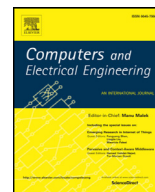




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Learning automata-based trust model for user recommendations in online social networks[☆]

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ABSTRACT

Nowadays, most of the online social media websites provide recommendations as service for selective decision making. Determining a recommended trust path based on the consumer's non-functional requirements, such as availability of the products, delay for computing recommendations and response time for a good recommendation is one of the challenging issues in online social networks. In this paper, we first design a recommendation-based online social network architecture by incorporating trust information (namely, direct trust and indirect trust), relevance degree and recommended influence value. We propose a high quality of social trust associated model for evaluating a recommended trust path. The proposed model estimates utility values with associated weights based on *Shannon* entropy information gain. Further, for best recommended trust path selection, we propose a *Learning Automata based Recommended Trust Path Selection* (LA-RTPS) algorithm to identify multiple recommended trust paths and to determine an aggregate path. The experimentation using real time datasets illustrates the efficacy of the proposed algorithm.

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1. Introduction

Online social networking websites attract a millions of users and provide variety of social services by interacting with participants [1]. In a social network structure, each node is identified as participant and each edge corresponds to the relationship between the participants. Each participant can interact with other participants directly or indirectly [2]. In a service-oriented system, trust plays a major role for selective decision making and requires a methodology to evaluate the trust paths between the participants who are unknown to each other. A service provider may choose trust path selection criteria, such as releasing an upgraded product and interviewing employees for evaluating the trustworthy services for the consumers. The trust value specified between two participants is based on their recommendations and the quality of the products [3]. Moreover, a trustworthy service is based on the social relationships and recommended influence value among the participants. Therefore, finding a trustworthy path by considering the above trust parameters is a challenging task [4].

A recommendation based online social network is shown in the Fig. 1. Participants *A* and *I* are indirectly linked by multiple paths. *A* is a service provider and *I* is a consumer (participant) to evaluate a trust path based on direct [5] and indirect trust values [3] (from *A* to *I*). In case of *Big Data* networks [6], multiple recommended trust paths exist between a service provider and the consumers [7]. Moreover, evaluating the trustworthy services for the consumers by considering multiple

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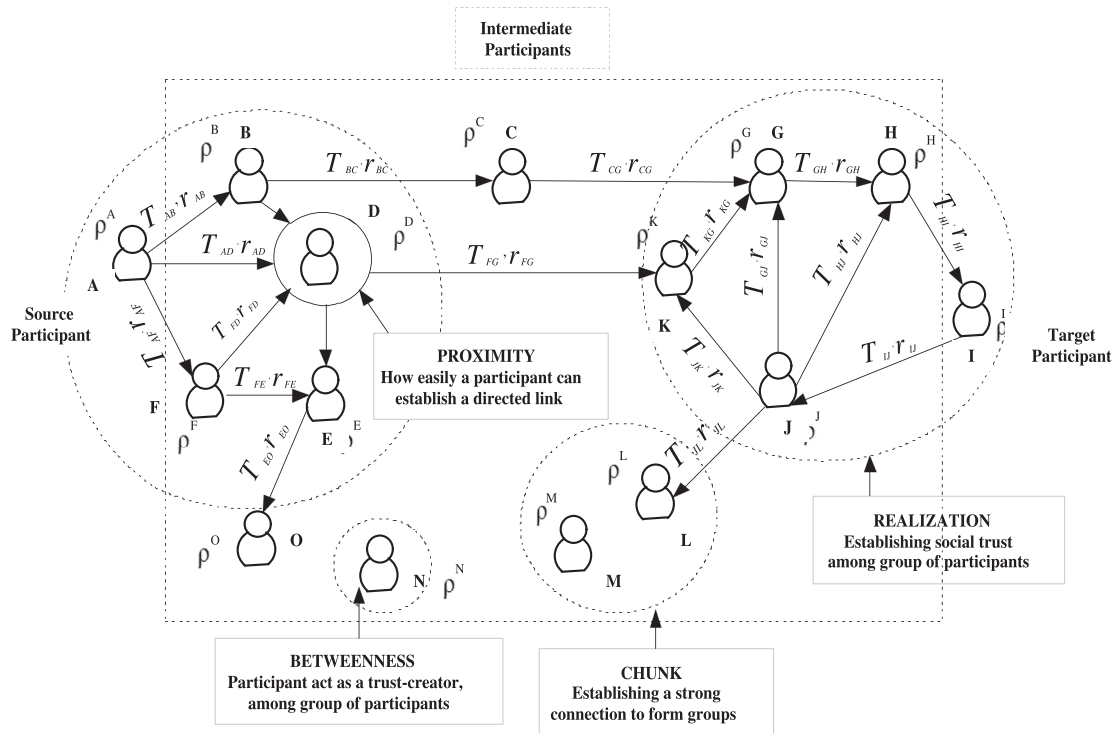


Fig. 1. A social network structure for finding recommended trust path between a source participant A and a target participant I.

social paths is a critical issue and time consuming process. Further, finding a best recommended trust path is a challenging problem in social networks. However, for identifying the social trust path, the shortest path based approaches are used [8]. For good recommendations, to purchase services, consumers need to focus mainly on the non-functional requirements, such as service cost, service availability and service delivery time (response time) along with the consumer feedbacks [9]. For accurate recommendations, we have considered social network criteria, such as proximity, realization, chunk and betweenness (as depicted in Fig. 1) including non-functional requirements (refer Section 4).

A participant (i.e., consumer) may select a recommended trust path with highest trust value. However, the participant may dislike a service as its cost may go beyond the participant's budget or some attributes may not fulfill the participant's preferences. Although, the requirements fulfill the participant's preferences, the services may not be selected by a participant if it is not a recommended trust path [10]. The following are the *Big Data* challenging issues that the existing algorithms fail to address: (i) The potential growth of large volume of non-functional requirements will increase the complexity of social network for selective decision making, (ii) Due to the uncertainty of trust information in a network, evaluating trustworthy services leads to variability in non-functional requirements, (iii) Heterogeneous qualitative or quantitative participant preferences and trust information lead to a variety of non-functional requirements in online social networks [11]. Therefore, we develop a *Big Data* model for finding a recommended trust path to evaluate trustworthy services based on the social trust information.

To address the above challenging issues in online social networks, we propose a novel approach for finding a recommended trust path by considering direct trust, indirect trust, social relationships and recommendations. We summarize our contributions as follows:

- We first develop a *High quality of Social trust (HoS)* constrained model for evaluating trustworthy services in online social networks by incorporating attributes, such as trust information (direct trust and indirect trust), social relationships and the participants' recommendations.
- We propose a Learning Automata based-Recommended Trust Path Selection (LA-RTPS) algorithm, where multiple recommended trust paths are identified from a source participant to a target participant.
- Experiments are conducted on two real online social network datasets, such as *Slashdot* dataset [12] and *Epinions* dataset [13] to evaluate the efficacy of the proposed LA-RTPS algorithm.

The rest of the paper is organized as follows. Section 2 discusses the related work. In Section 3, we discuss the basic definitions and overview of learning automata. In Section 4, we design multiple *HoS* constrained model for evaluating trustworthy services in online social networks and a *Learning Automata based-Recommended Trust Path Selection (LA-RTPS)*

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