

CHAPTER 2

BACKGROUND AND LITERATURE REVIEW

2.1 Introduction

This chapter provides an overview of the literature that is related to prediction in MANETs environments, so it is made of three main sections, section 2.2 defines our knowledge gap, section 2.3 explains the conceptual framework. Section 2.4 provides a theoretical framework with analytical and critical discussion of some recent related works.

2.2 Defining knowledge gap

The figure 2.1 shows our work point which is “prediction based on RSS”, in section 2.3 all concepts used in this cone or this research are explained.

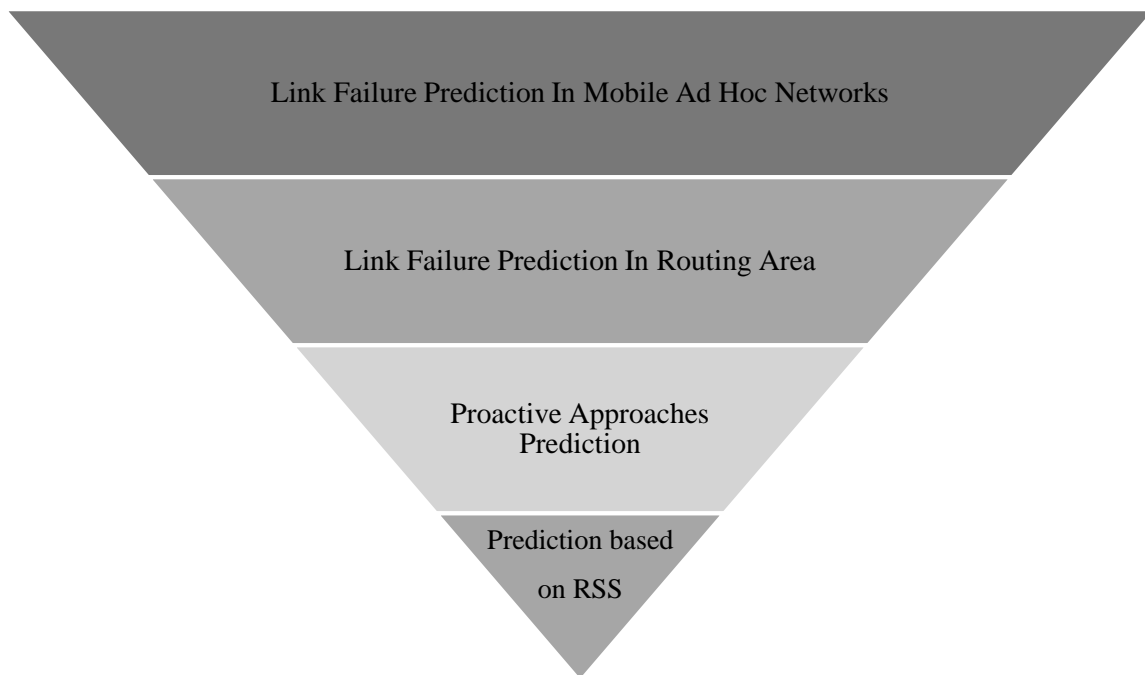


Figure 2.1 Conceptual Cone Determines our Knowledge Gap

2.3 Conceptual framework

This section explains the different concepts used in this literature, based on criteria types which are used to determine the type of prediction algorithms. The figure 2.2 shows four main criteria types used for classifying link failure prediction algorithms.

Like we showed in earlier chapter that MANET has a dynamic topology, means that it contains a set of nodes that are continuously moving leading to random changes in the network topology rapidly at unpredictable times.

For this purpose, the mobility of nodes and radio propagation effects cause frequent changes in the topology of MANET, so link failure and link recoveries occur frequently in MANET. Consequently “reliable high bandwidth” is a challenge in MANET. One successful strategy to alleviate the impact of topology changes is to **predict** [37, 40] them before the change occurs.

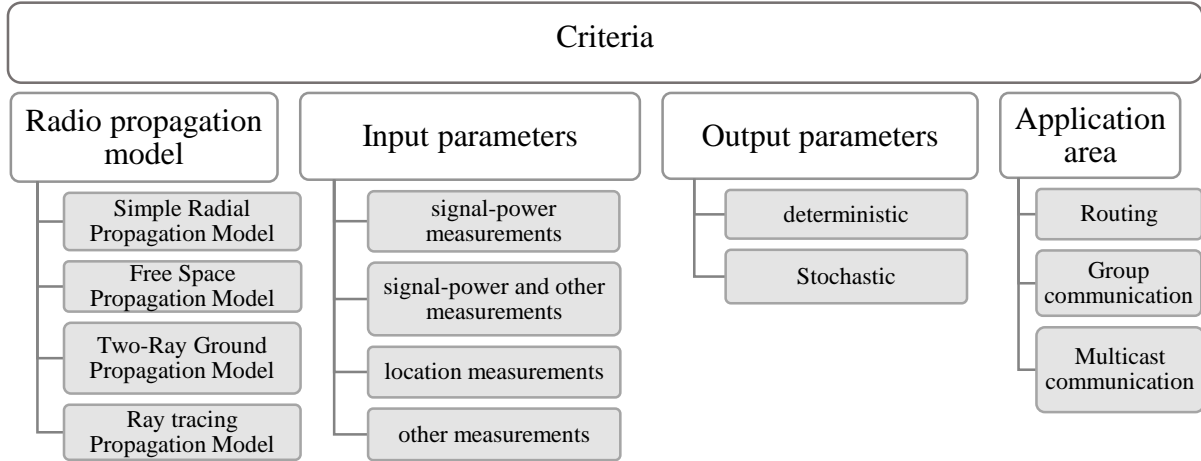


Figure 2.2 Criteria Types Used for Classifying Link Quality Prediction Algorithms

One of the criteria types used is the input parameters that the algorithm uses to make prediction. The inputs can be signal power measurements, location measurements obtained by GPS, and other measurements like in [30], such as the link age, hop count, or metrics that calculate ratios based on the number of transmitted and received packets in the recent past. Prediction based on RSSI (Received Signal Strength Indicator) focus on radio propagation model, prediction based on location measurements concentrate on the mobility model [45].

Another criterion is the output of the link quality prediction algorithm. So the output can be deterministic or stochastic.

➤ Deterministic, if the output is subnet of a finite set of states, so the input parameters are well known, i.e. deterministic. None of them is random. Most deterministic prediction algorithms surveyed have only two possible output states: Packets are predicted to be either lost or received for some time into the future [45].

➤ Stochastic, if the output of a link quality prediction algorithm is a subset of an infinite set of states, i.e. is a collection of random input parameters representing the evolution of some system of random values over time. Since the output is in that case usually a **probability**. Exp: an algorithm that estimates the probability of successfully receiving future transmitted packets is stochastic [45].

Another possible classification is the application area [30, 38] of prediction algorithm. The effectiveness of such proactive operations has been demonstrated in the area of multicast communication [39] and routing, partition prediction in group communication [45].

Last criterion is radio propagation models, which can be simple radial propagation model, free space propagation model [44], and tow ray ground propagation model [44]. In the simple radial propagation model a two nodes can communicate with each other's if the distance between them is less than or equal to a threshold [45].

2.4 Theoretical Framework

The table below presents some recent related works:

Author, year	title	Input parameter	scheme	Findings
Charu Gupta et al, 2014 [14].	An Approach to Link Failure in MANET	Rssi	A new Algorithm was proposed, which acquaint a method of link failure prediction and consequently execute a rapid local route repair.	Simulation proves that : -this algorithm minify packet dropping rate, end-to-end delay and maximize packet delivery rate.
Anita Yadav et al, 2015 [15].	Improving Routing Performance in AODV with Link Prediction in Mobile Adhoc Networks	Rssi	-A prediction function that predicts link breaks based on signal strength of the three consecutive received packets and a threshold signal strength was proposed. -The AODV can thus proactively initiate repair earlier than the failure.	The simulation results show that: -the proposed algorithm performs well and results in lower end-to-end delay and higher packet delivery ratio due to local and proactive repair processes, -and therefore leading to improvement of the Quality-of-Service.
Mohammed M. Kadhum et al, 2015 [16].	Innovative Route Maintenance Based on Link Failure Prediction for Mobile Ad Hoc Networks	Rssi and link state	route maintenance for source routing in MANETs was proposed by utilizing: -link status prediction -route recovery.	The experimental results showed That : -the proposed mechanism performs well in medium-sized highly dynamic environment. when a link or node on an active route is about to fail, -It was shown that the proposed mechanism offers better PDR and lower control overhead compared to DSR and AODV. -These metrics were measured with respect to the rate of link breakages occur in active routes that is based on the mobility of nodes.

continued				
Author, year	title	Input parameter	scheme	Findings
Gnanasekaran.P et al, 2015 [17].	Link Breakage Time Based QoS Improvement in Mobile Ad hoc Network	Rssi	-signal strength based routing mechanism and earlier prediction of link breakage time was proposed, to improve the throughput. -The throughput improvement enables the possibility of multimedia applications in mobile ad hoc network	The simulation results show that: - the throughput increment in LBT_AODV compared to normal AODV. - Throughput is increased because of selecting optimal links. - packets dropped is decreased in LBT_AODV, and the end-to-end delay is minimized due to the earlier prediction of new route.
Edward Y. Hua et al, 2015 [18].	Mobile-Projected Trajectory Algorithm With Velocity-Change Detection for Predicting Residual Link Lifetime in MANET	Distance measurements and velocity	- this study proved that when mobile nodes do not possess any knowledge of their speed, direction, or position, it is necessary to periodically measure only four distances to compute a unique RLL solution. - MPT algorithm to compute the RLL was proposed, which performs linear curve fitting based on the periodical distance measurements. - VCD test and derived a minimal detection Threshold was proposed that guarantees zero probability of false alarms.	The results show that: - MPT performance evaluation shows, that measuring more distances with a constant sampling period would improve the prediction performance. - The results showed that the VCD test achieved a very robust detection probability with low probability of false alarms.
Gaurav Singal et al, 2016 [19].	Moralism mobility prediction with link stability based multicast routing protocol in MANETs	Rssi and link state	- the links with long active duration time can be identified as a stable link for route construction. - Variation in signal strength is used to identify whether the direction of the node is towards or away from estimating node. - Signal strength was considered as QoS metric to calculate link stability for route construction.	- Analysis of simulation results show an improvement of various routing performance metrics such as DSDR, ART, routing overhead and packet drop ratio.

continued				
Author, year	title	Input parameter	scheme	Findings
Sedrati Maamar et al, 2016 [20].	Predict Link Failure in AODV Protocol to provide Quality of Service in MANET	Rssi	<ul style="list-style-type: none"> - PF_AODV protocol based on AODV was proposed which improved QoS for applications in MANETs - regulate conflicts caused by more than one procedure launch to ensure handoff phase between neighboring nodes to minimize control load is to introduce a random delay before each node initiates handoff phase, one node initiates this phase earlier than other or to promote nodes near the destination, if not; source recovery in AODV will better do. 	<ul style="list-style-type: none"> - The simulation results shows that: - PF_AODV provides better performance in terms of throughput, loss and delay.

Table 2.1 Summary For Some Recent Related Works

2.4.1 Discussion and critiques

In this section, we will discuss and criticize different methods and recent related works, which are focusing on link quality prediction algorithm. So the most important application area for link quality prediction in the literature was found in routing area [45].

Although, all link failure prediction algorithms are based on received signal strength which focus on radio propagation model [14-17, 19-24, 27, 29, 33, 36, 43], can be relied with a large proportion on speed of nodes [28]. So in [28] the whole network is divided into 6 zones. Also, 6 static speed monitors are deployed in each zone. These static speed monitor will monitor speed of each node present in that zone. The nodes moving with minimum speed are selected to route data from source to the destination.

Likewise, several researchers' takes two input parameters RSSI and GPS for determining the location of node thus prediction is made [26], other authors determine that they can use GPS with speed of nodes. [28]. But, however, various studies based on GPS for determining location of node [26, 22], GPS Does not give a good result [18]. Therefore, other measurements should be taken for getting best deterministic prediction.

However, several research studies focused that the outputs of prediction algorithms can be deterministic and can't base a study on random variables and probability of prediction [14-18,

28-33, 37-40], other study in [34] shows that it can take a good stochastic prediction using link availability measurements in order to find more reliable paths, Availability is used to measure probability or degree that a link is available. Therefore, it does not matter the output of prediction algorithms as much as utilization the inputs thoughtfully.

Interference prediction [41] and self-congestion prediction [42] methods are new measurements which taken to improve routing performance. In [41], a general-order linear model for node mobility was proposed, this model gave a best estimate of the time-varying interference at any time rather than long-term average effects.

In [42], a self-congestion prediction (SCP) algorithm for congestion prediction was proposed and modified AODV with SCP to propose a novel A-SCP protocol for alleviating congestion and efficient routing. . The objective of the algorithm is to minimize network overhead and improve the throughput without deteriorating the network. Consequently, according to the input types, several prediction approaches can be defined to improve the route quality and get better performances. This makes it an attractive research area.

2.5 Conclusion

According to several research works found in the literature, mobility prediction in MANET can be an interesting alternative to improve the performance of routing protocols. As the mobility of the nodes and the shared propriety of the wireless medium increase the complexity of the routing protocol, the prediction may increase the lifetime of the routes and, thus, improve the routing performance. This chapter has provided an overview of the literature of different types of prediction methods used in MANET routing research. So, several methods and different criteria were explained. The next chapter will discuss the conceptual design of the used prediction scheme, and how this method may improve the routing performance.