The European Future Technologies Conference and Exhibition 2011

CYBEREMOTIONS – Collective Emotions in Cyberspace

Junghyun Ahn [f], Anna Borowiec [i], Kevan Buckley [e], Di Cai [e], Anna Chmiel [a], Agnieszka Czaplicka [a], Grzegorz Dąbrowski [i], Antonios Garas [d], David Garcia [d], Stéphane Gobron [f], Robert Hillmann [b], Janusz Hołyst [a,*], Arvid Kappas [c], Dennis Küster [c], Marija Mitrovic [h], Georgios Paltoglou [e], Hannes Pirker [g], Stefan Rank [g], Frank Schweitzer [d], Julian Sienkiewicz [a], Marcin Skowron [g], Paweł Sobkowicz [a], Daniel Thalmann [f], Mike Thelwall [e], Mathias Theunis [c], Matthias Trier [b], Elena Tsankova [c], Paweł Weronski [a]

[a] *Warsaw University of Technology, Warsaw, Poland*
[b] *Technische Universitat Berlin, Berlin, Germany*
[c] *Jacobs University Bremen, Bremen, Germany*
[d] *ETH Zurich, Zurich, Switzerland*
[e] *University of Wolverhampton, Wolverhampton, UK*
[f] *Ecole Polytechnique Fédérale de Lausanne, Switzerland*
[g] *Austrian Research Institute for AI, Vienna, Austria*
[h] *Jozef Stefan Institute, Ljubljana, Slovenia*
[i] *Gemius SA, Warsaw, Poland*

Abstract

Emotions are an important part of most societal dynamics. As with face to face meetings, Internet exchanges may not only include factual information but may also elicit emotional responses; how participants feel about the subject discussed or other group members. The development of automatic sentiment analysis has made large scale emotion detection and analysis possible using text messages collected from the web. We present results of two years of studies performed in the EU Large Scale Integrating Project CYBEREMOTIONS (Collective emotions in cyberspace) Our goal is to understand the role of collective emotions in creating, forming and breaking-up ICT mediated communities and to prepare the background for the next generation of emotionally-intelligent ICT services. Project results have already attracted a lot of attention from various mass media and research journals including the *Science* and *New Scientist* magazines. Nine Project teams are organised in three layers (data, theory and ICT output).
© conference organizers and published by Elsevier B.V. Open access under CC BY-NC-ND license.
Selection and peer review under responsibility of FET11
Keywords: collective behaviour; complex systems; emotions

In the **data collection layer** large-scale corpora have been collected and analysed from a diverse set of online social communication networks and state-of-the-art sentiment detection algorithms developed. An analysis of top Twitter events in a month showed that even positive popular events normally generate increases in *negative* sentiment strength. We also collect live data on participants' responses to, and interactions with, emotionally charged Internet materials.

* Tel. +48-22-234-7133; fax +48-22-628-2171.
  E-mail address: jholyst@if.pw.edu.pl (J. Hołyst).

Our approach emphasizes a multi-level perspective on subjective and physiological (e.g., facial EMG, EKG, Skin Conductance) reactions while participants are reading, writing, or responding to emotional online discussions as they occur. On the other hand we use online qualitative research to place respondents in their natural environment, where they usually use the Internet, what makes them more receptive.

In the **theory layer** we show the collective character of affective phenomena in on-line media based on the analysis of the frequency of posts grouped into clusters with similar emotional valences. The results (i) prove that collective emotional states can be created and modulated via Internet communication, (ii) are used for simulating bot-human interactions in discussion forums. We also provide an agent-based model where agents represent Internet users with an emotional state composed of valence and arousal, which determine the expressions of the agent. These aggregate in a field which might receive external influences and under particular circumstances, this model has shown the emergence of transient collective emotional states, in which agents' emotions polarize and relax to a non-emotional state. In a parallel way we study the emergence of emotional behavior among Web users in Blogs and in dialogs in social networks, developing a methodology for quantitative analysis of user communities and their dynamic behaviors related to emotions expressed in the texts of comments.

In the **ICT output layer** we have elaborated two models and associated 3D software to visually simulate verbal and non-verbal communication between virtual humans. The resulting interpersonal micro virtual societies were tested by two user-tests: (i) at the individual level with avatar-to-agent relationships; (ii) at the social behavior level using multiple avatar relationships with eight simultaneous conversations in a single virtual world. Affect Listeners - artificial dialog systems applied for studying communication processes - are used to investigate the role of emotions in online, synchronous natural-language-based communication. Experiments demonstrated their capability to conduct dialogs as realistic and enjoyable for users and to establish an emotional connection. Users' ratings of the emotional connection to the system correlated with its affective profile (e.g. positive, negative, neutral). The theoretical foundation of the dynamic analysis of sentiment propagation in social networks is an event-based network data model, capable of accommodating direct as well as indirect interaction data of any kind, such as online fora or e-mail, together with attributes such as topics, sentiment strength, and time stamps. After the transformation and extraction of networks, the data is analyzed with focus on the sentiment dissemination, metrics of underlying sub-networks and the occurrence of dynamic effects.

Acknowledgements

Further reading

[1] Check the website http://www.cyberemotions.eu for the full list of papers.