search engines in various e-business applications ([6]).

Depending on the content of the shopping cart and the role of the customer, COSIMA grants personalized discounts and bargains about the price. Thereby, techniques like up/down and cross selling are used. A first prototype using our preference based multi-objective bargaining component was published at the AAMAS 2002 ([3]). Meanwhile, our preference based bargaining component was enhanced, embedded in our e-procurement scenario and combined with emotion recognition via mimic. As described in [1] using emotions is a promising way for an improved human-computer interaction. Illustrated in **Fig. 1** COSIMA takes the customer's emotion into account during the bargaining process and is therefore able to react to his or her emotions.

Fig. 1. The customer is smiling at the end of a successful bargaining

Of course COSIMA can be pleased by the customer's reaction, but otherwise can also become very angry when her opponent tries to cheat her. COSIMA shows her emotions via various mimics and gestures in combination with dynamic speech synthesis output like "You make me angry when you are so stingy!". At the end of the dialog, COSIMA waves good bye to the customer and thanks the customer for the purchase or for the interest in her offers.

We modeled the recognized customer emotions by means of Ekman's six major emotions ([2]). This model was enhanced by the two conditions "neutral" and "turning away" (**Fig. 2**), while the latter implies that the customer is disinterested or distracted. Most commonly used approaches for visually detecting emotions are data driven and do not incorporate any model of the extracted information at all. That does

not result in high robustness regarding the tracking of the customer's head and has no value for similar issues that could make use of the head's pose and deformation. Other approaches additionally incorporate the facial texture and 3D information, which improves the tracking quality but looses real time capability.

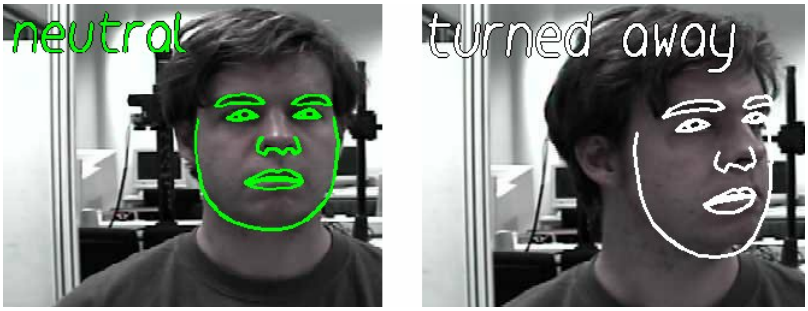

Fig. 2. Detected customer mimics "neutral" and "turned away"

Making use of a point distribution model we created a face outline model with high performance. Its tracking is based on multiple, redundant techniques. Since each of them embodies special strengths with respect to certain challenges our approach turns out to be very robust, e.g. to different persons, various backgrounds, and to background motion. Using optical flow, based on Open CV[6], our system can cope with fast head movements, whereas our novel approach of intensity profiles helps us to extract human face contours with high accuracy.

Furthermore, our system autonomously detects persons and starts tracking their heads without any human intervention. We achieve high accuracy using a boosted cascade of haar-like features[6]. Having tracked a human face successfully, our system is able to extract the parameters describing the facial deformation. By using those parameters a previously learned classifier detects the current mimic.

The communication between the mimic recognition and the J2EE based e-procurement application is managed via an agent based FIPA-OS platform. The source code meanwhile counts more than 100.000 lines.

3 Experiences, Summary and Outlook

Here, we focus on our experiences with the newly integrated mimic recognition component. For experiences with a speaking embodied character agent see our work [3].

When COSIMA recognized e.g. a laughing face of a customer she told him or her "You seem to be laughing". Most customers were surprised and wanted to know how COSIMA could know. They liked this feature and told us, that COSIMA seems to be interactive - it should be mentioned that some people did not like the idea of being observed by a computer. The main problem of the mimic recognition was that COSIMA did not always utter her comments within the context of conversation. The

[6] www.intel.com/research/mrl/research/opencv

agent sometimes told the customers that they were laughing, although they were not. In general, customers ignored the unfitting comments of mimic recognition technology. This might be due to the fact that COSIMA was considered a prototype system - as some customers explained later. But when the agent repeated the sentence several times most customers reacted annoyed, e.g. one person declared angrily "I am NOT laughing". This example points out that mimic recognition is highly sensitive to the context of conversation for human interaction ([4]). So, how to place mimic recognition within the communication with emotional embodied agents should be carefully considered. On the one hand the mimic recognition of an agent arouses high expectations on the side of the customer, who thinks the agent is more interactive and seems to follow a strategy. On the other hand the realization that the mimic recognition makes no sense within the situation may cause disappointment or negative feelings.

Summarized, for our novel interplay of e-procurement, personalization, and human-computer interaction technology we received lots of encouragement and also incentive for further improvements and enlargements. Thus, we intend to plug in and consider emotion recognition via speech input and also an emotional speech synthesis. We are already working on gesture recognition. A more powerful situation model will also be necessary in order to handle such complex processes adequately.

With the appropriate hardware, e.g. screens equipped with cameras and microphones, such interplay in business applications is not only a vision and could be very helpful for both parties, here e.g. the seller and the sales prospect.

Acknowledgments

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