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Implementation of Neural Network and Mobile Adhoc Sensor Network in Health Care System

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Abstract: *Health care system, Artificial Neural Network (ANNs) are opting to be the best solution in the research areas for diagnosing the diseases. The activation function and number of neurons in the hidden layer are selected using test and error method to reach maximum accuracy level with minimum error. A wireless mobile sensor network is autonomous, tiny, low cost and have mobile sensor nodes. Mobile ad-hoc sensor network consists of a number of sensor spreads in a geographical area having a powerful building application and each sensor is capable of mobile communication and has some level of intelligence to process signals and to transmit data.*

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I. Introduction

Healthcare is an area in which has an extensive amount of information accessible to clinical specialists, extending from the details of the biochemical data and outputs of imaging devices. Each type of data provides information that must be evaluated and assigned to a particular pathology during the diagnostic process [1]. To update the diagnostic process in daily routine and avoid misdiagnosis, artificial neural networks can be employed. The medical professionals are made to use these systems due to the some possible occurred errors during the diagnosis process [2][3]. The fast growing technology in wireless mobile technology has prompted a new communication, and the mobile adhoc network has produced a high degree of heterogeneity [4].

Health Care System

The present health care system consents constant monitoring of patient vigorous behavior, the systems require the sensors. The health monitoring systems will be done by orienting wireless networks such as commercial cellular / 3G networks or wireless LANs [5]. A well automated health care system helps improve quality of care because of their far-reaching capabilities. The wireless technology has provided a means of an easier method to treat and care for patients. The database servers are linked to a comprehensive electronic medical record system and using applications, a doctor can track their daily activities and improve healthy decisions in a beneficial manner. The e-health care system helps to monitor sensitive data of a patient unceasingly like a heartbeat, temperature, BP etc., by the help of sensors which captures these data to send it to the health care provider.

Figure 1. Central Sever in Health Care System

In a networked-healthcare in fig. 1, patients are aided and health care providers organize an easy access, it would reduce the percentage of in-office visits thus saves time and money [6].

Feed Forward Propagation Method

In health care research, artificial neural networks are applied widely as they can model highly non-linear systems in which the relationship is very complex. ANNs are interconnected neurons (nodes) in the multiple layers of each system. The input neurons are moved to the first layer, which send data via synapses to the next layer of neurons, which in turn to the third layer of output node (neurons). The synapses store parameters called weights that manipulate in the calculation. The ANN may involve several layers in certain required system.

The n inputs values are represented by x_1, x_2,…., x_n. Each of the inputs have the weights w_1, w_2,…., w_n. The input values are multiplied by the weight and summed as follows

$$S = w_1x_1 + w_2x_2 + \ldots + w_nx_n = \sum_{i=1}^{n} w_ix_i$$

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The output function y of the weighted sum is known as activation function y= f(s) +b, where b is known as bias parameter.

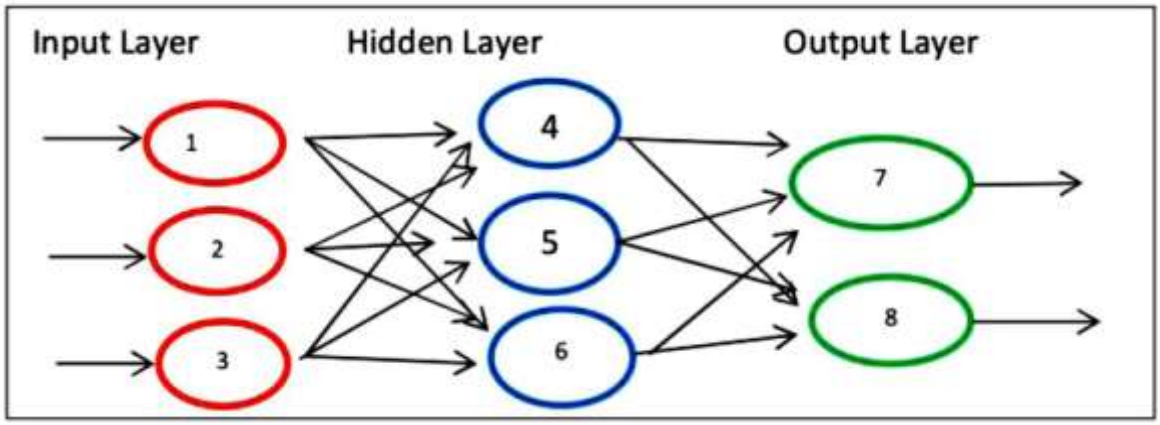

Figure 2. Feed Forward Neural Networks

The feed-forward neural networks as shown in fig.2 are those where the data enters at the input nodes and flows through the network, layer after layer and arrives at the output neuron. There is no feedback between any layers with the input passed in the only single direction.

The information collected for diagnostic care centre is passed as the inputs to the ANN where the analyzing is done to achieve the output. The specialists report the predicted output to the patients for appropriate and timely treatment [7].

Mobile Ad hoc Networks

The temporary network formed by the collection of mobile nodes without any static infrastructures, or centralized network backbones are mobile ad-hoc networks shown in fig.3. The mobile ad-hoc network consists of wireless PCs and laptop where the one node communicates with another taking multiple hops. The transmission range of a mobile node is limited to, routers that as intermediate nodes that lie in the communication paths, forwards the packet towards the hosts. A few characteristics of mobile ad-hoc networks:

1. Bandwidth and power constraints: The mobile nodes cannot communicate easily over the wireless channels providing bandwidth as a wired connection. The fading, shadowing, interference and collision are the conflicts for the mobile nodes to communicate. In a mobile network, if the computing and communication actions in a mobile device composed of energy-efficient node failure may occur.

2. Multi-hop delivery: In mobile ad hoc networks, the packets are sent from the source node to its destination, two or more intermediate nodes are required to relay the packets in a hop-by-hop fashion.

3. Network partitioning: Yet another distinctive task is for the network partitioning is the group mobility behavior where the mobile nodes with the identical mobility patterns form mobility groups exhibiting distinct movement patterns. In a few cases, network partitioning breaks a connected network topology into a number of separate disconnected partitions.

4. *Infrastructure unpredictable:* In a mobile ad hoc network, mobile nodes join or leave as required, the connectivity of links of mobile node changes with the time leading of the network topology unpredictability.

Mobile nodes have to update the routing table dynamically as they move around to refresh their global vision of the network [8].

Figure 3. Mobile Ad hoc Network

Mobile Ad-Hoc Network Architecture

The two types of wireless networks, namely Infrastructure and Ad-hoc network, the differences in the two networks is infrastructure networks have central control and nodes, but the ad hoc networks are autonomous. The major disadvantage of the infrastructure network is if the central node is destroyed, not a single node in this cell can perform any transmission.

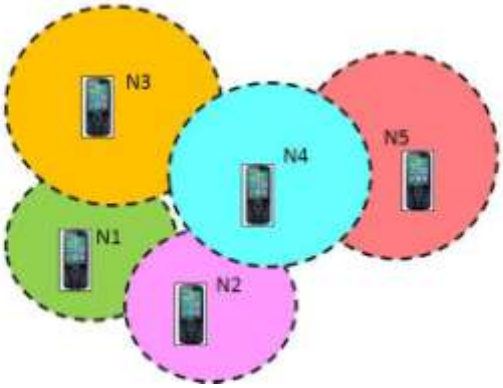

Figure 4. Mobile ad-hoc sensor network transmission range

Ad hoc networks with nodes connection is shown in Fig.4 if N1 requests to connect with N5. N1 must hop the message to N2-N4-N5 OR N3-N4-N5. The best route will be selected based on routing algorithm. The main advantage of ad-hoc network is if N2 leaves the network, N1 still has a route to N5. Hence adhoc networks are more robust than infrastructure. Mobile adhoc network sensors work like the adhoc network and providing mobility to the nodes in the network and here, mobile is the sensors; this provides dynamic topology for the network [9].

Handling data loss in Mobile Adhoc Network

The most fundamental in wireless sensor networks is Network-wide broadcast (NWB), it assists sensor nodes to propagate messages across the overall network design. NWB is defined as a process through which one mobile device sends a packet to all other devices in the network and provides it routes for both unicast and multi-cast data exchange operations. NWB in mobile ad-hoc networks provides control and route establishment functionality to different protocols of mobile ad-hoc networks.

The key issue is to try to reduce the packet, or the data loss during an active transmission. In the mobile adhoc networks, mobile-link transmission errors, mobility and network congestion are the major causes of data loss. In adhoc network, each mobile device has to rely on others for forwarding data packets to other nodes in the network. Paging, alarming, location updates, route discoveries and routing in the highly mobile adhoc environment are few important aspects of NWB [10].

II. Discussion

ANNs have advantages, including (*i*) The ability to process large amount of data (*ii*) Reduced overlooking relevant information and (*iii*) Reduction of diagnosis time. The summarizing and elaborating methods of informative and intelligent data are unceasing and educating and can contribute greatly to effective, precise, and swift medical diagnosis. The mobile adhoc networks built new opportunities for telecom operators and other service providers. The interconnections between hosts in a Wireless Mobile Ad-hoc Network (MANET) are a group of mobile sensor nodes, randomly and dynamically positioned on a systematic basis.

III. Conclusion

The most powerful tool ANN help physicians perform diagnosis and other enforcements and their use make the diagnosis more reliable and thus increases patient satisfaction. The large efforts of the MANET research community and the rapid progress made during the last years, a lot of challenging technical issues remain unanswered. Mobile Adhoc Network Sensors play a vital role in the transmission of the data in health care without any data loss and interruption on timely manner.

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