A reliable path between target users and clients in social networks using an inverted ant colony optimization algorithm

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Abstract

Internet has become an integral section of human life. Millions of people are joining online social networks every day, interacting with others whom they did not know already. Establishing trust among those indirectly connected users performs a crucial role in improving the quality of social network services and creating the security for them. Nowadays, there are many paths between clients (service requesters) and target users (service providers) in online social networks. Among existing paths finding a trust path for trustworthy services is a vital job. Also, in many previous methods, such as ant colony optimization algorithm (ACO) load balancing among target users is inefficient. Therefore, in this paper we propose an inverted ant colony optimization algorithm to find a reliable path along with improving load balancing among the target users. The inverted ant colony optimization algorithm is a diversity of the basic ant colony optimization algorithm in which, the updated pheromone has a reverse effect on the selected path by the ants. Finally, we simulate the proposed method by using the original experimental dataset and evaluate the proposed method in terms of load balancing, waiting time and execution time in comparison with the ant colony optimization algorithm. The obtained results are very promising.

1. Introduction

Internet is one of the main telecommunication facilities utilized by all people around the world [1−4]. Also, in all of the circumstances, it is impossible not to use the concept of big data [5,6]. Social networking is the practice of developing the number of one's business and/or social contacts by creating connections through individuals [7]. Online Social Networks (OSNs) are becoming more and more famous and have been utilized as the means in a variety of applications, like employment, CRM and e-Commerce [8]. Online social networks are increasingly being utilized as places where communities gather to change information, form opinions, and collaborate in response to a happening [9]. In the last few years, many online social networks, such as Facebook and Viber, have spread out around the world and the participants in such kinds of social networks can have a great number of claimed friends [10]. More and more people utilize online social

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networks to share their activities and make friends [11]. With the current popularity of online social networks, more and more users are joining and more and more information is distributed through social network services [12]. Social network services (SNS) focus on building online communities of people who share interests and/or activities, or who are interested in prospecting the interests and activities of others [13]. Online social network services, such as Instagram, Facebook, and Twitter, have experienced exponential growth in membership in recent years [14]. The important kinds of social network services include directories of some categories meant to connect friends and recommended systems linked to trust [15]. Social network services, like Epinions,[1] permit their users to represent their judgment about any type of product [16].

With the growth of social network services, the need for identifying trustworthy people has become an important concern in order to protect the users' great amounts of information from being misused by unreliable users [17]. How is it possible to identify reliable users within the chain of connections and rebuff unreliable users from accessing the network and misusing information? [18]. To address these questions, "trust" is an invaluable belief in social network services [17]. Trust and friendship among users is a type of social relationship resulted from common interests among users [19—22]. Trust helps reconnoiter users with whom we can communicate, share information, and form friendships. There have been some attempts to create mathematical definitions of trust [23,24] like, the degree of subjective notion about the behaviors of (information from) a specific entity [25]. The expectation that a service will be provided or a commitment will be fulfilled [26]. Trust in a person is a commitment to a task based on a belief that the next tasks of that person will lead to a good outcome [27]. Trust inference, which aims to infer a trustworthy score from the trustor to the trustee in the underlying social network is a primary task in many real world applications [28] containing e-commerce [29], peer-to-peer networks [30], and mobile ad hoc networks [31]. In addition, trust in online social networks has three essential characteristics: transitivity, asymmetry, and personalization [32]. Also "referral trust" and "functional trust", which were first proposed by Jøsang are distinguished [33].

Due to the increasing of popularity and usage of social networks in recent years, social network optimization (SNO) is introduced as an optimization algorithm to solve different challenges in recent years. This method is proposed as a population based algorithm inspired to the social network knowledge sharing and decision making process. This method first introduced in Ref. [34] in a simplistic way and further developed to enhance its performance, essentially built as a population based approach inspired to the social network knowledge sharing and emulating the decision making process recently introduced by these networks. In this algorithm, in fact, each individual indicates a social network member characterized by a proper social environment (a specific position in the solution space), a proper character, a personal reputation recognized by his group and a personal interest which can be compared to a sort of taste (or liking) shared among his relational network. The personal interest can be seen as preferred direction in the space domain due to both stronger and weaker characters and particular opinion leaders. The main characteristic of the SNO are status, memory, ranking groups and influencers.

In this paper, we address the trust challenge in social networks along with improving load balancing among the target users by proposing an inverted ant colony optimization algorithm. The proposed method has an important effect on improving load balancing with the help of an updated pheromone. After pheromone update in each iteration, ants in the next iteration try to satisfy client's requirements with by using new target users. The primary objectives of the proposed algorithm are as follows:

1. We try to establish load balancing among target users or service providers.
2. We try to reduce the waiting time of the clients or service requesters to receive requirements.

In the remainder of the paper, Section 2 surveys related works. The problem definition is offered in Section 3. We present the proposed method in Section 4 and the results of the proposed method are described in Section 5. Finally, Section 6 concludes this paper and suggests future works.

2. Related work

In this section, some of the primary methods for evaluating trust in social networks are presented and analyzed.

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[1] www.Epinions.com.