

Peer Prediction Based Trustworthiness Evaluation and Trustworthy Service Rating in Social Networks

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ABSTRACT: With the development of online applications based on the social network, many different approaches of service to achieve these applications have emerged. Users' reporting and sharing of their consumption experience or opinion can be utilized to rate the quality of different approaches of online services. How to ensure the authenticity of the users' reports and identify malicious ones with cheating reports become important issues to achieve an accurate service rating. In this paper, we provide a private-prior peer prediction mechanism based trustworthy service rating system with a data processing center (DPC), which requires users to report to it with their prior and posterior beliefs that their peer users will report a high quality opinion of the service. The DPC evaluates users' trustworthiness with their reports by applying the strictly proper scoring rule, and removes reports received from users with low trustworthiness from the service rating procedure. This peer prediction method is incentive compatible and able to motivate users to report honestly. In addition, to identify malicious users and bad-functioning/unreliable users with high error rate of quality judgement, an unreliability index is proposed in this paper to evaluate the uncertainty of reports. Reports with high unreliability values will also be excluded from the service rating system. By combining the trustworthiness and unreliability, malicious users will face a dilemma that they cannot receive a high trustworthiness and low unreliability at the same time when they report falsely. Simulation results indicate that the proposed peer prediction based trustworthy service rating can identify malicious and unreliable behaviours effectively, and motivate users to report truthfully. The relatively high service rating accuracy can be achieved by the proposed system.

KEYWORDS: Service rating, trustworthiness, reliability, peer prediction, private prior, social networks.

I. INTRODUCTION

Information communication and computation technologies have been developing rapidly in recent years. With the growing demands of big data and development of different applications, the emerging fifth generation (5G) mobile communication technology will be a multi-service and multi-technology integrated network, which can enhance the user experience by providing various intelligent and customized services. Moreover, social networks have become important platforms for users to enjoy different kinds of online services. With the rapid development of Internet-based applications, different approaches to achieve these applications have emerged. Take e-commerce for an instance, in which users are allowed to use different online or mobile payment systems, such as PayPal, Google Wallet, Alipay and Apple Pay, to complete payments. In addition, for some file sharing applications, users can use different downloaders to download their favourite music, movies or other media files. In order to provide accurate and useful suggestions to new users and help them to make choices, the use of service quality ratings for these different services has become an important method. Concerning this problem, the feedback and evaluation from users who have experienced a service provide essential reference information for the service rating.

Meanwhile, social networks provide platforms that collect and share users' feedback, according to which the service rating can be provided through some data fusion mechanism. However, false and dishonest reports from malicious users can destroy the fairness and usefulness of such ratings. Therefore, it is rather necessary to introduce some trust assessment function to such systems and design an incentive mechanism to motivate users to output truthful feedback. In this paper, we will establish a peer prediction based trustworthy service rating system for social networks. With peer prediction-based decision, network functions of malicious behaviour detection, trustworthiness and

unreliability assessment can be achieved. Then the reliable and trustworthy service ratings can be obtained by the feedback from honest and reliable users. In this work, we assume that the service quality is an objective evaluation independent of users' subjective judgements. This assumption is reasonable for many service quality indicators, such as convenience of online payment methods and download speeds

Paper is organized as follows. Section II describes how This rating mechanism entirely decoupled the credibility assessment of the evaluations from the ranking itself by using algorithm. private-prior peer prediction method, which enable to encourage users to provide rating reports truthfully shown in Section III. Section IV presents experimental results showing results of images tested. Finally, Section V presents conclusion.

II. RELATED WORK

Service ratings for different application systems have been active research topics over the past decades. Many service evaluation systems have been developed for mobile social networks [10], multiple providers service systems [1] and many other kinds of web services [2], [3]. In [4], researchers designed the objective rating scores of products or services through an iterative rating algorithm. This rating mechanism entirely decoupled the credibility assessment of the evaluations from the ranking itself, which makes it very robust against collusion attacks as well as random and biased raters. The work in this paper is divided in two stages. A two phase methodology was proposed in [5] for systematically evaluating the performance and availability of cluster-based Internet services. A service rating scheme that is robust against manipulations by malicious users and services was proposed in [6]. In [6], the service rating made by the target customer was predicted, based on which the system helped this customer to choose a suitable service.

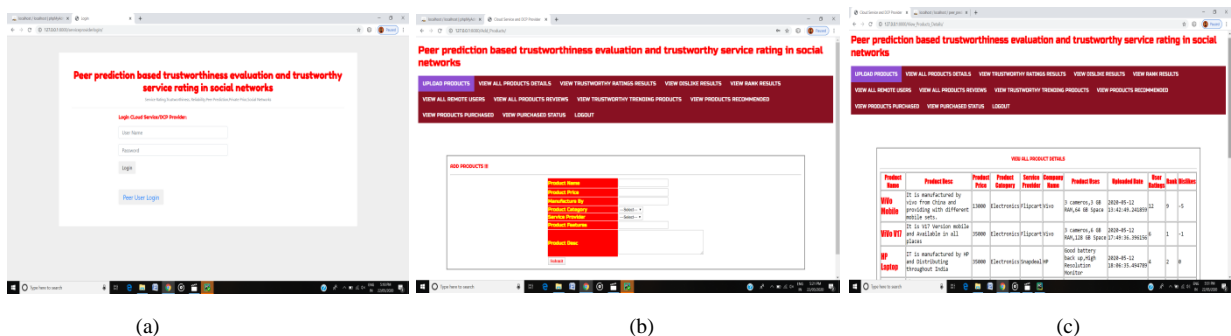
A social network is a platform that allows its users to obtain services and share their experiences [8]. Based on such feedback gathered, a data processing center (DPC) can provide quality ratings for different services, which can further give suggestions for new users. To ensure the accuracy of service ratings, the trustworthiness and reliability of the feedback from users need to be checked and ensured

III. METHODOLOGY

The private-prior peer prediction method, which enable to encourage users to provide rating reports truthfully. With some certain strictly proper scoring rules to estimate the users' trustworthiness, the mechanism can identify malicious users those with low trustworthiness. Then users are motivated to report truthfully in order to obtain high trustworthiness and avoid being considered as the malicious. 1) Prior belief reports to the cloud: In the system established in this work, for rating the quality of service m , we consider that each user i has one peer user j selected randomly from other users who have accepted and will still accept the same service m as i . Before experiencing the service, user i is required to report his/her prior belief $y_{ij} \in [0,1]$, or called information report, to the cloud that his/her peer user j will report a high quality signal, i.e., $x_j = 1$. 2) Posterior belief reports to the cloud: After experiencing the service, user i makes his/her own opinion of the service quality $S_i = s_i$, and then sends the posterior belief, or called prediction report to the cloud, denoted by $y'_{ij}(s_i) \in [0,1]$, that the peer user j will report of a high quality evaluation for the service.

IV. EXPERIMENTAL RESULTS

Figure.1 (a) shows the admin login page. (b) it shows a main page of DCP Provider , in this page there will be view all products details, view trustworthy rating results, view dislike results, view rank result, view remote user, view trustworthy trending products, view product recommended, product purchased status and logout



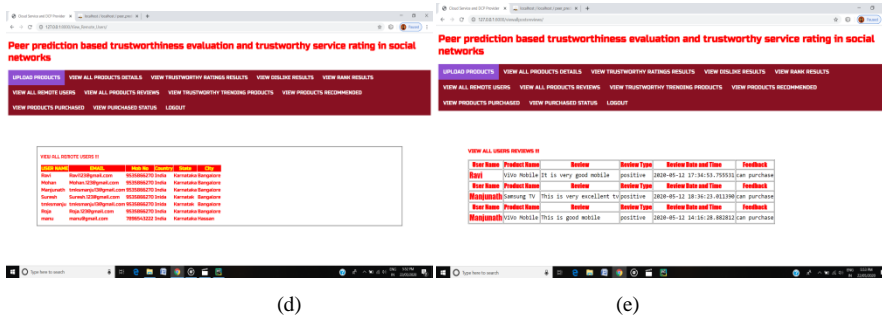


Fig. 2. Review results in charts (a)In this page service provider can view the trustworthy rating result of all products through pie chart..(b)through line chart(c), in this page service provider can view the dislike result of all products through pie chart (d) through bar

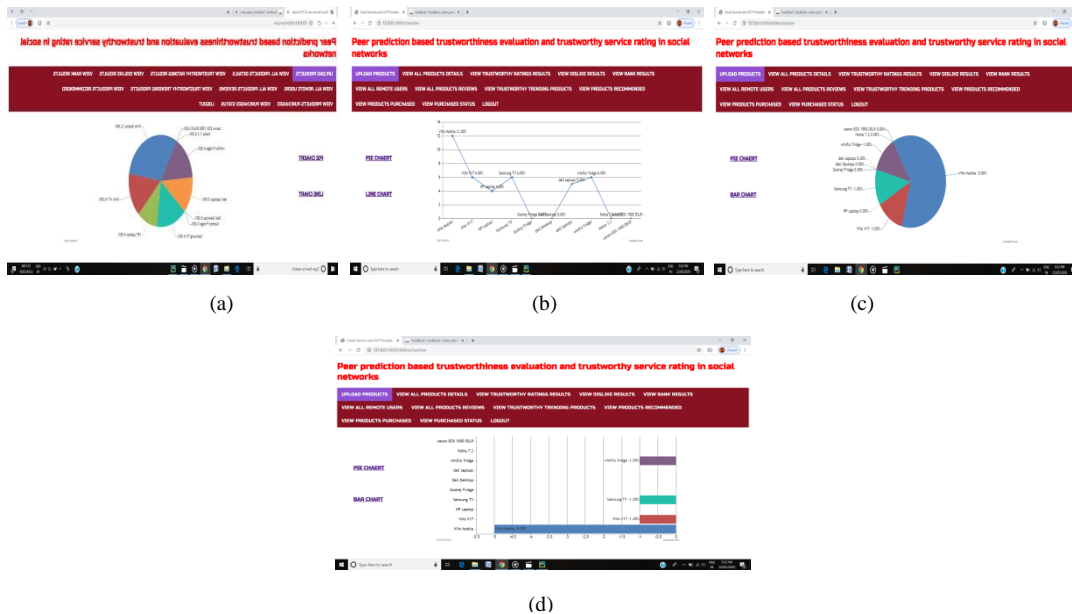
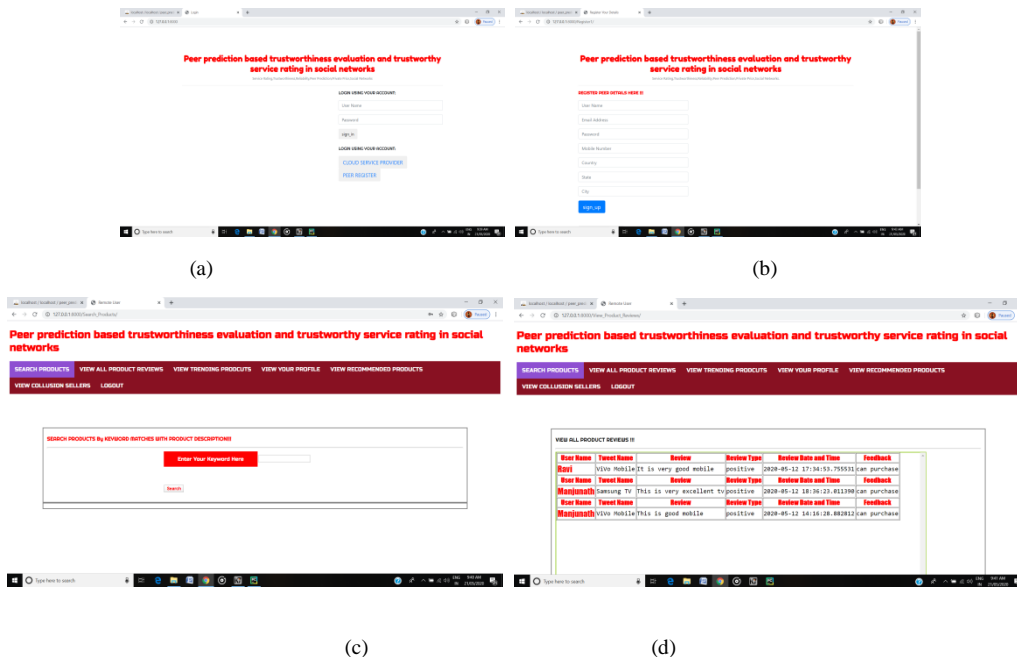
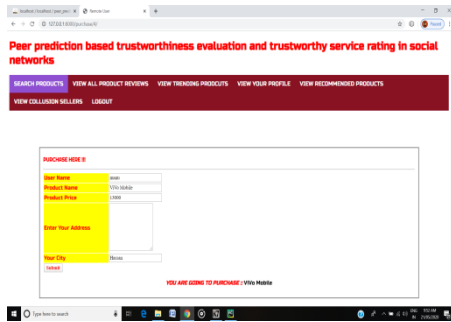
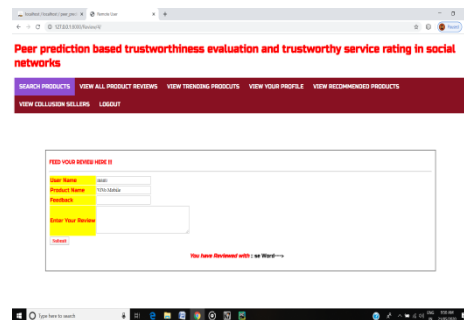


Fig. 3 Peer page (a) Login page for users (b) Registration page for new users (c) Products search page (d) all product review page (e)product purchase page (f)feed the review page





(e)



(f)

V. CONCLUSION

We are proposing a cloud based architecture for the service rating system. To achieve a trustworthy service rating, a private-prior peer prediction based mechanism was designed to identify malicious and dishonest users. Coupled with some certain strictly proper scoring rules, the peer prediction method can evaluate users' trustworthiness and motivate them to report honestly and also designing to ensure the reliability of the user's reports. According to the trustworthiness and unreliability index, untruthful and unreliable reports can be identified and eliminated to improve the accuracy of service rating. The proposed peer prediction based trustworthy service rating system can identify malicious and unreliable behaviours effectively, and achieve relatively high service rating accuracy.

REFERENCES

- [1] L. Xu, C. Jiang, N. He, Z. Han, and A. Benslimane, "Trust-based collaborative privacy management in online social networks," *IEEE Trans. Inf. Forens. Security*, pp. 1–1, May 2018.
- [2] B. Rashidi, C. Fung, A. Nguyen, T. Vu, and E. Bertino, "Android user privacy preserving through crowdsourcing," *IEEE Trans. Inf. Forens. Security*, vol. 13, no. 3, pp. 773–787, Mar. 2018.
- [3] L. Xu, C. Jiang, Y. Chen, Y. Ren, and K. J. R. Liu, "User participation in collaborative filtering-based recommendation systems: A game theoretic approach," *IEEE Trans. Cybernetics*, vol. PP, no. 99, pp. 1–14, Feb. 2018.
- [4] M. Chen, Y. Zhang, L. Hu, T. Taleb, and Z. Sheng, "Cloud-based wireless network: Virtualized, reconfigurable, smart wireless network to enable 5G technologies," *Mobile Networks and Applicat.*, vol. 20, no. 6, pp. 704–712, Feb. 2015.
- [5] G. Zhao, X. Qian, and C. Kang, "Service rating prediction by exploring social mobile users' geographical locations," *IEEE Trans. Big Data*, vol. 3, no. 1, pp. 67–78, Mar. 2017.
- [6] J. Du, C. Jiang, S. Yu, K. C. Chen, and Y. Ren, "Privacy protection: A community-structured evolutionary game approach," in *IEEE Global Conf. Signal Inform. Process. (GlobalSIP)*. Washington, DC, USA, 7-9Dec. 2016, pp. 415–419.
- [7] G. Zhao, X. Qian, and X. Xie, "User-service rating prediction by exploring social users' rating behaviors," *IEEE Trans. Multimedia*, vol. 18, no. 3, pp. 496–506, Mar. 2016.
- [8] X. Li, H. Ma, F. Zhou, and W. Yao, "T-broker: A trust-aware service brokering scheme for multiple cloud collaborative services," *IEEE Trans. Security*, vol. 10, no. 7, pp. 1402–1415, Jul. 2015.
- [9] Y. Yang, Y. Sun, S. Kay, and Q. Yang, "Securing rating aggregation systems using statistical detectors and trust," *IEEE Trans. Inf. Forens. Security*, vol. 4, no. 4, pp. 883–898, Dec. 2009.
- [10] L. Xu, C. Jiang, Y. Chen, Y. Ren, and K. J. R. Liu, "Privacy or utility in data collection? a contract theoretic approach," *IEEE J. Sel. Topics Signal Process.*, vol. 9, no. 7, pp. 1256–1269, Oct. 2015.
- [11] S. Chikkerur, V. Sundaram, M. Reisslein, and L. J. Karam, "Objective video quality assessment methods: A classification, review, and performance comparison," *IEEE Trans. Broadcasting*, vol. 57, no. 2, pp. 165–182, Jun. 2011.