Online Trust and Reputation Systems

Neel Sundaresan
eBay Research Labs
2145 Hamilton Avenue
San Jose, CA 95125
(408)376-8422
nsundaresan@ebay.com

ABSTRACT
As online commerce, social networks, and user-generated content become common, need for trust and reputation models become prime. This tutorial will give an overview of trust and reputation systems as studied by social network researchers. Other topics include: Reputation and its relationship to security and fraud; Feedback and other Manifestations and Implementations of trust and reputations; Models of reputation; platforms: P2P systems, Centralized systems; Auctions, Incentive systems; Collaborative filtering; Social Networking and Social reputation; Portability and Universality of Identity, trust, and reputation.

Categories and Subject Descriptors
I.2.11 [**Artificial Intelligence**]: Distributed Artificial Intelligence.

General Terms
Economics, Human Factors, Verification, Management, Algorithms, Theory.

Keywords
Identity; Trust; Fraud; Reputation; Electronic Commerce; Social Networks

1. INTRODUCTION
Over the past decade electronic commerce, user generated content and recommendations, and social networking applications have become common on the web. As reliance on these applications grow the need for a trust and reputation model has become essential. Users look for recommendations on products, web site, suppliers, buyers, content, and peers based upon the nature of interaction. Recommendations are provided based upon personal experience, usefulness of prior recommendations, and other behaviors on the system. The roles and behaviors of any user in an online application define the trust that other users of the system have on the user. This also defines the reputation of the user in the community.

Feedback on an online marketplace like eBay is an expression of reputation. It provides a simple accumulative model for reputation. Social network sites like Slashdot.org and digg.com have their own model of reputation where users with extensive authorship and recommendation are promoted to being moderators and super-moderators.

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Trust is well-studied among social network researchers. It is explicated through referrals and ratings. Resnick[] has marked out the characteristics of a reputation system. These include 1. actors in such a system have to be long lived to influence future reputation scores; 2. mechanism to capture current scores to influence future scores; 3. ratings about past interactions to guide current interactions. The characteristics apply well not only to eCommerce systems like clicks-and-mortar stores where an individual business is rated by its customers but also in peer-to-peer marketplaces and social network sites which include interactions, reviews, and guides.

Trust and reputation often identify other related entities like fraud and safety. Algorithms defined to compute reputation are closely attached to those designed to detect fraud or compute safety measures. Lack of trust leads means higher possibility of fraud or fraud committers try and take over reputed member's trust to commit fraud. Mechanisms that restrict such takeover are of importance to build low fraud applications.

2. TUTORIAL OVERVIEW
This tutorial will cover several areas of online reputation systems. Some key topics include:

1. Concepts and definition of online trust and reputation.
2. Reputation and its relationship to security and fraud.
3. Feedback and other manifestations and Implementations of trust and reputations
4. Models of reputation
5. Platforms: P2P systems, Centralized systems
6. Auctions, Incentive systems
7. Collaborative filtering
8. Social Networking and Social reputation
9. Degrees of freedom; Circles of trust
10. Example Applications (Amazon, Epinions, eBay, Slashdot.org, Digg etc.)

3. TUTOR BIOGRAPHY
Neel Sundaresan is the Director and Head of eBay Research Labs. His current areas of research interest includes Social and Incentive Networks, Trust and Reputation Systems, Machine Learning as applied to Recommender systems, Classification, Ontology, and Search. Prior to joining eBay was a founder and CTO of a startup focused on multi-attribute fuzzy search and network CRM. Prior to this he was the head of the eMerging Internet Technologies group at the IBM Research Center. There he built the first XML-based Search Engine. He was one of the

early leaders in building XML technologies including schema-aware compression algorithms, application component generators and pattern-match systems and compilers. He built the first RDF reference implementation as a W3C standard recommendation. He led research work in other areas like domain specific search engines, multi-modal interfaces and assistive technologies, semantic transcoding, web mining, query systems, and classification for semi-structured data. Prior to this he worked on C++ compiler and runtime systems for massively parallel machines and for shared memory systems and also on retargetable compilers, program translators and generators. He has over 40 research publications and several patents to his credit. He has been a frequent speaker at several national and international technology conferences. He has advised several PhD and masters dissertations. He has a degree in mathematics and a masters in computer science and engineering from the Indian Institute of Technology, Mumbai India and a PhD in computer science from Indiana University, Bloomington.

4. REFERENCES

[1] Z. Abrams, R. McGrew and S. Plotkin. A Non-Manipulable Trust System Based on EigenTrust. ACM SIGecom Exchanges, Vol.5, No. 4, July 2005, pages 21-30.

[2] Z. Abrams, R. McGrew and S. Plotkin. Keeping Peers Honest in EigenTrust. Proceedings of the Second Workshop on Economics of Peer-Peer Systems. 2004.

[3] C. Dellarocas. Goodwill Hunting: An Economically Efficient Online Feedback Mechanism for Environments with Variable kProduct Quality. AMEC 2002, LNAI 2531. J. Padget et al. (Eds.). pages 238-252. 2002.

[4] O. Farideh. Bibliometrics, Citation Analysis and Co-citation Analysis: A Review of Literature L. Libri 46, September 1996. 149-158.

[5] E. Fourquet, K. Larson and W. Cowan. A Reputation Mechanism for Layered Communities. ACM SIGecom Exchanges, Vol. 6 No. 1, 05 2006, pages 11-22.

[6] R. Guha, R. Kumar, P. Raghavan and A. Tomkins. Propagation of Trust and Distrust. Proceedings of the WWW2004, May 17-22, 2004, New York, New York, USA.

[7] D. Houser. Reputation in Auctions: Theory and Evidence from eBay. Journal of Economics and Management Strategy, 2004.

[8] A. Josang, R. Ismail and Colin Boyd. A Survey of Trust and Reputation Systems for Online Service Provision. Decision Support Systems 2006. pages 1-46.

[9] S. Kamvar, M. Schlosser and H. Garcia-Molina. The EigenTrust Algorithm for Reputation Management in P2P Networks. Prodceedings of the WWW2003, Budapest, Hungary. May 2003.

[10] R. Larson, Bibliometrics of the World Wide Web: An exploratory analysis of the intellectual structure of cyberspace. Annual Meeting of the American Society for Information Science, 1996.

[11] T. Papaioannou and G. Stamoulis. An Incentives' Mechanism for Promoting Truthful Feedback in Peer-to-Peer Systems. In CCGRID 05: Proceedings of the 5th IEEE/ACM Internation Symposium on Cluster Computing and the Grid, IEEE Computer Society Press, Pages 259-266.

[12] P. Resnick and R. Zeckhauser. Trust Among Strangers in Internet Transactions: Empirical Analysis of eBay's Reputation System. In the Economics of the Internet and e-Commerce, M.R. Baye, Ed. Advances in Applied micronomics, vol. 11. Elsevier Science, Amsterdam, 127-157.

[13] J. Sabater and C. Sierra. Reputation and Social Network Analysis in Multi-Agent Systems. Proceedings of the 1st International Joint Conference on Autonomous Agents and Multi-agent Systems. 475-482. 2002.

[14] J. R. Seeley, The net of reciprocal influence: A problem in treating sociometric data. Canadian Journal of Psychology, 3, pages 234-240, 1949.

[15] N. Sundaresan. On an Online Reputation System. eBay Research Labs Technical Report. 2006.

[16] S. Wasserman and K. Faust, *Social Network Analysis: Methods and Applications.* Cambridge University Press, 1994.