

# Trust, Reputation and User Modeling

Julita Vassileva<sup>1</sup> and Jie Zhang<sup>2</sup>

<sup>1</sup> University of Saskatchewan, Canada

<sup>2</sup> Nanyang Technological University, Singapore  
jiv@cs.usask.ca, zhangj@ntu.edu.sg

**Keywords:** Trust and Reputation; Decentralized User Modeling; Subjectivity in Reputation Modeling; Stereotype-based Trust Modeling; User's Trust in Systems.

## 1 Introduction

The Trust, Reputation and User Modeling (TRUM) workshop (<http://madmuc.usask.ca/WS-TRUM/>) pursued the following objectives:

- To bring researchers together from the communities of trust and reputation modeling and user modeling;
- To initiate and facilitate discussions on the new trends in trust, reputation and user modeling, and to move the trends forward;
- To provide a forum for cutting-age research.

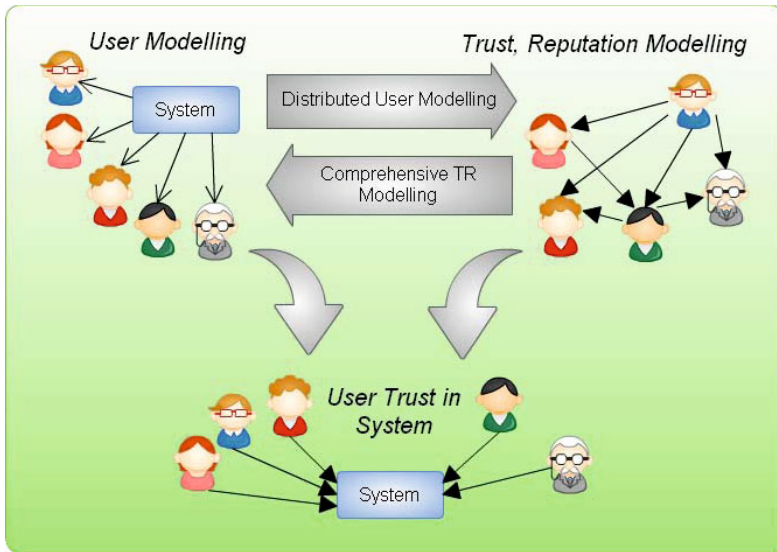
Eleven papers were submitted to the workshop. Each submitted paper was carefully reviewed by at least 3 committee members. Finally, seven papers were accepted, including four full papers (12 pages), 2 short papers (8 pages), and 1 poster paper (3 pages + a poster). These high quality papers provide thoughtful discussions on different issues of trust and reputation modeling. They also touch upon the different aspects of user modeling, reflecting the strong connections between trust / reputation modeling and user modeling. All seven accepted papers were invited the post-workshop proceedings and six of them were submitted.

## 2 Themes Represented

There are three ways in which the area of user modeling and the area of trust and reputation modeling overlap (Figure 1):

- User modeling approaches using ideas, approaches and techniques from the area of trust and reputation (this trend will be called for brevity “T&R in UM”),
- Trust and reputation management approaches, seeking depth of representation and using some methods and techniques from user modeling (called “UM in T&R”),
- User trust in adaptive systems and environments (called “User Trust”).

These main themes will be elaborated on further in the next sub-sections.



**Fig. 1.** Relationships between User Modeling and Trust & Reputation Modeling

## 2.1 T&R in UM

Decentralized and ubiquitous user modeling has sought inspiration from research in multi-agent systems over the last 6 years, resulting in a series of workshops at the UM conference in 2005, 2007 and UMAP 2009. The current trend towards software apps using the cloud to store and process information that can be downloaded on social networks and mobile devices platforms brings new importance to the area of decentralized user modeling. Frameworks for dynamic and purpose based sharing of user model fragments among apps needs to take into account the trust among these apps. The trust of one agent in another can be viewed as a simple user/agent model. Researchers in the area of trust and reputation mechanisms have studied for many years techniques allowing autonomous agents and peers to share, aggregate and make decisions based on these simple user models. User modeling researchers can gain useful insights from approaches for trust and reputation management. The paper “Recommending Services in a Trust-Based Decentralized User Modeling System” by *Sabrina Nusrat and Julita Vassileva* [1], for example, aims at finding appropriate service providers in communities of users. Trust values are used to differentiate among members of the community as well as to recommend a service provider. Although different users have different needs and expectations in different aspects of the service providers, traditional trust-based models do not use trust values on neighbours for judging different aspects of service providers. The paper proposes a multi-faceted trust model where each user has two sets of trust values: i) trust on different aspects of the quality of service providers, ii) trust on recommendations provided for these aspects.

Another workshop paper, “Decision Making and Recommendation Protocol Based on Trust for Multi-Agent Systems” by *Ondřej Malačka, Jan Samek, František Zbořil, and František Vítězslav Zbořil* [2], explores the use of trust management to select appropriate partners. The motivation of this work is not only to find the best possible entity for cooperation but also to propose a simple method meeting some design recommendations, such as context-dependency of trust, considering the source of trust recommendation, subjectivity of trust, selecting a newcomer with less probability than trustworthy entities and considering the risk associated with transactions. The authors propose a decision-making protocol based on multi-context. One of the parts of this proposal is a recommendation protocol, which is used for obtaining recommendations from third party agents and gathering information for building trust.

Two of the submissions indicate that there is probably an emerging sub-area of application of T&R techniques in UM, specifically in the context of social networks and virtual communities. Both of these papers apply approaches for group user modeling, based on recorded activities of users in the social network or community. The first paper, “Building Trust Communities Using Social Trust” by *Surya Nepal, Wanita Sherchan, Cecile Paris* [3], proposes a social trust model for social networks to allow users to interact safely in trusted communities. The authors define social trust as the firm belief in the competence of an entity to act as expected, such that this firm belief is not a fixed value associated with the entity, but rather it is subject to the entity’s behaviour and applies only within a specific context at any given time. The social trust model considers two important aspects of social life in an online community: popularity and engagement. Popularity trust captures the popularity of an individual member in the community. The engagement trust captures the involvement of an individual member in the community. The social trust of an individual member in the community is a linear combination of her popularity and engagement trust. The authors propose to use the social trust value to recommend friends, content and topics for conversations.

The second paper, “The Influence of Interaction Attributes on Trust in Virtual Communities” by *L. Zhang, C. P. Tan, S. Li, H. Fang, P. Rai, Y. Chen, R. Luthra, W. K. Ng, J. Zhang* [4], explores the theme of modelling trust in communities and social networks, proposing a new trust ranking based recommendation model for virtual communities, that does not require extensive subjective feedback, but relies only on objective interaction attributes from the community.

## 2.2 UM in T&R

The area of trust and reputation modeling has experienced rapid growth in the past seven years. Recently, two important trends have been emerging in this area. One is the computational modeling of agents' cognition, such as subjectivity and disposition, to achieve more accurate trust and reputation modeling. The paper “Handling Subjective User Feedback for Reputation Computation in Virtual Reality” by *Hui Fang, Murat Şensoy, Jie Zhang, and Nadia Magnenat Thalmann* [5] propose a novel approach to align subjectivity in user feedback for reputation computation in virtual marketplaces. Subjective user feedback, e.g. using terms such as “soft” that have different semantics for different buyers poses challenges in the evaluation of the feedback and updating of sellers’ reputation. The authors demonstrate how sensory

data in virtual reality can be exploited to handle subjectivity and describe how the aligned feedback can be used in seller reputation computation.

Another trend is modeling agents' trust using a stereotype approach to deal with the problem of lack of experience. Both of this trend and the previous (modeling agent cognition) seek inspiration and deploy techniques from the area of user modeling. The evidential success of these new trends inspires and encourages researchers in the trust community to make use of the rich literature in user modeling to develop more comprehensive trust and reputation modeling approaches. An example is the paper "Improving Access Control for Mobile Consumers of Services by use of Context & Trust within the Call-Stack" by *Min Luo and Ralph Deters* [6]. It focuses on improving the existing access control approach for service-oriented systems by applying to service providers the concept of device comfort, proposed by Marsh et al. [7]. Similarly to requiring devices to feel comfortable with the user actions, service providers are required to feel comfortable with requests sent to them. A set of trusted call-contexts, similar to stereotype models from User Modeling are proposed, enabling service-providers to determine the trust of requests by analyzing the context data. This paper is also an example of a submission addressing the third theme, "User Trust", but in a reverse way, instead of the user trusting the system, the system trusts the user in particular context.

### 2.3 User Trust

A third important way in which research in user modeling overlaps with trust is the user's trust in the adaptive / personalized application. In effect it is a symmetrical area to that of user modeling: while user modeling suggests that the system models the user, here the user models the system. It relates to issues of user's understanding of the application, and of the privacy and integrity of the user model data, both of which are actively studied in the user modeling community. Facilitating user understanding and trust in the system's functioning and the way it manages the user's data is very important, since it determines the user's acceptance of the application's recommendations or persuasion, the user's satisfaction with the application's functionality, and ultimately, its success. The workshop received one submission in this area, the paper by *Ekaterina Kurdyukova, Elisabeth André*, "Making Adaptation Trustworthy: Experiences from the Design of an Adaptive Display", which argues that the design of adaptation in transparent and controllable way preserves user trust and keeps high interaction comfort. The paper presents the design of an adaptive system consisting of a public display and an assisting mobile device; the system adapts to the social context in order to protect private data from observation. Unfortunately, this paper is not part of this collection, since it is submitted or published elsewhere. The interested reader can find the doctoral symposium paper by the first author is part of the UMAP conference proceedings [8].

## 3 Conclusions

Apparently, new research in both user modeling is looking for ideas, approaches and techniques from trust & reputation systems and reversely, more complex user modeling approaches can be seen incorporated into trust and reputation systems. Trust in adaptive and personalized systems is also gaining importance with the abundance

of mobile and ubiquitous applications and social networks. The workshop has outlined a promising area of research and will likely continue in the future associated with the UMAP Conference and possibly with applied systems conferences, such as ACM/WI/IAT/IEEE or PST, to allow for more exposure and communication across the two communities.

**Acknowledgements.** Acknowledgements are due to the PC members and additional reviewers for the invaluable help with reviewing submissions.

## References

1. Nusrat, S., Vassileva, J.: Recommending Services in a Trust-Based Decentralized User Modeling System. In: Ardissono, L., Kuflik, T. (eds.) UMAP 2011 Workshops. LNCS, vol. 7138, pp. 230–242. Springer, Heidelberg (2012)
2. Malačka, O., Samek, J., Zbořil, F., Zbořil, V.: Decision Making and Recommendation Protocol Based on Trust for Multi-Agent Systems. In: Ardissono, L., Kuflik, T. (eds.) UMAP 2011 Workshops. LNCS, vol. 7138, pp. 280–291. Springer, Heidelberg (2012)
3. Nepal, S., Sherchan, W., Paris, C.: Building Trust Communities Using Social Trust. In: Ardissono, L., Kuflik, T. (eds.) UMAP 2011 Workshops. LNCS, vol. 7138, pp. 243–255. Springer, Heidelberg (2012)
4. Luthra, R., Ng, W.K., Zhang, J.: The Influence of Interaction Attributes on Trust in Virtual Communities. In: Ardissono, L., Kuflik, T. (eds.) UMAP 2011 Workshops. LNCS, vol. 7138, pp. 268–279. Springer, Heidelberg (2012)
5. Fang, H., Sensoy, M., Zhang, J., Magnenat-Thalmann, N.: Handling Subjective User Feedback for Reputation Computation in Virtual Reality. In: Ardissono, L., Kuflik, T. (eds.) UMAP 2011 Workshops. LNCS, vol. 7138, pp. 292–303. Springer, Heidelberg (2012)
6. Luo, M., Deters, R.: Improving Access Control for Mobile Consumers of Services by Use of Context & Trust within the Call-Stack. In: Ardissono, L., Kuflik, T. (eds.) UMAP 2011 Workshops. LNCS, vol. 7138, pp. 256–267. Springer, Heidelberg (2012)
7. Marsh, S., Briggs, P., El-Khatib, K., Esfandiari, B., Stewart, J.A.: Defining and Investigating Device Comfort. *Journal of Information Processing* 19, 231–252 (2011)
8. Kurdyukova, E.: Designing Trustworthy Adaptation on Public Displays. In: Konstan, J.A., Conejo, R., Marzo, J.L., Oliver, N. (eds.) UMAP 2011. LNCS, vol. 6787, pp. 442–445. Springer, Heidelberg (2011)