# Improving Proficient Routing using Periodic Encounter Patterns for Sporadically Connected Mobile Networks

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**Abstract**

*Delay Tolerant Mobile Networks (DTMNs) make available announcement despite the sporadic attendance of incoherent sub networks. This work really finding a set of sequential opportunistic encounters pattern between pairs of mobile system. In this background, considerate mobile node behavior is indispensable to design effective and efficient network protocols. In previous work designed to predict future encounters where predictions depend on exploring the possibility age of encounters and integrated connections in the mobile data. However, those previous result put up with from not fixed predicted encounters with be deficient in of routing information such as encounter times. These jobs propose to take advantage of periodicity within mobile data to find constant encounters for routing in DTMNs. In this work, first in attendance a generic methodology to model and find periodic encounter patterns by using the auto-persistence function and detection techniques derived from it.*

***Keywords:*** *Wireless Access point, Delay Tolerant Mobile Networks*

**Preamble**

Mobile nodes have been observed to exhibit periodic behaviors[1]. They tend to have a relatively stable sequence of activities because of their social or controlled behaviors[2]. For example, people often use the same routes daily to commute to and from work. Farm animals and animals in the wild also exhibit predictable mobility behaviors in terms of paths followed, places they rest, feed, etc. One result of these repeated activities is that each mobile node may encounter one or more other nodes periodically[3]. In real world communication is very important one source to destination. Some time communication is broken up for when communicated, so can detect and extract these periodic encounters. Therefore, periodic encounters can be used to find and schedule routes for communication. In order to utilize periodic encounter patterns, so first need to detect and extract them from node mobility. In this work propose a methodology to find periodic behavior within real mobility traces and examine connectivity's among mobile nodes with periodic behavior.

**Existing Method**

1. The previous work not controlled routing[4] with a social network the time delay of delivery.
2. Mobility traces respect to inter-contact times and reach ability of nodes are not matched.
3. Device associations were captured every minute and every time in a real network.
4. The network index was calculated as the average of the location similarity index values for all devices for a given time lag between successive observations not sufficient.
5. Each trace was split up into consecutive intervals based on a given granularity.
6. To finding exact periodicity and partial periodicity in transactions with the characteristic that events are perfectly periodically.

**Proposed Technique**

1. The Proposed technique extracting the specific encounter patterns for pairs of nodes that meet each other periodically.
2. To conduct experiments on different network types including Bluetooth, cellular and wireless local area networks whereas previous studies only concentrated on wireless local area networks.
3. To investigate the persistence of detected periodic behaviors.
4. To discover periodicity in human routines, a new method was proposed to find the minimum routine period of events that

have some periodicity but do not always occur at the exactly the same time.

**Proposed methodology**

To introduce the methodology used to find periodic patterns. First, to determine the terminology and model mobility traces. Second, to determine the analyze time series and produce periodic encounter patterns. The auto-persistence function is planned from the restricted probabilities of the diverse combinations of two values in a binary time series that are split by a given lag k, that is k positions away in encounter series. It define the auto-persistence function (APF) as

APF (k) = P (dt+k = 1jdt = 1) (1)

where k is the lag between intervals. An experimental corresponding item to the auto-persistence function, the auto-persistence graph (APG) is defined as:

$$APG(k) = \frac{n}{n-k} \frac{\sum_{t=1}^{n-k-1} I\{d_{t+k}=1, d_t=1\}}{\sum_{t=1}^{n} I\{d_t=1\}} \quad (2)$$

where n is the size of encounter series, k is the lag, and I is the binary indication function, whose value equals 1 if and only if the condition is satisfied.

$$R_{x,y} = \frac{\sum_{j=1}^{n} d_j}{n} \qquad R_{x,y} = \frac{\sum_{j=1}^{n} d_j}{n} \quad (3)$$

$$P_{x,y}^{m} = p_1, p_2, \cdots, p_m \; where$$

$$m < \lfloor \frac{n}{4} \rfloor \; and$$

$$p_j = \begin{cases} 1 & iff \; \sum_{i}^{\lfloor \frac{n}{m} \rfloor} d_{i*m+j} \geq T * \lfloor \frac{n}{m} \rfloor \; for \; j \in [1,m], \; i \in [0, \lfloor \frac{n}{m} \rfloor - 1] \\ 0 & otherwise \end{cases} \quad (4)$$

From the APG after pre-processing, considered the declare whether an encounter series has a periodic encounter behavior or not. In addition, it can identify the period of the behavior. Once the period is known, the extract the encounter pattern from the original encounter series using alignment, where each encounter series is split into several disjoint segments, each of whose length equals the period previously detected. In general, multiple encounter behaviors with different periods could appear in a lengthy segment; thus, we use the term period to refer specifically to the interval over which a behavior repeats (irrespective of phase), and segment to refer to a fixed-length portion of a trace. Given the length of the input series, n, and the period length, m, there would be [n/m] complete segments. It consider an encounter a periodic encounter if it has a frequency greater than the threshold, T *[n/m], at the same phase during all observed periods.

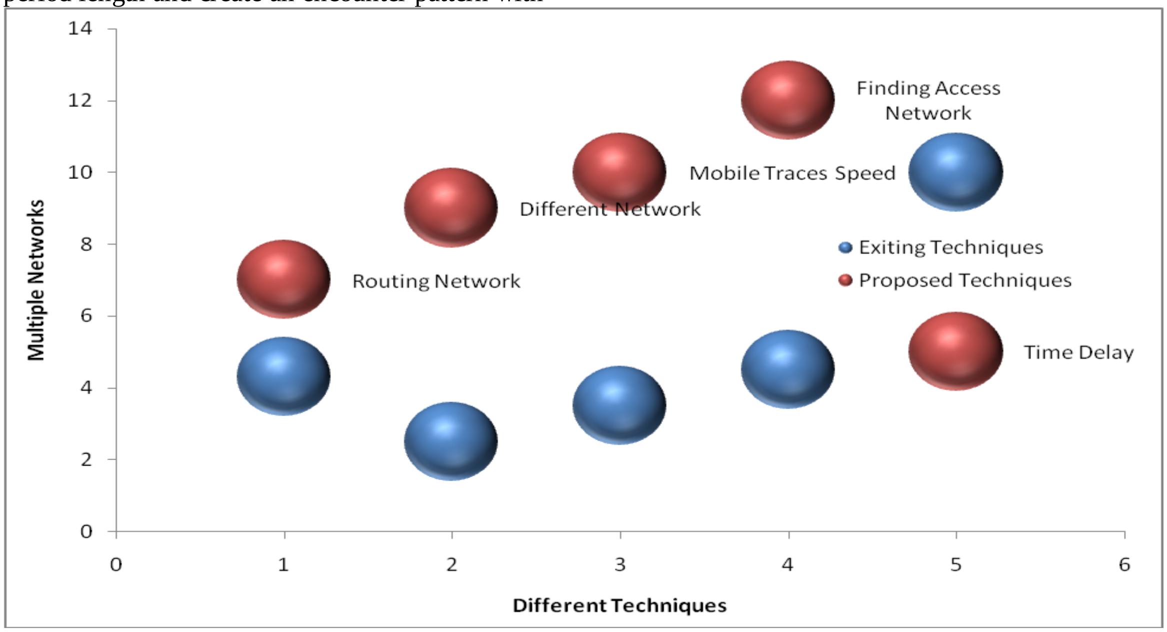
**Experimental results**

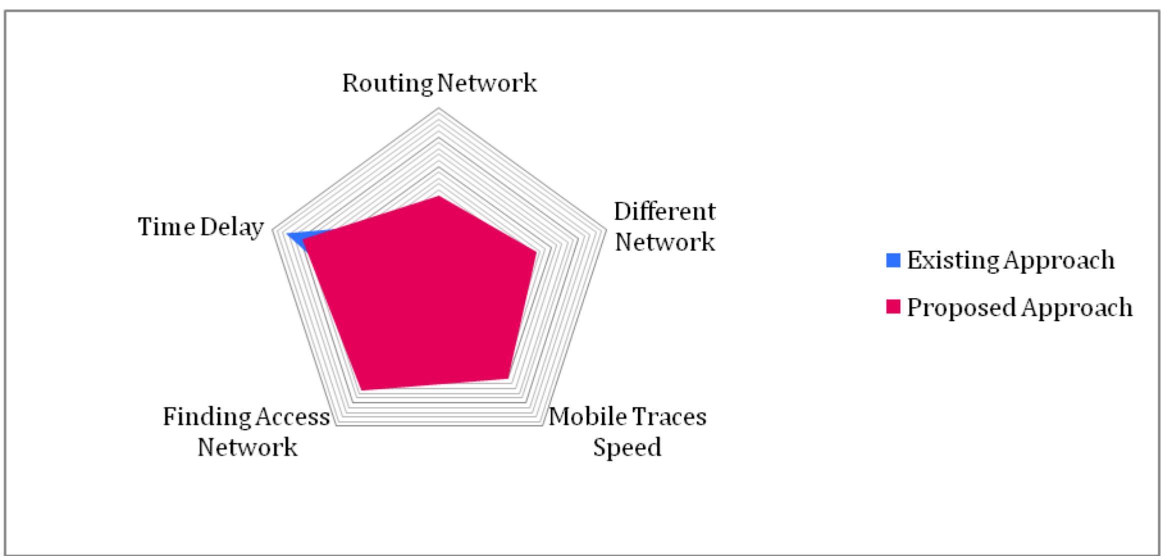
By constructing synthetic traces[5], It can control the characteristics of the encounter patterns, including period lengths and the phase(s) of encounters within a pattern. This work proposed four controlled variables to create synthetic encounter series.

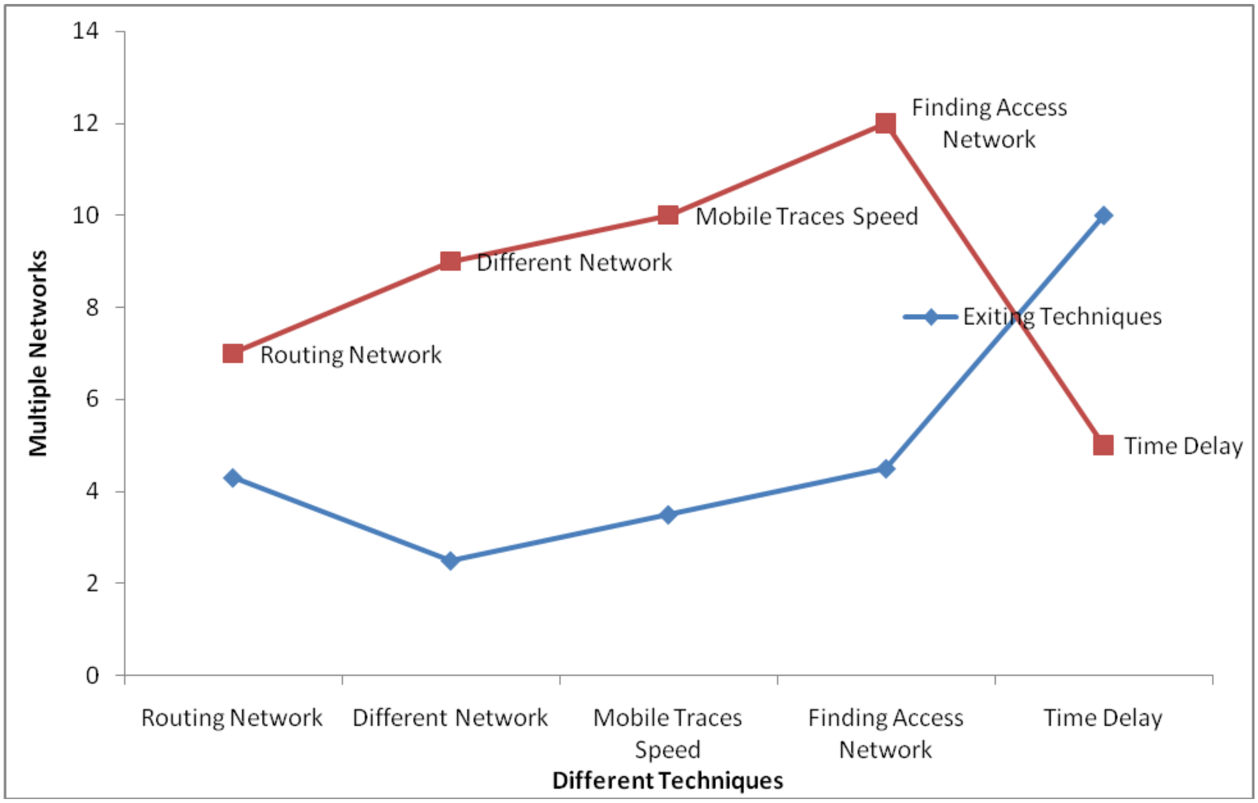
1. Period length m is used to control the length of an encounter pattern Pm x;y.
2. Probability pa is used to control the chance of missing an encounter within a periodic pattern. In other words, pa controls the probability that a periodic encounter does not occur.
3. Probability pb is used to control the chance of an unexpected/occasional encounter occurring at a non-encounter phase.
4. Threshold T defines the probability of a periodic encounter appearing at a phase. Period length is controlled for

consistency. Given fixed values for pa and pb , the longer the period, the higher the chance that an event will be changed. In order to keep probabilities consistent, period length m is controlled as well.

To produce an encounter series, work need to select a series length, n. In these experiments, n is set to be 1440 to model duration of one day with a one minute granularity, or 60 days with a 1 hour granularity and so on. These works first chooses a period length and create an encounter pattern with the chosen length. Note that there is at least one encounter within an encounter pattern. Then, encounter patterns are concatenated until the desired series length n is reached. If probabilities pa and pb equal zero, then we have a perfect encounter series. As both probabilities increase, they bring more and more noise into the encounter series. For the following, set T = 80%. The generated 100,000 encounter series for each combination of the remaining three variables and applied our method to produce the results.






## Conclusion

This work concluded user mobility, and the patterns of encounters between nodes, is critical for communications within a DTN. Instead of blindly using opportunistic encounters, periodic encounters can be used in routing messages between nodes. It is considered explore the periodicity and regularity within encounter series by applying the auto-persistence graph. Our experimental results show that our method is robust and can detect and extract the periodic behaviours in synthetic traces. It can also detect and extract encounter patterns in real traces with up to 100% accuracy. It is show that noise in the form of unexpected encounters, and in the form of missing periodic encounters, affect the fidelity of our method equally and there is no long-term periodicity within mobility traces whereas periodic behaviours could be interrupted by unexpected events from time to time.

## Future Issues

In future suggest that periodic behaviours are highly likely to change after a few months. This helps us to determine how stable and persistent a pattern is, which explains why one is not able to find a pattern that lasts the whole duration of the mobility trace. To understand the properties of networks formed by periodic encounter series and networks are scale-free networks delivered through a very small number of hops in the network.

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