

ABSTRACT

This paper aims to intend efficient data forwarding technique based on social similarity in case of mobile social networks (MSNs). Mobile Social Network (MSN) with miscellaneous connectivity characteristics is a grouping of opportunistic network. Since the major difficulty of data forwarding is the mobile ad hoc network and also opportunistic part, techniques intended for opportunistic networks are normally used to forward data/message in MSNs. Different definitions of social similarity, acting as the criteria of relay selection, create various forwarding techniques; and the appropriateness and expediency of definitions establish the presentation of the system indeed. The finest solution given that they do not consider the ubiquitous existences of Transient Connected Components (TCCs), where nodes within a TCC can reach each other by multi-hop wireless communications. In this paper, firstly introduce the design of a data forwarding system for MSNs relay on community detection in dynamic weighted networks which is known as LASS. This system is addressed by taking into account the dissimilarity of members' activity inside every community, i.e., local activity. Then, secondly introduce a propose Enhance TCC-aware data forwarding strategies which develop the special description of TCCs to increase the contact opportunities and then increase the performance of data forwarding. And finally compare results of LASS and TCC data forwarding techniques.

KEYWORDS: Mobile Social Network (MSN); Enhance TCC; LASS; Community structure.

INTRODUCTION

In Mobile Social Networks (MSNs), human-carried mobile devices opportunistically form wireless peer-to-peer connections with each other in the absence of the network infrastructure. According to different underlying network architectures, MSNs (Mobile Social Networks) can be classified into two broad types, i.e., centralized MSNs and distributed MSNs. The former, the traditional online social networking services (MySpace, Facebook etc.) migrate their centralized social applications or portal web sites to mobile devices. It is an extension of web-based social networks. Cellular networks provide the most popular network infrastructure to support centralized MSNs [1]. The latter, mobile users disseminate data in a decentralized way which is on the basis of opportunistic contacts. Thus, the ad-hoc networks are fit for the distributed MSNs, e.g. proximity-based applications using Bluetooth.

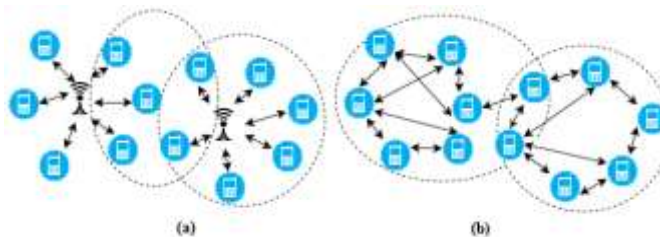


Fig1. (a)Centralized MSN, (b) Decentralized MSN

Although most research assumes that MSNs are highly sparse, a close scrutiny on most current MSN traces reveals that the connectivity inside a network is diverse, and there are ubiquitous existences of Transient Connected Components (TCCs). Inside TCCs, nodes have transient contacts with each other and form a connected component. For example, students in a classroom have transient connections with each other, and vehicles on highways form platoons and have transient connections inside a platoon [p-4].

An MSN with diverse connectivity characteristics is a combination of opportunistic network and mobile ad hoc network (MANET). Inside a TCC, a MANET is formed where nodes can reach each other by multi-hop wireless communications. Outside of TCC, nodes contact each other opportunistically through “carry-and-forward”. Since the major difficulty of data forwarding is the opportunistic part, techniques designed for opportunistic networks are commonly used to forward data in MSNs. However, this may not be the best solution since they do not consider the diverse connectivity characteristics of MSNs.

In this paper, we address the problem of data forwarding in MSNs with diverse connectivity characteristics by proposing two TCC-aware data forwarding strategies. Since a TCC is a MANET, it is treated as one component and data carriers in this TCC are selected for opportunistic data forwarding. More specifically, the paper has two contributions. 1) We identify the existence of TCCs and analyze their properties based on five traces. We find that there are significant number of TCCs in MSNs, and the distributions of TCC size and node degree follow exponential distribution. By treating multi-hop wireless communications inside TCCs as indirect contacts, through theoretical analyses, we show that the contact opportunities can be significantly increased in all traces. 2) We propose a Enhance TCC-aware data forwarding strategy to exploit TCCs to improve the performance of data forwarding in MSNs. In section II survey on Data forwarding techniques is addressed.

LITERATURE REVIEW

In this section survey on literature is addressed. Daly and Haahr [14] proposed SimBet data forwarding algorithm in delay tolerant MANETs. It uses betweenness centrality and social similarity to improve the probability of successful data forwarding. Authors illustrate that SimBet performs fine, particularly when the connectivity is low. But, it does not consider contact frequencies between pair of nodes. Hui et al. [9] projected an algorithm known as BUBBLE RAP in DTNs, with making use node centrality and weighted k-clique community structure to improve delivery performance. It is good than Daly and Haahr [14]. But, it requires providing a priori value of k to identify significant community structure, which is not practical in MSNs. Furthermore, it has the same issue with [14], i.e., using betweenness to compute global and local centrality, not considering node come across probability. Gao et al. [12] deliberate multicast in DTNs from the social network viewpoint.

Author formulates the convey choice as a combine knapsack issue. But this system assumes that community structures are already recognized and several parameters’ optimization requires global information to support. Fan et al. [3] considered geo-community-based broadcasting techniques for mobile social networks by exploiting node geo-centrality and geo-community. Nguyen et al. [10] projected Nguyen’s Routing algorithm which is an overlapping community based data forwarding algorithm.

Li et al. [13] addressed generally self-centred properties into data forwarding system in delay tolerant networks, where protocol SSAR measured both users’ forwarding readiness and their contact occasion. Li et al. [6] introduced a joint rate control, capacity, and routing allocation method to carry out best multi-rate multicast in dynamic wireless networks, which addressed social selfishness of users by differentiating convey costs towards dissimilar destinations. Lin et al. [7] projected a PrefCast algorithm. It examines users’ heterogeneous preferences for dissimilar content objects in mobile social distribution, and for the meantime produces the maximal entire utility for all users. Wu et al. [8] projected a social characteristic based multipath routing system in DTNs. It is beginning on the idea that the social characteristics will take a significant role in data forwarding in social communication networks. At last, the scheme makes the routing problem turn out to be a hypercube based feature corresponding method.

The work by Tie et al. [11] measured data forwarding in networks with diverse connectivity explanation; though, their respond is dissimilar from ours and they do not consider the belongings of TCCs. They predictable packet replication to be the key difference between protocols projected for well linked networks and moderately connected networks, and deliberate a routing protocol known as R3, which determines the amount of data copies to create based on the predicted delays beside network paths.

Raffels berger et al. [4] incorporated store and forward to MANET protocols. In MANET protocols, a statistics thing is abandonment while the routing table does not hold an entrance for the target. With this store-and-forward method, data is buffering until a route to the target can establish using MANET protocols. Although, their explanation lacks a instrument to make a decision effective information carriers for deliver data to destination. There exists different works on analyzing TCCs. For instance, [5] conventional the size of the giant connected components changes eventually.

TCC-AWARE DATA FORWARDING STRATEGIES

Data forwarding in MSNs is tricky because of the opportunistic environment of the network. Being conscious of the continuation of TCCs, this paper intend better data forwarding strategies by utilizing the contact opportunities in TCCs. Within a TCC, nodes can arrive at each other by multi-hop wireless interactions, which will considerably increase the increase the chance of forwarding data to the destination and contact opportunities. The purpose of the TCC-aware information forwarding system is to utilize TCCs to get better the presentation of data forwarding in MSNs.

Identifying the TCC

To make use of TCCs, the initial step is to recognize the TCCs. A node can identify the nodes in the existing TCC by broadcasting within the TCC, and every node delivery the broadcast sends an acknowledgement. With the intention of recognize what data objects are being forwarded in the present TCC, the node reception the broadcast message replies with an acknowledgement that carries the information concerning the data items in its buffer. By gathering acknowledgements from other nodes in the TCC, the original main sender can recognize the nodes and the forwarded information in its existing TCC.

Forwarding Strategy

For every data item formed in the network, propose to forward it from the resource to the intention inside the time constraint T. In the procedure of forwarding, statistics can be simulated and forwarded to other nodes in conformity with definite strategies. The forwarding is doing well as long as one information copy of this records item arrives at the purpose. Strategies intended for opportunistic networks are usually used to forward records in MSNs. These data forwarding strategies are in general derived from social-aware forwarding metrics such as centrality [14] [9][12], which calculate mobile node's ability of contacting others in the network. When a node delivery data connection an additional node, the data packet is forwarded based on Compare-and-Forward [14], i.e., the data mover forwards the records if and only if the contacted node has a higher centrality and does not have this record. The innovative data carrier also keeps a copy following forwarding the data.

PROPOSED SYSTEM

LASS Data Forwarding technique

LASS (Local-Activity and Social Similarly), which has two new characteristics as compare to the existing community-based techniques as follows: (1) LASS takes into account the multiplicity of members' action inside every community based on weighted network models, i.e., local activity, more willingly than making no differentiation to all members in conditions of activity. (2) The total activity of a node can be distinct by an activity vector whose initializations are the local activity of this node for all present communities; after that, a new classification of the social similarity of two different nodes by the inner product of their activity vectors is known, by which the forwarding system can function according to a straightforward rule of choosing the convey node with advanced social similarity to the purpose.

Proposed Enhanced TCC-aware Data Forwarding Technique

In TCC-aware data forwarding approach, a like process is used. Nevertheless, the data forwarding decisions are not incompletes to these two different contacted nodes, except between all nodes in the TCC. A TCC be able to form by merging two active TCCs or by accumulating novel nodes to existing TCCs. In the TCC-aware data forwarding approach, the node with the maximum centrality in the TCC gets one data reproduction and the creative data carriers also stay their data copies. Though, this may not be the greatest option in numerous cases.

To deal with this difficulty, this paper proposes an enhanced TCC-aware data forwarding scheme, where data carriers are particular to capitalize on the data forwarding opportunity. Dissimilar from the earlier TCC-aware data forwarding system, which chooses the maximum centrality node as the data carrier, Selection of a set of nodes is done with the believe take into account that as data carriers which can exploit the data forwarding opportunity.

MATHEMATICAL MODEL

NP Complete

1. LASS Algorithm

Algorithm 1 LASS: a session from node u to w at time t

```

1: for each encountered node  $v_i$  do
2:   calculate  $SS_{uw}^t$  and  $SS_{v_iw}^t$ 
3:   if  $SS_{v_iw}^t > SS_{uw}^t$ 
4:     add  $SS_{v_iw}^t$  to the set  $Temp^t$ 
5: if  $Temp^t \neq \emptyset$ 
6:   sort the values in set  $Temp^t$  in descending order
7:   choose the largest  $SS_{v_iw}^t$  from  $Temp^t$ 
8:   node  $u$  transmits the message to node  $v_i$ 
9: else
10:  node  $u$  maintains the message

```

In this algorithm the social similarity is calculate and gain $SS_{uw} = 0.91$, $SS_{v1w} = 1.52$, $SS_{v2w} = 1.08$. From above results, node $v1$ and $v2$ can both exercise as the next hop. If $SS_{v1w} > SS_{v2w}$, then choose node $v1$ and transmit the message from u to $v1$. After that, node $v1$ keeps on doing the similar operations like algorithm [b-1].

For LASS algorithm first needs to initialize community structure as given below

Algorithm 2 Constructing Initial Community Structure

```

Input:  $G_0 = (V_0, E_0, W_0, F_0)$ 
Output: the set of initial communities  $C_{init}$ 
1:  $x_0 \leftarrow$  apply Definition 4 on  $G_0$ 
2:  $E' \leftarrow E_0$ 
3: for each  $w_{uv} \in W_0$ 
4:   if  $w_{uv} < x_0$ 
5:      $E' \leftarrow E' \setminus (u, v)$ 
6: sort the edge weight in a descending order
7: from the largest weighted edge  $(u, v) \in E'$ 
8:   if  $Com_t(u) \cap Com_t(v) = \emptyset$ 
9:     find  $O_t(u, v)$  according to Definition 5
10:    if  $\Phi(O_t(u, v)) \geq \delta(O_t(u, v))$  and  $|V_t(u, v)| \geq 4$ 
11:       $C_{raw} = C_{raw} \cup \{V_t(u, v)\}$ 
12:  $C_{init} \leftarrow C_{raw}$ 
13: for  $C_i, C_j \in C_{raw}$  and !Done
14:   if  $\Gamma(C_i, C_j) \geq \alpha$ 
15:      $C' \leftarrow$  combine  $C_i$  and  $C_j$ 
16:      $C_{init} = (C_{init} \setminus \{C_i, C_j\}) \cup \{C'\}$ 
17:     Done  $\leftarrow$  False

```

This algorithm is federal and executes only once at the initial constructing phase. Then this structure is use to evaluate LASS. After constructing the original communities, through the passage of period, the weights of edges will vary because of strength changes of social associations, such as new people making friends with one another, users joining in or moving back from the whole social network or local communities. Thus there is need to cope with the dynamic changes. It shows in two different aspects, “out-pool” and “in-pool” cases. One can discover the insertion and deletion performance of nodes and edges between nodes. Particularly with changing edge weights, the accumulating and removing edges are established by subsequent algorithm.

Algorithm 3 Finding Changed Edges**Input:** the community structures G_{t-1} and G_t **Output:** the set of ΔE_t

```

1:  $x_{t-1} \leftarrow$  apply Definition 4 on  $G_{t-1}$ 
2:  $E'_{t-1} \leftarrow E_{t-1}$ 
3: for each  $w_{uv} \in W_{t-1}$ 
4:   if  $w_{uv} < x_{t-1}$ 
5:      $E'_{t-1} \leftarrow E'_{t-1} \setminus (u, v)$ 
6:  $x_t \leftarrow$  apply Definition 4 on  $G_t$ 
7:  $E'_t \leftarrow E_t$ 
8: for each  $w_{uv} \in W_t$ 
9:   if  $w_{uv} < x_t$ 
10:     $E'_t \leftarrow E'_t \setminus (u, v)$ 
11: compare  $E'_{t-1}$  and  $E'_t$ 
12: get the set of changed edges  $\Delta E_t$ 

```

2. Enhance TCC-aware Algorithm

Algorithm 2 Enhanced TCC-aware Data Forwarding Strategy when two Nodes A, B Contact

```

1:  $\mathcal{M}_A \leftarrow$  the set of nodes in  $A$ 's original TCC
2:  $\mathcal{M}_B \leftarrow$  the set of nodes in  $B$ 's original TCC
3: if  $\mathcal{M}_A = \mathcal{M}_B$  then
4:   Do NOTHING /* $A, B$  are already in the same TCC */
5: else
6:   /* Forwarding decision inside the TCC will be made centrally
7:   at a command node  $C$ , which is chosen from  $A, B$ .*/
8:   if  $|\mathcal{M}_A| \leq |\mathcal{M}_B|$  then
9:      $C \leftarrow B$ 
10:   else
11:      $C \leftarrow A$ 
12:   end if
13:   /* $C$  will identify the nodes inside the new TCC and the data
14:   items carried by them, and make the forwarding decision.*/
15:    $\mathcal{M} \leftarrow \mathcal{M}_A \cup \mathcal{M}_B$ 
16:    $\mathcal{D} \leftarrow$  the set of unique data items in the new TCC
17:   for each data item  $d \in \mathcal{D}$  do
18:     if  $\mathcal{M}$  includes  $d$ 's destination then
19:        $d$  is forwarded to  $d$ 's destination
20:       Go to next data item
21:     end if
22:      $k_d \leftarrow$  number of copies of  $d$  in  $\mathcal{M}$ 
23:      $H_d \leftarrow$  node with the highest centrality
24:     if  $H_d$  does not have  $d$  then
25:        $k_d \leftarrow k_d + 1$  /*Add one extra data copy*/
26:     end if
27:      $\mathcal{S}^* \leftarrow$  the optimal set of  $k_d$  nodes
28:     /*Decide  $\mathcal{S}^*$  as discussed in Section III-B3.*/
29:     /*Nodes in  $\mathcal{S}^*$  will be new carries of data item  $d$ .*/
30:     Data are forwarded from old carriers to nodes in  $\mathcal{S}^*$ 
31:   end for
32: end if

```

The enhanced TCC-aware data forwarding approach is presented in above algorithm. On the basis of the original TCC-aware data forwarding approach, the enhanced TCC-aware data forwarding strategy adds an additional step that redistributes records copies within a single TCC. Alike the novel scheme, one additional data copy is produced if the node with the maximum centrality does not have the record. Then, all data copies are redistributed in the TCC, to confirm that they are carried by a set of nodes with the most favourable forwarding capability.

PERFORMANCE EVALUATION

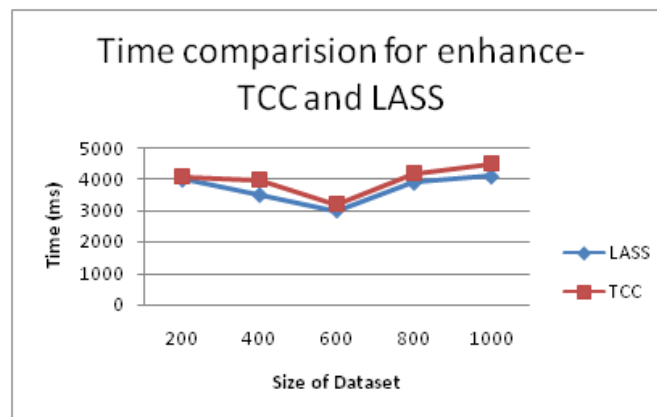
Simulation setup

We evaluate all the data forwarding strategies on dataset consist of multiple nodes. As depicted, not only in the best case but also in the worst case, the appropriate value for combining Threshold α is 0.6.

Comparative analysis

From result it Enhance TCC aware data forwarding approach gives better results than LASS data forwarding system. Among several nodes the predictable result must find such nodes which have highest similarity to forward message over it devoid of considering mobility. Because in this dataset is employ to get outcome.

From the overall study and computation, time require or finding path to pass message is less in enhance-TCC as compare to LASS technique.



Execution Time comparison of LASS and enhance-TCC.

CONCLUSION

This paper signifies different forwarding techniques, and the correctness and pragmatism of definitions preside over performance of the technique indeed. From results, Enhanced TCC-aware data forwarding algorithm is intended to get good performance of data forwarding in MSNs. This improves the TCC-aware data forwarding by select a best set of nodes in the TCC to keep away from overlap in their contacts and exploit the data forwarding prospect with a small amount of nodes. In future, this technique will apply on dynamic operations. And also frequent adding and deleting actions reduces performance of method so to increase efficiency there will have particular mathematical methods.

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