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Role of Deep Learning in Mobile Ad-hoc Networks

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Abstract—The portable capability of MANETs has specially delighted in an unexpected expansion. A massive need for dynamic ad-hoc basis networking continues to be created by advancements in hardware design, high-speed growth in the wireless network communications infrastructure, and increased user requirements for node mobility and regional delivery processes. There are several challenging issues in mobile ad-hoc networks, such as machine learning method cannot analyze features like node mobility, channel variation, channel interference because of the absence of deep neural layers. Due to decentralized nature of mobile ad hoc networks, its necessitate to concentrate over some extremely serious issues like stability, scalability, routing based problems such as network congestion, optimal path selection, etc. and security.

Keywords-LSTM; GRUs; DeepChannel; Deep Neural Networks; Deep Q-learning Algorithm; MANETs; Clustering Algorithm.

I. Introduction

MANETs support multi hop wireless communications that are self-organizing and self-configuring without centralized point control, where wireless connections and impulsive interactions take place in a highly dynamic environment between mobile nodes [20]. Over the most recent couple of years, mobile ad-hoc networks have been effectively utilized in day to day applications and military applications. Their capacity to self-put together and self-adjust, without the requirement for a fundamental framework, leads their quick arrangement in non-ordinary situations, such as calamity recuperation [9]. All nodes MANETs have similar features & capabilities of mobility. Due to decentralized nature of mobile ad-hoc networks (MANETs) some extremely serious issues like stability and scalability, routing based problems such as network congestion, optimal path selection, etc. and security [10].

TABLE I. POINT OF COMPARISON BETWEEN DEEP LEARNING (DL) AND MACHINE LEARNING (ML)

Deep Learning	Machine learning
• Deep Learning handle huge amount of structured and unstructured data.	• Machine learning is unable to handle huge quantities of data.
• Deep learning can easily solved by complex operations, problems.	• Machine learning cannot handle complex problems like real world problem.
• To train the model, deep learning can automatically feature extraction.	• To train the model, machine learning can manually feature extraction.
• Training time required to train any particular model as compared to machine learning is more because of handle huge amount of data.	• So any specific model requires less training time compared to deep learning.
• Compared to machine learning, testing time was less necessary.	• In comparison to deep learning, testing time requires more.
• A deep learning-based model necessitates a large amount of datasets.	• With a machine learning-based model, good results can be achieved even with small datasets.
• Data is processed through a series of non-linear transformations to produce an output in deep learning.	• Data is processed through a series of linear transformations to produce an output in machine learning.
• Artificial neural networks are used in deep learning to allow machines to make decisions.	• Machine learning allows machines to make decisions based on past data on their own.
• The issue is resolved from end to end manner.	• Instead the problem is divided into components and resolved individually and then combined.
• Deep learning examples like Google lens, Facebook face recognition, mobile check deposits.	• Machine learning example like Google recommendation, amazon recommendation.

II. Background and Related Works

VANETs are self-organizing ad-hoc basis networks made up of self-regulating nodes with dynamic node mobility that frequently keeps changing network architectures. The main aim and objective of VANETs deployment is to increase road safety and decrease the number of traffic accidents. Routing becomes difficult in a VANET because the nodes are so movable. The topology of the VANET changes as the nodes move quickly. As a consequence, predicting node movement in an ad-hoc basis system of automobiles is still a difficult task. More accurate mobility prediction aids in determining the most suitable path between nodes, resulting in more efficient routing. Estimating secure paths between many nodes among nodes

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reforms in a more efficient manner in this, lowering overhead and minimizing connection interruptions [1].

Authors established mathematical model is related to numerous processor constructions of the cellular network, but the emphasis here is also on the complete architecture of the network separation control or sometimes even data. Furthermore the, as major part of the holistic cost, HO original prediction is usually recommended and actually calculated for the first time, including by the simply applying a recurring deep learning-based design for investigation, precisely a stacked_long_term_memory (SLTM) model [2].

It is necessary to effectively model and predict difference in the quality of wireless communications links. Deep channel design, decoder-encoder based order to order model that can detect connectivity signal power differences based on signal quality data calculated previously. In this work Authors study two dissimilar kinds of deep channel versions; the first and second types of variations use long short term memory (LSTM) as their basic cell structure, and gated recurrent units (GRUs). Unlike earlier work started to concentrate on designing models for specific wireless communication settings, deep channel is extremely active and can appropriately make predictions channel conditions for numerous communication systems, sampling rates, patterns with mobility, and standards with communication [3].

The clustering techniques in this are amongst the most cost effective ways of matching routing in MANETs to focus solely on strengthening performance of the network using key characteristics and metrics. Selection process of the cluster head (CH), clustering techniques have indeed been thoroughly researched and spread across multiple types, leading to a better understanding about how every kind of clustering algorithm distinguishes within each supplementary [4].

In this paper authors try to introducing a deep learning based framework throughout this work for the implementation of communication system routing flow of traffic. Routing decisions can be made in distinctive perspectives based on the individual objective and, predicated on that objective function, optimum solution can be determined using a variety of approaches. Evaluating these solutions, however, involves overcoming complex optimization problems and, consequently, typically cannot be done at runtime [12]. Conversely, heuristics are often created for these challenges, but in many cases, constructing them is not trivial. A suggestion for the architecture of abstractions is the mobile network routing framework suggested in this, while still achieving satisfactory precision [16]. This is accomplished through the creation of a deep learning model trained in optimal solution choices and decisions that flow from recognized traffic requirements [5].

An effective tool for helping to protect mobile ad-hoc networks data traffic against threats and malicious attacks was the network-based intrusion detection system (IDS). Numerous techniques have recently been suggested; however, due to the constant exposure of new security issues that are not identified by current systems, these face numerous challenges. Authors introduce additional two phase deep learning-based model for very well organized NID, depending on a stacked-auto-encoder (SAE) with a soft-max differentiator [25]. The model distinction was a two possible phase: an initiation phase that takes responsibility for categorizing network traffic as normal as well as anomalous, using a probabilistic score value such as this one. In the final conclusion phase of development, this was then used to notice the regular state and supplementary classifications of attack as an interesting benefit. From massive quantities of unlabeled data, the authors recommended system can gain knowledge of helpful feature representations and categories them periodically and appropriately [7].

III. OVERVIEW OF DIFFERENT RESEARCH METHODOLOGY AND THEIR DESIGN

A. *The Management of Node Movement in MANETs*

One of its most necessary issues in the management of movement's is the provision of ubiquitous wireless communication. Throughout specific, the critical process of movement's management is the significant mechanism which provides a time-varying modeling between both the mobile node identifier in wireless networks as well as its location in relation to the network structure.

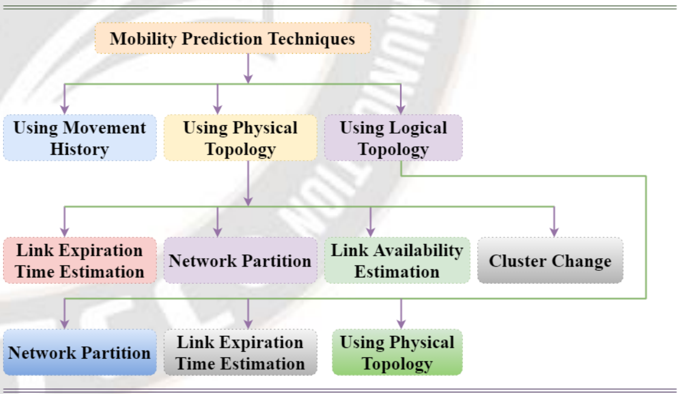

Figure 1. The Movement Prediction Approach Classification

Node movement's prediction analysis is used to examine the future location of user nodes to adequately exhibit the agent nodes during the transmission purpose of maximizing connectivity in MANETs. In addition to wireless customers and units, movement assumption plays a very crucial role in the environmentally friendly management and planning of available network resources (for example, bandwidth, and CPU time, so on) for MANETs. In the Figure 1, a show illustrates the classification of movement's prediction

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methods mostly on basic principle of the important information used in the prediction system.

A new tactic looks to be using a model based on a neural learning machine to predict future node places in MANETs. This model is compared with the existing MLP and ELM architectures. The recommended method is based on an architectural design with a SFFL known as the ELM. In order to predict routing tables that would decrease data exchange in MANETs and improve the performance of the node battery further and further, the suggested prediction method of the ELM will be prolonged.

- **Neural Machines Learning based Prediction Model**

The behavior patterns of human brain neurons are imitated by neural network based devices, influenced by the mammal's brain [4]. Though the interconnecting as many neurons as required, these machines can gain or gaining information of functions that are highly nonlinear and complex [5]. In Figure 2, a prototypical complex or specifically constructed neural network based learning machine is on the condition or understanding that. The architectural design of the two hidden layers of a neural network is organized by an input layer, two hidden layers, and an output layer. Each hidden layer extracts a more complicated depiction for the preceding layer, so that the last hidden layer would also have a recognition intentionally designed to differentiate between specimens of various classes. As a result, models based on neural network learning, including data mining, computer vision and reinforcement learning, have long been crucial in a multiplicity of applications. The models of prediction using neural machine learning are composed of

1. Neural Learning for Learning with Multilayer Perceptron (MLP) based Architectures

The perceptron model was developed in 1958 as the first adaptive learning algorithm [6]. Through some kind of trial and error basis, it can acquire knowledge of linear data patterns. It should be mentioned, however, that the perceptron model is not capable of recognizing non-linearly able to be separated or treated separately data such as that relating to the XOR problem [7]. These solutions have fallen by the wayside and have been stable for more than a decade because of certain constraints [8]. In the meantime, those certain different algorithms, such as support vector machines (SVMs), were considered satisfactory for addressing such critical tasks as well as issues.

2. Extreme Learning Machine-based Architectures besides Neural Learning Machine (NLM)

The extreme learning machine model was then lengthened to an oversimplified SLFN where the neuron-like framework of the network isn't really needed. Extreme learning machine doesn't really necessitate parameter tuning in its hidden layer, much more so than conventional SLFN. The extreme learning machine construction framework also follows an unknown quantitative node in the hidden layer, completely separately from the training data. In this direction, not only does this model accomplish the smallest training error, as well as the smallest specification of output weight. The output weights are then assessed on the basis of fixed specifications in the hidden extreme learning machine layer by using the least square solution (LSS).

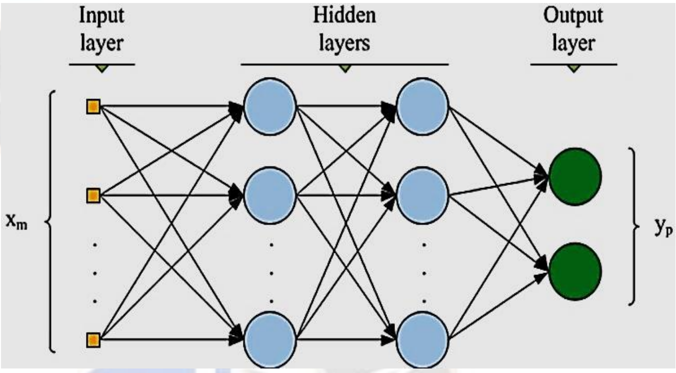

Figure 2. Architecture-based Two-Hidden Layer Neural Learning Machine

It illustrates a simple representation of the learning architecture of the extreme learning machine as shown in Figure 3. A simple response to the problems of MANET movements of nodes based on neural network learning, in which future changes in the pattern of the overall network framework are accurately identified.

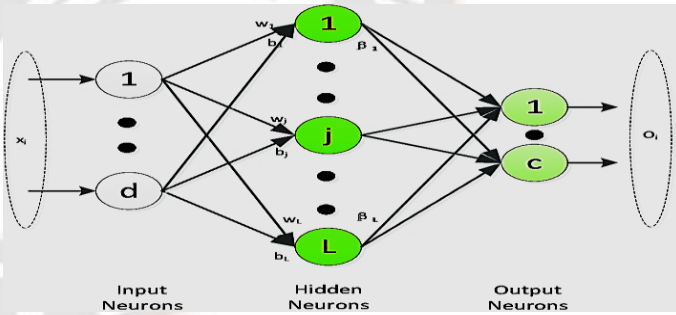

Figure 3. Extreme Learning Machine Model Traditional Architectural Design

A deep learning model is a recently appropriate approach to predict current movement's based on pause time; speed and direction of influence the actions on the node moment history to recognize mobile stations. Through some kind of deep structure consisting of multiple processing layers, deep learning is highly distinguished from input data. Multi-layer neural network (MNN) is recommended for this task, especially called deep learning algorithm. Because of the use of multi-layer neural network (MNN) to focus on improving

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the efficiency of deep learning negative issues in attempting to solve movement's prediction nevertheless remains unexploited, this should have been addressed. Effectiveness will enable improved preparation and enhanced QoS with the assistance of deep learning algorithms in terms of knowledge ease of access of services and efficient energy management in MANETs.

B. To Reducing Channel Interference in a Mobile Ad-hoc Networks (MANETs)

Interference might be what modifies a signal in an undisciplined manner in digital communications, especially throughout the wireless transmission environment, because it travels along a channel between its source and destination. The term is sometimes used to refer to the undisciplined addition of undesired radio signals to a beneficial radio signal. The movements of mobile nodes in wireless transmission environments have indeed been continuing to increase. Because with the increased movements with mobile nodes, co-channel or adjacent interference is most often experienced here. These phenomena of interference are very much a massive problem because they represent significant wireless communication performance degradation.

Significant observations in wireless ad hoc communications and wireless ad-hoc networking research have been obtained here just to model and identify wireless link quality variations effectively. This paper is based on several predictable application areas that have a huge impact on data transmission, such as improved scheduling and enhanced video streaming upwards of 4G WANETs, bit rate adaptation to continue improving the performance of the Wi-Fi network and energy efficient and large volumes of wireless communication network data transfer.

There are sudden different versions in the strength of the received signal in wireless ad hoc networking, caused by several major elements such as the ecosystem, movement's support, and communications systems, thus trying to pose a problem in developing a defining and determining task for the purpose of this prediction. The goal of these tasks is to develop a recommendation system that can accurately predict changes in received signal strength regardless of node mobility, communication standard, as well as sampling frequency.

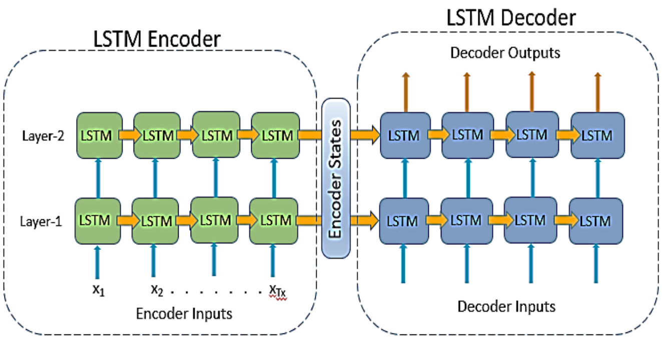

Figure 4. Sequence to Sequence Architecture-based Encoder-decoder [2]

In this, researchers attempting to design DeepChannel, a series to series encoder-decoder based neural network prototype for predicting modifications in wireless signal capacity. With the help of DeepChannel, with us objective is to generate a neural network framework that can accurately catch and forecast in wireless link feature across a variety of communication networks and movement scenarios, while also working across wireless transmission benchmarks and sample selection rates. DeepChannel includes two primary elements, each of which is an individual RNN.

I. The Encoder
II. A Decoder

The encoder's role is to calculate a state vector based on the strength of the previous signal, which truly captures the information about the channel. This state vector is used by the decoder to predict future signal strength changes. Based on the internal cell architecture used in the encoder and decoder, two model variations, an LSTM variation and a GRU variation, are presumed.

Deep one sequence to the next sequence models have the capability to forecast an increasing number of information points established on prior information calculation experience, allowing them to accurately predict more and more in the future. Furthermore, neural network models are particularly well suitable to situations where it is more difficult to differentiate precisely the reason for the information point frameworks using model based alternative methods, but the model can be realized mechanically by preparation on large amounts of information.

The profound engineering takes into account elegant learning of such nonlinear conditions as the encoded signal permits through the various distinct concealed layers. DeepChannel determinedly utilizes a repetitive engineering and plan that is most appropriate to the LSTM variation or GRU variation of time arrangement information. Cells that store the memory of dependencies that affect the prediction in a useful way. Since the sign strength key contrasts got in a genuine climate over a remote channel fluctuate generally unpredictably and have the property to be connected for significant stretches of time, this makes it in a perfect world reasonable for planning profound models explicitly made for this forecast task.

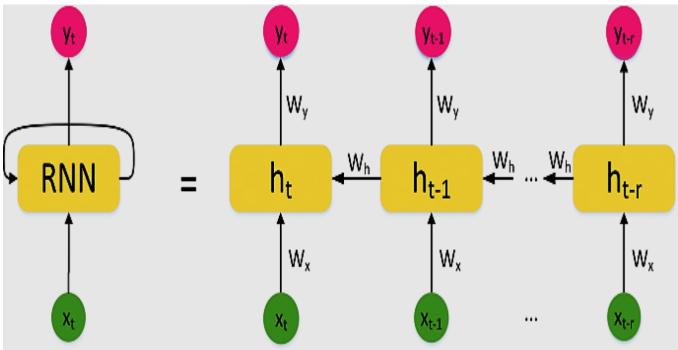

Figure 5. Illustration of RNN Architecture (RNN Folded & RNN Unfolded) [2]

The LSTM and GRU variations are based on the neural network concept, with the number of gates and their interrelations being the main differences. The LSTM cell has three gates: one *input gate*, second *output gate*, and a third *forgate* for long-term dependencies. A *reset gate* is the first gate in a GRU cell, and it combines the current input with previous memory. An *update gate* is the second gate in a GRU Cell, and it calculates the percentage of the previous state that should be remembered. Both LSTM and GRU neural network-based models were found to be efficient and effective in a variety of prediction tasks in this research. Theoretically, determining which one is more likely to be suitable for a given issue is exceptionally hard.

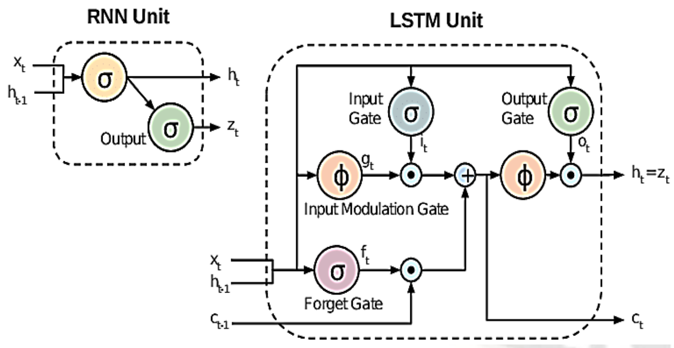

Figure 6. Design of LSTM cell Construction, gt(Input gate); ft(forget) and qt(output gate) [2]

C. To Improve better Stability and Scalability in a MANETs

MANETs have recent times commanded to an increasing number of commercials from research scientists due to their ease of deployment and ability to adapt or learn to adapt too many completely different functions or activities. The clustering process is applicable in a various fields, such as business sectors, image processing, web technology, and information retrieval. Clustering techniques, for example, can be used to analyze customer shopping behavior, sales campaigns, and customer attention in the retail industry. Clustering is without a doubt one of the most efficient ways to organize network routing in MANETs and improve network performance. The challenges of routing protocols can be try to overcome by clustering and it helps to improve scalability [23].

In mobile ad-hoc networks clustering provides a stable way to efficiently allocate network resources (i.e. bandwidth, CPU time, and so on) and also pretty much ensures network structure stability by simply providing a hierarchically organized environment [24]. Clustering is a technique for dividing objects into groups based on data points that are similar. The main features of mobile ad-hoc networks can be successfully achieved through the use of a wireless network based on clustering. Typically available, a truly big wireless network consists of smaller subgroups. As shown in Figure 7, clusters are what these subgroups are called.

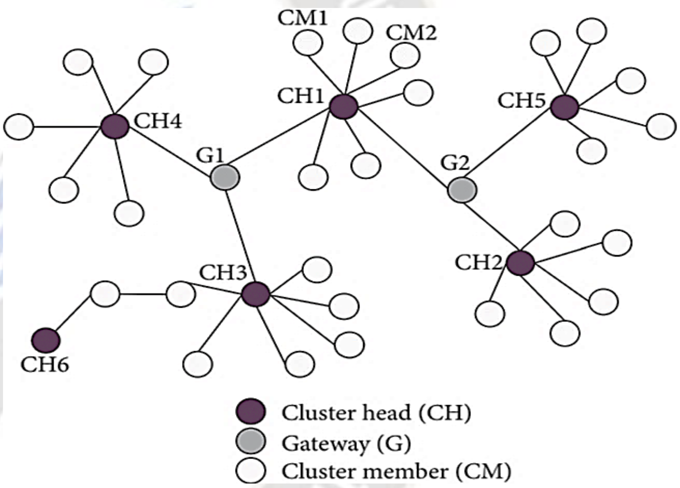

Figure 7. Clustering Techniques in MANETs

In a cluster process, a *CH* (cluster head) is chosen from among all the available peers. *CH* has the responsibility of managing cluster-related activities and ensuring that all member nodes are accessible. The CH must also control all nodes in the wireless network; as a result, the CH's selection becomes a critical factor in the network's long-term survival. As shown in Figure 7, a gateway (G) peer is a member of multiple clusters and provides a connection between them. In particular shows, the important role to play of the clustering algorithm in wireless ad-hoc networking, it performs two main functions.

I. Constructing clusters
II. Monitoring clusters

In this, cluster construction involves selecting cluster heads between nodes to form structural members. The different activities of the clustering process are handled by the cluster head, including those for cluster management process, path

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information updating, and new path discovery. Multiple clusters related activities take place in the cluster maintenance stage. These activities include re-selection of the head of the cluster, communication between clusters and intra based clustering, and the shortest path to be selected effectively.

A principal impartial of the clustering algorithm is to select the optimum CH based entirely on the safe choice rule, taking into account the performance measures. Therefore, in this empiric observation, we initially designated the proposed algorithm throughout MANETs into numerousdissimilar kinds on the simple basis of the CH eligibility criteria as well as how the nodes or peers are categorized to form a cluster of unlawful behavior. The different sorts of cluster analysis are shown in Figure 8.

- **Clustering Process based on Node Energy**

In an energy-based clustering process, the energy level of a node is the most important parameter for selecting the best cluster head. As cluster head intends the cluster and maintains the business cluster, it generates an enormous power consumption that again affects the performance of the system. As a result, the node's power limit can be a useful parameter for choosing the right CH because it directly affects the overall network life.

- **Clustering Methodology based on Network Node Mobility**

The movement level of a node in movement's based clustering is a key parameter also used to select a CH as a node in MANETs that is unable to move without a method or decision of consciousness. It is critical to monitor the movement level of each and every node or peer within a cluster in clustering based MANETs. Consequently, the node's movement level is an absolutely essential limitation that can actually significantly impact the network's performance and accuracy, and so the CH selection process can be a useful characteristic.

- **Clustering based on Identifiers**

The identifier based clustering algorithm in MANETs is a clustering algorithm in which each node has a unique identity. In MANETs, the cluster head is chosen from the nodes with the lowest and highest identities.

- **Clustering Process based on Network Topology Structure**

The node transmission range, wireless communication connections between network nodes, and node-to-CH hops all influence the structure of the wireless network's network topology. The primary objective of topology-based clustering is to better regulate the network's topology.

- **Clustering based on Artificial Intelligence (AI)**

Fuzzy logic-based, genetic approach-based, AI-based algorithms are used for every decision eventuality in the clustering process. A cluster head is also chosen by searching among all the other member nodes of a cluster for the ultimate form and most entirely appropriate node.

- **Hybrid Clustering Process**

Clustering algorithms that are hybridized are made up of two or more algorithms. Even when using a wireless connection, these various algorithms can be quickly adapted to provide more stable clustering.

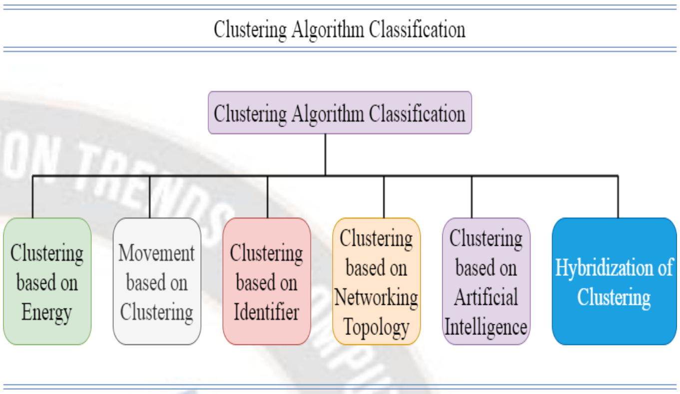

Figure 8. Different Classifications of Algorithms for Clustering Process

Instead by improving the performance of the wireless network related to spatial reuse, throughput, scalability, and power consumption, the clustering process enables better performance of the medium access control layer protocol. To improve the performance of network routing and reduce the overhead transmission system of the wireless network, efficient handling of basic parameters of movement management is required. Each node stores so much less network topology structure information and actually saves mobile node and network resources (i.e. bandwidth, CPU time, or etc.) energy for MANET algorithm multi-path. In MANETs, a relatively large as well as completely flat network is managed using network topology for clustering. In way of comparison to other network topologies, the clustering technique requires construction and maintenance costs.

D. To Minimize Routing based Difficult such as Network Congestion, Optimal Path Selection in Mobile Ad-hoc Networks

- **Deep Neural Networks**

In this case, a DNN is a neural network with a certain level of complexity that is usually hidden by at least two layers. Process data in complex structural ways in the deep neural network through the use of sophisticated math modeling. For different reasons, congestion can be caused by wireless networking, such as a routing algorithm that always selects the shortest route. As overloaded devices fail to handle traffic fully and properly, this can result in a less reliable service even in the wireless environment. But there are other specific examples of traffic engineering applications, such as with

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minimizing energy consumption [24], such as certain finding a network routing solution that once again minimizes the number of active connections in order to decrease power consumption with minimal effect on wireless system performance.

A neural network-based solution to the MANET traffic flow routing issue. This is accomplished by building a deep learning model that is trained on the best choices for traffic demand flows. Even for a number of different fields, including MANETs, machine learning models such as DNNs can be a completely appropriate tool for addressing traffic engineering applications.

Deep neural networks refer to the deeper structure of multi-layered neural networks as an extension of the multilayer perceptron with more than one hidden layer. Because it can try to extract high level abstraction from low level as well as raw data unique characteristics, a DNN can outperform shallow networks. Deep learning techniques are required to ensure hyper parameter tuning to model complex data during the training process. The previous network routing problem in the wireless environment by using a frame work based on a supervised learning (SL) model to identify the best route for each flow. Two components of the deep neural network recommended routing system are composed of

I. To determine the path with help of deep neural network (DNN).
II. A post-processing routing algorithm (PPRA) to construct a valid route from a DNN output.

An easy and appropriate way to convert a deep neural network output to a route would be to just apply a limits (-For example set limits 0.5) to each output unit that sometimes adds the corresponding network link again to the route if its value is greater than the limits value.

However, this could easily result in incorrect routes. Therefore, to ensure a correct route is obtained, a post processing algorithm on neural network outputs is applied in this. The post processing algorithm (PPA) makes it possible to obtain correct routes that take into account the DNNs preference, as the chosen route is more likely to go through connections with the DNNs higher output values, thereby reducing the link's weight.

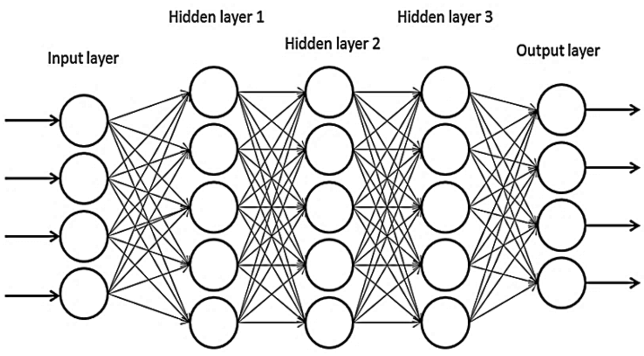

Figure 9. Deep Neural Network (DNN)

- **Dijkstra's Algorithm**

Conceivably the Dijkstra's algorithm is a greedy sort of tactic in order to discover the shortest route from a source node (for example single source node) to the destination node (for example single destination node) of the other weighted graph nodes in the logical wireless communication network. This algorithm, of course eventually, it is used to attempt to discover the shortest route between two fixed nodes i.e. the source and destination.

TABLE II. THE PSEUDO CODE FOR DIJKSTRA'S SHORTEST PATH ALGORITHM

Dijkstra's Shortest Path Algorithm is explained in detail.

```
function Dijkstra's (Network, Originator):
create node set R
for each node n in Network:
sink [n] ← ENDLESS
prior [n] ← UNKNOWN
add n to R
sink [originator] ← 0
while R is not empty:
x ←  node in R with min sink [u]
remove u from R
for each neighbor n of x:   //  only n that are still
choice ← sink [x]  +  length ( x, n )
if choice < sink [n]:
sink [n] ← choice
prior [n] ← x
return sink [ ] , prior [ ]
```

This algorithm is used in cluster analysis, as displayed in Figure 11. The non-negative weight of graph edges could be the only requirement for using Dijkstra's algorithm. The learning automate and clustering based routing algorithm for NDN algorithm, discovers the shortest route between each cluster head to other cluster heads in the network topology identification stage and records this information in a table called the table of such Dijkstra's (i.e. this table will be continuously updated periodically). In this respect and consideration, after running the LCRN algorithm and finding nodes with new accessories and particularly considering it as a

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proper response to automata from the operating environment, the shortest route can be achieved based on Dijkstra's shortest path algorithm.

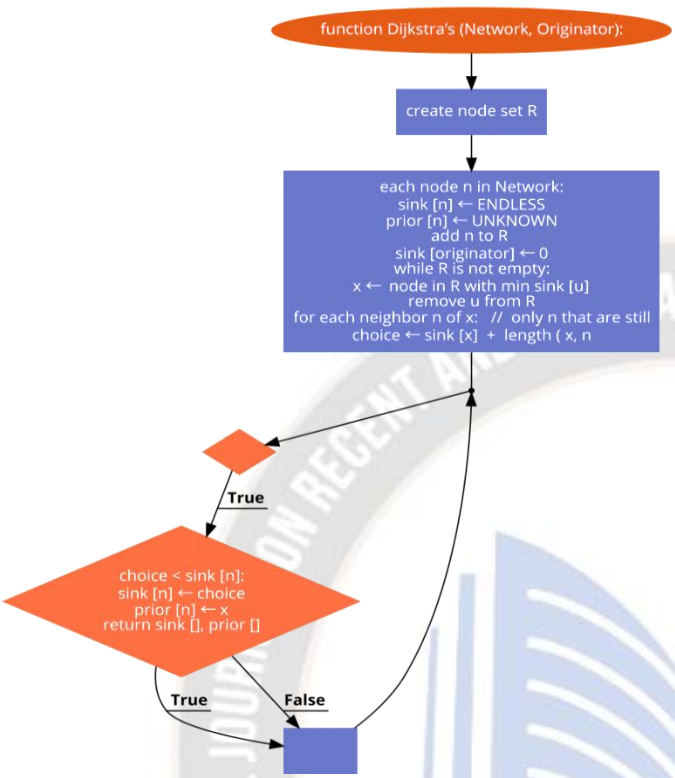

Figure 10. Dijkstra's algorithm pseudo code control flow

The algorithm pseudo code, the code *x ← node* in *R* with min *sink[x]*, searches for the *node x* in the *node set R* that has the least *sink[x]* value. The *length (x, n)* returns the length of the edge joining (i.e. the distance between) the two neighbor-nodes *x* and *n*. The *length* of the path from the root node to the *neighbor node n* if it passes through *x* is the variable *choice* on line 16.This path is replaced by this *choice* path if it is shorter than the current shortest path recorded for *n*.To find the shortest path to the source, the previous array is filled with a pointer to the source network's next-hop node.

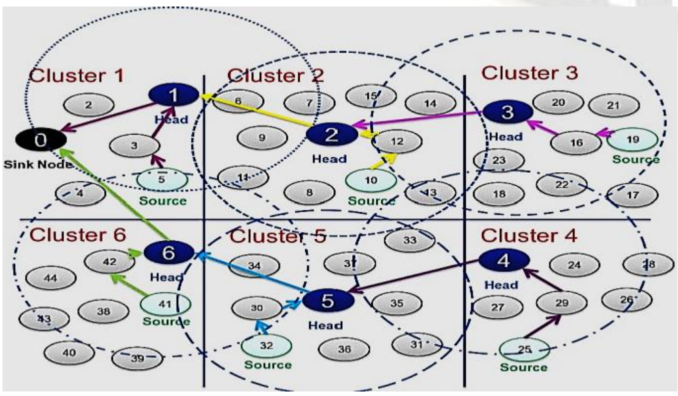

Figure 11. Dijkstra's Algorithm used in Clustering Techniques

E. To reduce data packet transmission time between nodes in MANETs by minimizing network routing-related problems.

In the Deep Q Learning Algorithm (DQL), therefore, there is high significance corresponding to the continue moving in the communication system due to the relative moment of the nodes. Route shortness as well as route stability should be actually considered for the steadily decreasing data packet transmission time between the nodes.

Conceivably the important key rate of interest is determined of connection stabilization and path smallness have indeed been taken into account and reinforcement learning techniques have been used to suggest method to make the best choice between the node of friends and neighbors to send a packet to the receiver at any time. That is, using reinforcement learning techniques, the highly recommended method was designed to correctly predict the nodes behavior pattern in relation to the target single node. To estimate the value of actions, the recommended method employs a DQL algorithm with greater uniformity. First of all, as input, system takes prior jamming condition & corresponding choice. Next, in order to find an optimal policy, Deep Q Network (DQN) learns from sufficient historical experience. Then it actually provides the next time slot's predicted jamming condition as output.

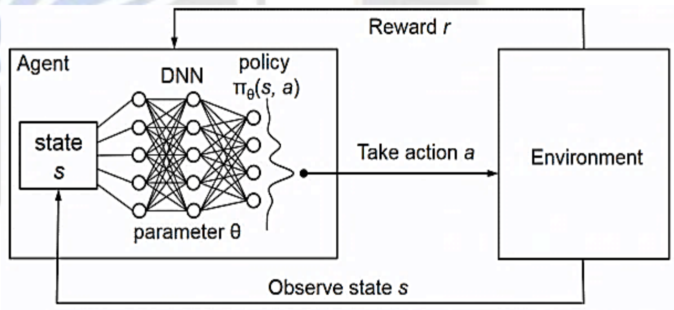

Figure 12. Illustration of Deep Q Learning

IV. ADVANTAGES

In order to increase connectivity in MANETs, movement's prediction (MP) models are used to detect the future location of user nodes to adequately deploy the agent nodes throughout transmission time. The movement prediction of network clients and units plays an identicalsignificant role in the environmentally sustainable development of wireless communication resource management (i.e. bandwidth, CPU time, and so on) accessible in MANETs.

The movement of mobile nodes in wireless communication environments has been continuing to increase. Because of the increased movements of mobile nodes, co-channel as well as adjacent interference is quite often experienced in this. Such interference phenomena have become a significant challenge even though they discuss aspects wireless network

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performance degradation. With the assistance of deep learning, to help decrease channel interference and attention on improving performance of the system in MANETs [26]. S. L. Bangare et al. [27-28] worked in the fields of machine learning and Internet of Things. G. Awate et al. [29] employed CNN techniques. Xu Wu et al. [30] proposed the network security effort. A. S. Ladkat et al. [31] used deep neural networks well for brain tumor research. and colleagues. The authors of [32-34] have analyzed and employed latest variant of CNN called as Capsule Network which is a deep ;earning model for image retrieval.

The clustering algorithm can solve the challenges of routing protocols in this, working to increase scalability. The Mobile ad-hoc Networks, clustering algorithm provides a reliable simple and efficient way allocate network resources (for example bandwidth, CPU time, and so on.) and also helps to ensure network structure stability by supplying a hierarchical environment.

Due to various factors, the network congestion could be here, one of the purposes is a routing protocol (RP) which always prefers the shortest route. It can really head up to a less responsible service as that of the loaded with too great a burden or cargo on wireless communication instrument fails to properly control traffic. Other instances of the application of traffic engineering exist, including such minimizing the energy consumption, – for example. In order to save power with minimum impact on network fulfillment, finding a wireless network routing solution minimum the number of active connections. A solution based on deep learning to the major issue of routing traffic flow in mobile ad-hoc networks [40]. This is done by creating a deep learning model trained on the optimum choices of traffic demands over wireless network flow pattern.

V. LIMITATIONS

Deep learning algorithms (DLAs) work on high performance machines, as well as machine learning algorithms (MLAs) can work on traditional central processing units (CPUs). In the decentralized system of deep learning algorithms, the training of an assured specific model takes too long. Because of the huge amount of structured and unstructured information that deep learning handles.

VI. APPLICATIONS

An MANET is indeed an interconnection of independent mobile nodes which can transmit and receive radio signals in a random direction based on random selection velocity. In a wireless network environment, there is no existing infrastructure as well as centralized administration deemed necessary. This is why ad-hoc wireless networks such as this are very helpful when dealing circumstances such as war communication, natural disaster communication, aircraft and marine communication, industrial as well as other contexts.

VII. CONCLUSION

In MANETs, there are several promising platform including such limited network resources (-for example such as bandwidth, CPU time, energy, and so on.), selection of an optimal path, increasing data packet transmission time, propagation delay, mobility, limited link capacity. Here, considering all these issues related to MANETs, deep learning algorithms can be a suitable solution.

REFERENCES

[1] K. Tayade, M. Kharat and S. Gumaste, "Mobility Prediction in Vehicular Ad Hoc Networks: A Survey", Solid State Technology, vol. 63, no. 2, pp. 1026-1035, 2020.

[2] Kumar, K., Kumar, S., Kaiwartya, O., Kashyap, P., Lloret, J. and Song, H., “Drone assisted Flying Ad-Hoc Networks: Mobility and Service oriented modeling using Neuro-fuzzy”, Ad Hoc Networks, 106, p.102242, 2020.

[3] A. Kulkarni, A. Seetharam, A. Ramesh and J. Herath, "DeepChannel: Wireless Channel Quality Prediction Using Deep Learning", IEEE Transactions on Vehicular Technology, vol. 69, no. 1, pp. 443-456, 2020.

[4] T. Rahman, I. Ullah, A. Rehman and R. Naqvi, "Notice of Violation of IEEE Publication Principles: Clustering Schemes in MANETs: Performance Evaluation, Open Challenges, and Proposed Solutions", IEEE Access, vol. 8, pp. 25135-25158, 2020.

[5] D. Gaikwad and A. Mukeri, "Fine Tuned Deep Neural Networks for Intrusion Detection System", Journal of Network Security Computer Networks, vol. 06, no. 02, pp. 9-16, 2020.

[6] M. Zhang, B. Xu, X. Li, M. Yin, B. Wu and K. Qiu, "Deep neural network-based soft-failure detection and failure aware routing and spectrum allocation for elastic optic networks", Optical Engineering, vol. 58, no. 06, p. 1, 2019.
B. Sahoo, T. Amgoth and H. Pandey, "Particle swarm optimization based energy efficient clustering and sink mobility in heterogeneous wireless sensor network", Ad Hoc Networks, vol. 106, p. 102237, 2020.

[7] F. Aina, S. Yousef and O. Osanaiye, "RAAC: A bandwidth estimation technique for admission control in MANET", Factauniversitatis - Series: Electronics and Energetics, vol. 32, no. 3, pp. 463-478, 2019.

[8] K. Darabkh, M. El-Yabroudi and A. El-Mousa, "BPA-CRP: A balanced power-aware clustering and routing protocol for wireless sensor networks", Ad Hoc Networks, vol. 82, pp. 155-171, 2019.

[9] K. Fang, L. Ru, Y. Yu, X. Jia and S. Liu, "An energy balance and mobility prediction clustering algorithm for large-scale UAV ad hoc networks", Engineering review, vol. 39, no. 1, pp. 1-10, 2019.

[10] D. Ergenç, L. Eksert and E. Onur, "Dependability-based clustering in mobile ad-hoc networks", Ad Hoc Networks, vol. 93, p. 101926, 2019.

[11] M. Alabdullah, B. Atiyah, K. Khalaf and S. Yadgar, "Analysis and simulation of three MANET routing protocols: A research on AODV, DSR & DSDV Characteristics and their performance evaluation", Periodicals of Engineering and Natural Sciences (PEN), vol. 7, no. 3, p. 1228, 2019.

[12] H. Xu, Y. Zhao, L. Zhang and J. Wang, "A Bio-Inspired Gateway Selection Scheme for Hybrid Mobile Ad Hoc Networks", IEEE Access, vol. 7, pp. 61997-62010, 2019.

[13] B. Geng, "Traffic prediction and transmission scheduling of artificial intelligence-driven cognitive wireless networks", International Journal of Computers and Applications, pp. 1-9, 2019.

[14] F. Jiang, Z. Yuan, C. Sun and J. Wang, "Deep Q-Learning-Based Content Caching With Update Strategy for Fog Radio Access Networks", IEEE Access, vol. 7, pp. 97505-97514, 2019.

[15] S. Blakeway, A. Kirpichnikova, M. Schaeffer and E. Secco, "Transmission Power and Effects on Energy Consumption and Performance in MANET", ICST Transactions on Mobile Communications and Applications, vol. 5, no. 16, p. 159336, 2019.

[16] J. Iqbal, A. Umar, N. Amin and A. Waheed, "Efficient and secure attribute-based heterogeneous online/offline signcryption for body sensor networks based on blockchain", International Journal of Distributed Sensor Networks, vol. 15, no. 9, p. 155014771987565, 2019.

[17] D. Sah and T. Amgoth, "A novel efficient clustering protocol for energy harvesting in wireless sensor networks", Wireless Networks, vol. 26, no. 6, pp. 4723-4737, 2020.

[18] M. Shi and X. Wang, "Design of Hybrid Energy Harvesting Self-Powered Power Supply for Transmission Line Sensor", IOP Conference Series: Earth and Environmental Science, vol. 440, p. 032091, 2020.

[19] M. Al-kahtani, L. Ferdouse and L. Karim, "Energy Efficient Power Domain Non-Orthogonal Multiple Access Based Cellular Device-to-Device Communication for 5G Networks", Electronics, vol. 9, no. 2, p. 237, 2020.

[20] D. Nguyen, P. Pathirana, M. Ding and A. Seneviratne, "Blockchain for 5G and beyond networks: A state of the art survey", Journal of Network and Computer Applications, vol. 166, p. 102693, 2020.

[21] Y. Zeng, H. Gu, W. Wei and Y. Guo, "$Deep-Full-Range$: A Deep Learning Based Network Encrypted Traffic Classification and Intrusion Detection Framework", IEEE Access, vol. 7, pp. 45182-45190, 2019.

[22] S. Kasongo and Y. Sun, "A deep learning method with wrapper based feature extraction for wireless intrusion detection system", Computers & Security, vol. 92, p. 101752, 2020.

[23] X. Li and S. Zhang, "Network Intrusion Detection Methods Based on Deep Learning", Recent Patents on Engineering, vol. 14, 2020.

[24] Vijay U. Rathod, Shyamrao V. Gumaste, "Effect of Deep Channel to Improve Performance On Mobile Ad-Hoc Networks", J. Optoelectron. Laser, vol. 41, no. 7, pp. 754–756, Jul. 2022.

[25] N. P. Sable, V. U. Rathod, P. N. Mahalle and D. R. Birari, "A Multiple Stage Deep Learning Model for NID in MANETs," 2022 International Conference on Emerging Smart Computing and Informatics (ESCI), 2022, pp. 1-6, doi: 10.1109/ESCI53509.2022.9758191.

[26] N. P.Sable, V. U. Rathod, P. N. . Mahalle, and P. N. . Railkar, "An Efficient and Reliable Data Transmission Service using Network Coding Algorithms in Peer-to-Peer Network", IJRITCC, vol. 10, no. 1s, pp. 144–154, Dec. 2022.

[27] S. L. Bangare, A. R. Khare, P. S. Bangare, "Code parser for object Oriented software Modularization", International Journal of Engineering Science and Technology, ISSN: 0975-5462, Vol. 2 (12), 2010, 7262-7265.

[28] S. L. Bangare, "Classification of optimal brain tissue using dynamic region growing and fuzzy min-max neural network in brain magnetic resonance images", Neuroscience Informatics, Volume 2, Issue 3, September 2022, 100019, ISSN 2772-5286, https://doi.org/10.1016/j.neuri.2021.100019.

[29] Gururaj Awate, S. L. Bangare, G. Pradeepini and S. T. Patil, "Detection of Alzheimers Disease from MRI using Convolutional Neural Network with Tensorflow", arXiv, https://doi.org/10.48550/arXiv.1806.10170

[30] Xu Wu, Dezhi Wei, Bharati P. Vasgi, Ahmed Kareem Oleiwi, Sunil L. Bangare, and Evans Asenso, "Research on Network Security Situational Awareness Based on Crawler Algorithm", Security and Communication Networks, Hindawi, ISSN:1939-0114, E-ISSN:1939-0122, vol. 2022, Article ID 3639174, 9 pages, 2022. https://doi.org/10.1155/2022/3639174.

[31] Ajay S. Ladkat, Sunil L. Bangare, Vishal Jagota, Sumaya Sanober, Shehab Mohamed Beram, Kantilal Rane, Bhupesh Kumar Singh, "Deep Neural Network-Based Novel Mathematical Model for 3D Brain Tumor Segmentation", Computational Intelligence and Neuroscience, vol. 2022, Article ID 4271711, 8 pages, 2022. https://doi.org/10.1155/2022/4271711.

[32] Sandeep Pande and Manna Sheela Rani Chetty, "Analysis of Capsule Network (Capsnet) Architectures and Applications", Journal of Advanced Research in Dynamical and Control Systems, Vol. 10, No. 10, pp. 2765-2771, 2018.

[33] Sandeep Pande and Manna Sheela Rani Chetty, "Bezier Curve Based Medicinal Leaf Classification using Capsule Network", International Journal of Advanced Trends in Computer Science and Engineering, Vol. 8, No. 6, pp. 2735-2742, 2019.

[34] Pande S.D., Chetty M.S.R. (2021) Fast Medicinal Leaf Retrieval Using CapsNet. In: Bhattacharyya S., Nayak J., Prakash K.B., Naik B., Abraham A. (eds) International Conference on Intelligent and Smart Computing in Data Analytics. Advances in Intelligent Systems and Computing, vol 1312.