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Advanced Event-base Exhibition Management Mobile Applications Social Networks Using Fuzzy Reasoning-based Routing Cum Forwarding Algorithm

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Abstract

At present, with the rapid growth of mobile Internet, the widespread use of mobile devices, the advent of the era of big data and the gradual integration of mobile, social and location services, the mobile social network (MSN) composed of mobile users with similar interests or common characteristics has become a hot spot in communication network research. In order to explore the mechanism and law of online MSN information dissemination, this article puts forward a modeling analysis method based on fuzzy reasoning, and applies data mining technology together. The algorithm combines the contact probability between nodes with social attributes, and uses this as a judgment condition to evaluate whether nodes are suitable for data transmission as relay nodes in MSN scenarios. Compared with the traditional methods, the packet loss rate of the routing protocol in this algorithm increases slowly, and the energy consumption of the routing protocol in this article decreases by 8.7%. The optimized network has stronger time division multiplexing processing ability and flexible processing ability. The application of this model makes MSN more risk-resistant, and it is less likely that a single node or other nodes will fail in security.

Keywords

Mobile Social Network; Routing Protocol; Fuzzy Reasoning.

1. Introduction

With the continuous growth of science and technology, online social platforms are increasing. It not only has the characteristics of "time-space bias" of traditional media, but also can realize the diversification of information dissemination subjects and fragmentation of content, provide people with diversified choices and meet people's individual needs [1-2]. In opportunistic networks, nodes mostly adopt the strategy of store and forward, and use opportunistic contact with other nodes to transmit data packets, while MSN mainly studies the social relations between nodes in network application scenarios, so it has certain social attributes [3]. Because of the particularity of MSN mechanism, it also has the characteristics of similar delay network different from traditional network. First of all, users in MSN are highly mobile, and data sharing and transmission in MSN are generated between users associated through a certain community, and it is precisely because of users' mobility that data can be spread [4-5]. Many communication tools used by nodes in MSN are intelligent mobile devices, which are obviously different from traditional MSN. However, due to the poor transmission distance and node mobility, this kind of network often appears intermittent connection and frequent disconnection. In order to promote the continuous growth of complex networks and system science, it is necessary to explore the information dissemination mechanism of online MSN and improve the level of Internet governance [6].

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MSN defines the structure and relationship between users, and users and systems can use these attributes to improve the performance of network services. In such a network, mobile users can use their social relationships to access, share and distribute data. Because of the mobility and sociality of nodes, the network may be divided into several disconnected small areas, which makes it impossible to form a complete communication link between the source node and the destination node [7]. At this time, the mobile ad hoc network can not find the information transmission path to the destination node according to the previous communication mode, which greatly reduces the routing efficiency or even fails to work normally. Because the path from the source node to the destination is intermittent, the conventional routing protocol is usually not applicable, and the network often has intermittent connection and frequent disconnection [8]. At present, a large number of mobile devices access the Internet, resulting in a huge communication load, which has a negative impact on the guarantee of service quality. With the increase of communication load, the limited resources of mobile devices and communication networks have not been fully utilized, so improving the utilization efficiency of resources to cope with the increase of communication load has become a key issue. In order to explore the mechanism and law of online MSN information dissemination, this article puts forward a modeling analysis method based on fuzzy reasoning, and applies data mining technology together.

2. Methodology

MSN is a new network which aims at information sharing and uses social relations between people to spread data [9]. The special data propagation model determines that MSN is intermittent and has the general characteristics of delay-tolerant network. In MSN, the carriers of node devices are usually people or groups with social relations, and accordingly, nodes will show certain social attributes. With the deepening of complex network research and the mastery of the main properties and mechanisms of the network, scholars have put forward the basic model of complex network research. Among them, regular networks, random networks, small-world networks and scale-free networks are widely influenced [10]. Compared with the nodes between communities, the nodes within a community have stronger social relations, such as kinship or work friends. Traditional routing protocols can not meet the routing requirements of this kind of delay-tolerant networks [11]. Considering the particularity of MSN, users are all connected by certain common attributes, so a kind of routing algorithm based on context information came into being. This kind of algorithm can integrate the characteristics of MSN with the routing method.

In the actual MSN, nodes are controlled by rational individuals or organizations, so in the protection of their own resources, nodes will have certain selfish behavior. With the increase of selfish nodes, the performance of the network will also be greatly affected. Assuming that the initial network has m_0 nodes, select m nodes from the network. Each time a new node is set, the new node is connected to the selected m nodes, and the probability of connection is:

$$\prod_i = \frac{k_i}{\sum_i k_j} \tag{1}$$

After the t step, the number of nodes in the generated network is $N = t + m_0$, and the number of edges is mt. The average path length of the network is:

$$L \sim \frac{\log N}{\log \log N} \tag{2}$$

The clustering coefficient is:

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$$C = \frac{m^2(m+1)^2}{4(m-1)}\left[\ln\left(\frac{m+1}{m}\right) - \frac{1}{m+1}\right]\frac{[\ln(t)]^2}{t} \tag{3}$$

The probability distribution of the node degree value in the network is called the network degree distribution, denoted as $P(k)$, and the degree distribution usually also means that a node is randomly selected, and its degree is the probability of k.

MSN is a network composed of wireless mobile nodes with certain social attributes, which lacks network infrastructure and has intermittent connectivity between nodes. Therefore, it is very difficult to design a reliable routing algorithm for effective communication. The generation of fuzzy sets can solve this problem well. Therefore, in this article, the fuzzy set algorithm is introduced to calculate different trust attributes. The trust of each node is divided into four grades by fuzzy set, and the membership of each node at each trust grade is calculated according to a certain membership function.

When the available bandwidth of the network m is $i \in B_m$, the revenue that the service can obtain is set as $a_m(i)$. The available bandwidth is an attribute that the bigger the better, and it is a benefit index, so the benefits it brings are:

$$a_m(i) = \frac{i - b_{\min}}{b_{\max} - b_{\min}}, i \in B_m \tag{4}$$

Let $v_m(i)$ be the total revenue that the service can get when the available bandwidth of the network m is i:

$$v_m(i) = a_m(i) + \sum_{j \in B_m} P_m(i, j) v_m(j), i \in B_m \tag{5}$$

The calculation of $v_m(i)$ adopts an iterative method. Definition:

$$v_m^{(0)}(i) = a_m(i), i \in B_m \tag{6}$$

Then there are:

$$v_m^{(k)}(i) = a_m(b) + \sum_{j \in B_m} P_m(i, j) v_m^{(k-1)}(j), k \geq 1 \tag{7}$$

The iteration is terminated when the following formula is satisfied:

$$\sum_{i \in B_m} \left[v_m^{(k)}(i) - v_m^{(k-1)}(i)\right]^2 \leq \varepsilon \tag{8}$$

At this time, the total revenue value is the final value, and the final value is used for comparison in network selection.

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In MSN, nodes in the same community have more frequent opportunities to meet, so community detection can be more conducive to selecting appropriate relay nodes for message forwarding.

3. Result Analysis and Discussion

In distributed and frequently divided mobile node groups, community detection mechanism can effectively improve the transmission rate of messages. However, due to the high-speed and dynamic movement of nodes, community detection in MSN is quite difficult and complicated, and more detailed social news needs to be obtained. In the network, the concept of trust is extended to judge the relationship between nodes, so that nodes can choose more credible nodes for data interaction. It is precisely because of this uncertainty and subjectivity of trust that it is difficult for us to determine whether a subject is credible in the form of either right or wrong or neither. Because trust is a node's prediction of another node's behavior based on historical information, which is usually complicated and changeable, and the node's behavior is also complicated. Optimizing MSN routing can not only stabilize the network connection, but also have excellent scalability and security, which can quickly converge and further realize the efficient performance of the network. The MSN routing optimization algorithm in this article is compared with the method in literature [7], and the packet loss rate of routing protocols with different malicious nodes is analyzed. The simulation results are shown in Figure 1.

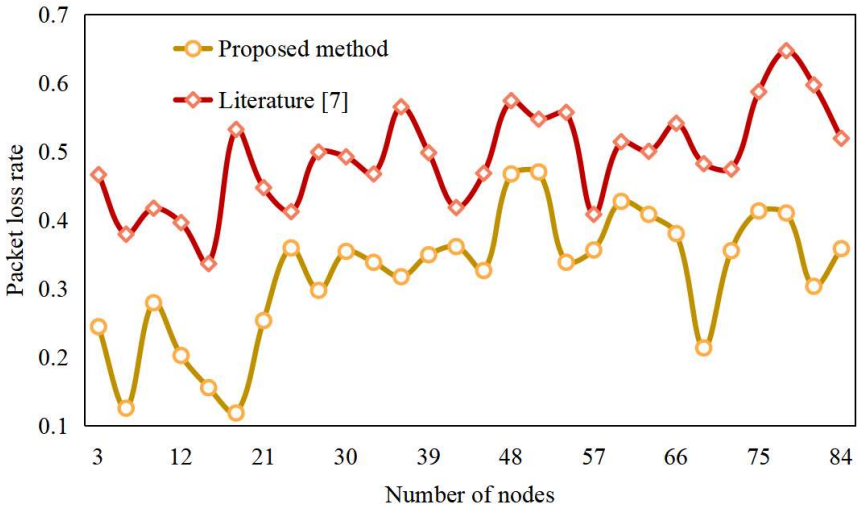

Figure 1. Network packet loss rate with different malicious nodes

Compared with the method in literature [7], the packet loss rate of the routing protocol of this algorithm increases slowly, because it can select routing nodes according to the reputation value of nodes and avoid the possibility of malicious nodes being selected, so the packet loss rate of the network is low. Community detection mechanism is often used to discover unknown groups or mobile user groups in the network. In reality, nodes are controlled by people or organizations with personal will, so there must be some selfish or even malicious nodes in the network in order to save resources and maximize self-interest. These nodes will receive sharing from other nodes, but refuse to serve others and are unwilling to participate in the forwarding process. When the load is small, the network is in a state of free flow, and the routing process is similar to the shortest routing algorithm, and the data packet will mainly be delivered along the shortest path. MSN optimization should follow the principle of flexibility, adapt to the changes of optical transmission technology in time, and ensure the flexibility of information transmission and exchange. Currently available routing information will be transmitted in the whole network. In order to ensure the smooth progress of adaptive routing, the shortest path should be calculated according to the routing protocol and the routing mode should be

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defined. Compare the overall energy consumption rate of all nodes in the network within a certain time, as shown in Figure 2.

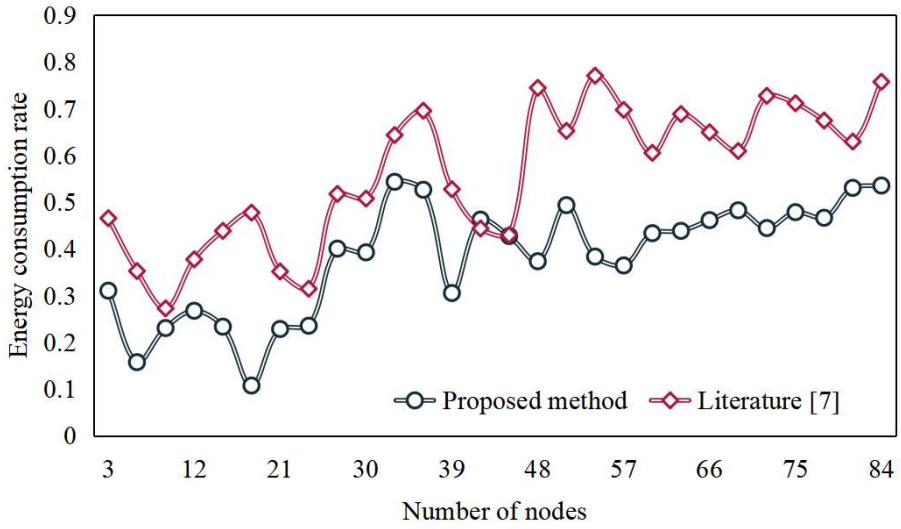

Figure 2. Comparison of energy consumption rates of different protocols

Experimental results show that compared with the algorithm of literature [7], the energy consumption of the routing protocol in this article is reduced by 8.7%. The optimized network has stronger time division multiplexing processing ability and flexible processing ability. The application of this model makes MSN more risk-resistant, and it is less likely that a single node or other nodes will fail in security. Because the concept of trust originally comes from the communication process between people in human society, there are often many uncertain factors in the process of judging trust, so trust is subjective and uncertain.

4. Conclusion

MSN is a new network which aims at information sharing and uses social relations between people to spread data. The special data propagation model determines that MSN is intermittent and has the general characteristics of delay-tolerant network. When forwarding messages, nodes often show a certain degree of selfishness due to the limitation of their own resources. The existing routing algorithm Want Want ignores this negative attribute of nodes. In order to promote the continuous growth of complex network and system science, it is necessary to explore the information dissemination mechanism of online MSN and improve the level of Internet governance. In this article, a modeling and analysis method based on fuzzy reasoning is proposed, and data mining technology is jointly applied. Experimental results show that compared with the algorithm of literature, the energy consumption of the routing protocol in this article is reduced by 8.7%. The optimized network has stronger time division multiplexing processing ability and flexible processing ability. Although the trust model proposed in this article can reduce the influence of selfish nodes on network performance to a certain extent, there is still room for improvement. Future work can optimize the simulation platform to make it more in line with the characteristics of MSN.

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