Advances in Parallel Computing Technologies and Applications
D.J. Hemanth et al. (Eds.)

doi:10.3233/APC210117

VANET: Trust Evaluation Using Artificial Neural Network

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Abstract. There is an increasing emphasis on enhancing the efficiency traffic management systems. Information is exchanged between the vehicular nodes to efficiently monitor and control huge volumes of vehicle. All existing applications in this area have focused on reliable data exchange and authentication process of vehicular nodes to forward messages. This study proposes a new entity centric trust framework using decision tree classification and artificial neural networks. Decision tree classification is used to derive rules for trust calculation and artificial neural networks are used to self-train the vehicular nodes, when expected value is not met. This model uses multifaceted role and distance based metrics like Euclidean distance to estimate the trust. The proposed entity centric trust model, uses a versatile new direct and recommended trust evaluation strategy to compute trust values. The suggested model is simple, reliable and efficient in comparison to the other popular entity centric trust models.

Keywords. Vehicular nodes, LDA, Artificial neural networks (ANN).

1. Introduction

There is an importance on enhancing the capability of traffic management systems. Road safety congestion control and security are three important components are considered. Traditional traffic control systems are slowly replaced by new vehicular networking technologies where each vehicular node is considered as a networking node. The vehicular nodes are information multifaceted, and they usually comprise of vehicles, Roadside units (RSU) and data centres. Information is exchanged between the vehicular nodes ability to manage monitor huge volume of vehicles. Moreover, the trustworthy between vehicles is important when messages are exchanged. The trustworthiness between the vehicles within the specified range, message interchange to maintain integrity is an important task. Information exchange between the vehicles is important. Moreover, data transmission between the vehicles directly affects the security in vehicular environments and the quality of service being provided largely depends on the trustworthiness of the date. Vehicular networks rapidly use wireless networking for data exchange. Traditional networking principles for data transfer and security measures cannot be apply in such

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environments directly changes the dynamic resulting from mobility. In real time applications, networks are broadly used in dynamic information exchange to ease vehicular applications.

Decision tree classification is used to derive trust rules and Artificial Neural Networks is implemented to self-train the vehicular nodes when expected trust value is not met. It improves the ability and reliability of the proposed model. Entity based trust model estimates trust between the participating vehicular nodes before exchange of information between them. The proposed approach effectively manages entity-oriented problems in vehicular networks and helps to maintain the integrity in vehicular environments.

The existing models use vehicular entities like vehicular nodes, RSUs, OBU and data centres to compute trust. Attributes of the message exchanged between the vehicular entities to estimates trust. However none of models follow a concrete model to take decision on the vehicular nodes depends on the valued trust. A vehicular node follows the decision either to forward or receive the messages due to dynamic changes of vehicular nodes some scenarios may not get hold on the recent study traffic based on their trust values and the message received from the vehicles entities. This study introduces the decision tree and ANN algorithm for the vehicular nodes to get the optimal trust value and forward the reliable the message to the vehicles if the vehicles does not get the trusted values it forward the untrustworthy information to the RSU.

2. Related Works

This gives the overview of literature surveys. It represents some of the relevant work done by the researchers. Many existing techniques have been studied by the researchers on trust evaluation; few of them are discussed below.

In the blooming era of the web of Things (IoT), trust has been accepted as an important factor for provisioning secure, reliable, seamless communications and services [1]. However, an outsized number of challenges still remain unsolved thanks to the anomaly of the concept of trust also because of the sort of divergent trust models in several contexts [2]. Vehicular Ad Hoc Networks (VANETs) are usually used to reduce the traffic accidents, improve traffic efficiency and safety, promote commercial or infotainment products etc. All the applications are based on the exchange of data among nodes, so not only reliable data delivery but also the authenticity and reliability of the data itself are prerequisite [3]. Vehicles to communicate on the roads, vehicular networks is improve the traffic safety. Trust management and privacy protection are play major role in vehicular environment. Existing work mainly on the two issues separately and have not provided a satisfactory solution. Thi Ngoc Diep Pham, et al., [4] proposed work manage the vehicles for trust and privacy. ALRS A secure linkability scheme to enable vehicles to identified the trust level of vehicle to protect privacy need to update the value in vehicles. The vehicular ad hoc networks (VANETs) aim basically to enhance the traffic safety performance, improve the traffic efficiency and achieve a comfortable driving experience. To reach these purposes, it is crucial to ensure the security of this network. Trust is one of the key challenges for VANET security enhancement. Trust management aims to investigate the relationship between the different entities in the network in order to ensure that only trustworthy messages are delivered to drivers. Solutions for trust evaluation are not self adaptively adjusted to discriminate between the requirements of each class of applications [5]. Intelligent Transportation systems constitute be vehicular ad hoc networks (VANETs) are key components contributing to the smart city based on the repeated exchange of periodic and event triggered messages while smart vehicles can enhance road safely and traffic system to provide support reliable trust information between the vehicles the drawback of the paper lots of dishonest information delivered to unwanted solution, chaker abdelaziz kerrache et al [6] proposed the two main components cryptography and trust .In vehicles environment the trust is forward the reliable message and then the cryptography is not mitigate all possible attacks so the existing models cannot handle trust together with some possible solutions. An optimized multilayer feed forward network (MLFN) is developed to construct a soft sensor for controlling naphtha dry point. To overcome the two main flaws in the structure and weight of MLFNs, which are trained by a back propagation learning algorithm, minimal redundancy maximal relevance partial mutual information clustering (mPMIc) integrated with least square regression (LSR) is proposed by Chen and Xuefeng yan [7] to optimize the MLFN. When the redundant nodes from the hidden layer are removed, the ideal MLFN structure can be obtained according to the test error results. In actual applications, the naphtha dry point must be controlled accurately because it strongly affects the production yield and the stability of subsequent operational processes. The mPMIc LSR MLFN with a simple network size performs better than other improved MLFN variants and existing efficient models. In [8] author judged the surface temperature using improved the neural network on satellite remote sensing data. The author also compared different models and further improved model parameters for better performance.

Traditional single hidden layer feedforward network (SLFN) is extended to novel generalized SLFN (GSLFN) by employing polynomial functions of inputs as output weights connecting randomly generated hidden units with corresponding output nodes. sequential ridge ELM(BR ELM and OSR ELM) learning algorithms, high performance of the proposed GSLFNs in terms of generalization and learning speed is guaranteed [9]. Vehicular Ad Hoc Network (VANET) is a class of mobile ad hoc network (MANET) support the vehicle to vehicle (V2V) and vehicle to infrastructure (V2I) communications. The features of VANET includes, self organization, distributed networking, and highly dynamic topology.. The transmission of messages in an access environment like VANET is most important and challenging security issues. Authentication, data confidentiality, data integrity, data availability, and non repudiation are components of security in VANET [10]. A hybrid SVM based decision tree to speed up SVMs in phase for binary classification. existing methods is aim to reduce the number of support vector. The central idea of Arun Kumar and Gopal [11] is to give the accuracy result the decision boundary of SVM using decision trees. The resulting tree is a hybrid tree in the sense that it has both 10 univariate and multivariate (SVM) nodes. Dhanalakshmi et al., [12] proposed a new protocol for sender-based responsive techniques on energy, mobility and routing for wireless sensor networks (WSNs). It improves the basic quality of service (QOS) metrics such as delay, Hop-count and energy level for each connection with multiple routes and predicts the optimal path to develop the efficient communication.

3. System Design

3.1. Neural Networks

A neural network is a computing layered structure resembles the network structure with layers of connected nodes. A neural network can learn the data so it can be trained to recognize pattern and classify data. Common machine learning techniques for designing neural network applications include supervised and unsupervised learning, classification, regression, pattern recognition and clustering methods.

3.2. Design Methodologies

In existing system, a new entity centric trust framework using decision tree classification and artificial neural network. Decision tree classification is used derive rule for trust calculation and artificial neutral networks are used to self-train the vehicular nodes, which expected trust value or not. In proposed system, an efficient model that uses the self-trained network. In the proposed system, design of trust evaluation is implemented using the deep neural network model as part of improving the proposed trust evaluation better. Preprocessing the raw IOT data uses linear discriminant analysis (LDA).The neural network utilizes the self-organized mapping model with that decision making algorithm produces accurate trust evaluation

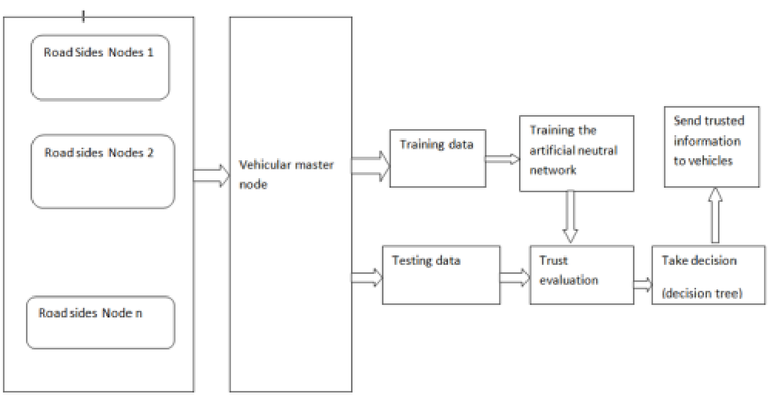

Figure 1. Architecture Diagram.

3.3. System Architecture

The existing system focused on implementing the trust evaluation model using artificial neural networks learning. The existing system uses a new entity centric trust framework using decision tree classification and artificial neural networks. Decision tree classification model is used to derive rules for trust calculation and artificial neural networks are used to self-train the vehicular nodes, when expected trust value is not met. This model uses multifaceted role and distance based metrics like Euclidean distance to estimate the trust. In the proposed system, design of trust evaluation is implemented using the deep

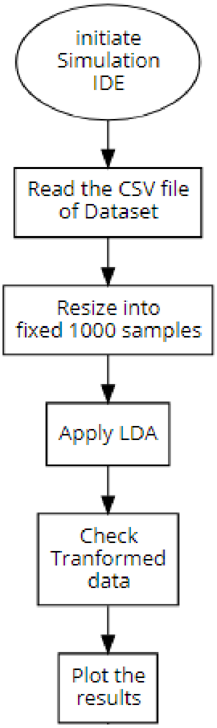

Figure 2. Dataflow Diagram.

neural network model as part of improving the proposed trust evaluation better. Preprocessing the raw IOT data uses linear discriminant analysis (LDA).The neural network utilizes the self-organized mapping model with that decision making algorithm produces accurate trust evaluation. The Vehicles network dataset is used for evaluation of vehicle count. The trust evaluation is based on information provided by the IOT sensor networks. The decision making considers the number of vehicles, type of vehicle, emergency vehicle information are the attributes.

4. Implementation Methodology

The neural network utilizes the self-organized mapping model with that decision making algorithm produces accurate trust evaluation. The Vehicles network dataset is used for evaluation of vehicle count. The trust evaluation is based on information provided by the IOT sensor networks. The decision making considers the number of vehicles, type of vehicle, emergency vehicle information are the attributes.

4.1. Module Description

4.1.1. Data Set

The Vehicles network dataset are used for preprocessing it is used for evaluation of vehicle count. Dataset tells the attributes of vehicles which is consists of class of vehicles, radio, maximum distance.

4.1.2. Data Preprocessing

The purpose of Preprocessing the raw IOT data uses linear discriminant analysis (LDA) that fits machine learning Structured and clean data allows data to get more precise results from an applied machine learning model. The technique includes data formatting, cleaning, and sampling.

4.1.3. Dataset Splitting

A dataset used for machine learning should be partitioned into three subsets Training, test, and validation sets. Training set. A data scientist uses a training set to train a model and define its optimal parameters it has to learn from data Test set. A test set is needed for an evaluation of the trained model and its Capability for generalization.

4.1.4. Artificial Neural Network For Classification

Data has preprocessed the collected data and split it into train and test can proceed with model training. ANN allows vehicular nodes to self-train both message forwarding and message receiving vehicular nodes to get the expected trust values. ANN comprises input nodes, middle node, output node, activation function to initiate the functions of ANN and adjusting weights to adjust output values from the layers.

4.1.5. Trust Evaluation

The recommending vehicular nodes use these rules to take appropriate decision on message forwarding vehicular nodes.

Table 1. Trust Rule Table

R1: If Trust Value < 0.5 = Distrust
R2: If Trust Value > 0.5 And Trust Value ≤ 8 (Further evaluate the message forwarding vehicular nodes)
R3: If Trust Value > 0.8 And Trust Value ≤ 1 = Trust
R4: If Trust Value > 1 = Distrust

4.1.6. Direct trust computation

- Direct trust computation is a Role based strategy, priority based strategy and threading concepts are used to prioritize the vehicles and messages to calculate the trust value.
- Direct trust evaluation uses the attributes like time of message forwarded and message received to vehicular nodes, distance between the sender and receiver node to vehicles and packet loss between the sender and received to the vehicular nodes.

4.1.7. Recommended trust computation

- Estimating the trust using recommended trust computing
- Euclidean distance or Euclidean metric is a measure of straight line distance between two points in Euclidean space. Euclidean distance between two attributes.

5. Simmulation Rrsults & Discussions

A simulation based analysis was administered to evaluate the performance of the trust model. The simulation environment was developed using MATLAB under Windows 64-bit platform. The result shows the every modules of the project

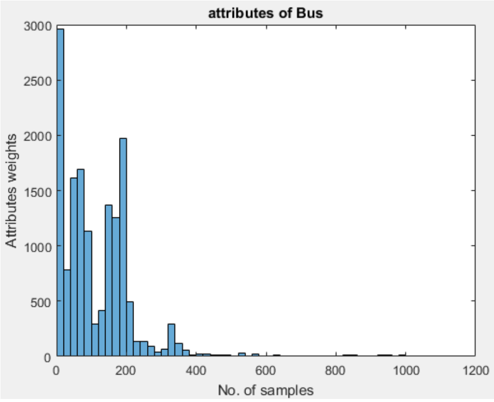

Figure 3. Input dataset of bus.

In Figure 3 shows the input data of vehicles from the graph x tell the number of samples and y tells the attributes

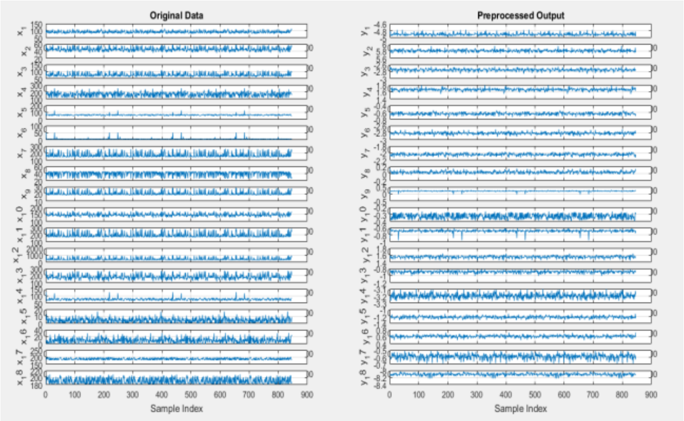

Figure 4. Preprocessing.

In Figure 5 shows the output of performance of algorithm x value tell the epochs and y tells the gradient value. Test, validation, train, best data are plotted. In Figure 6 slows the ROC curve (receiver operating characteristic curve) is a graph showing the performance of a classification model at all classification thresholds. This curve plots two parameters: True Positive Rate and False Positive Rate. In Figure 7 slows the Error histogram is the histogram of the errors between target values and predicted values after training a feed forward neural network.

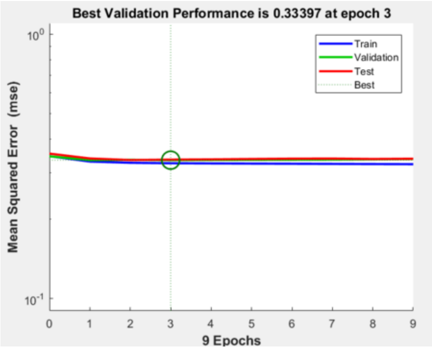

Figure 5. Performance of algorithm.

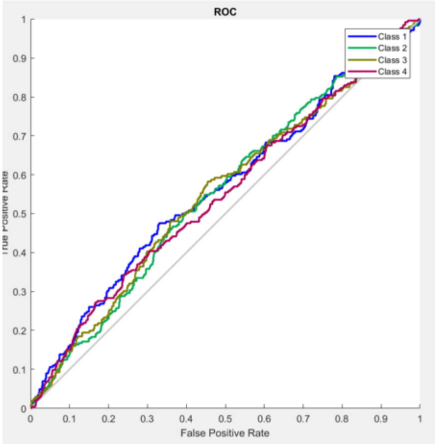

Figure 6. ROC Curve

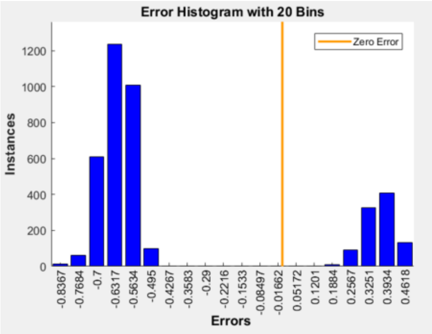

Figure 7. Error histogram

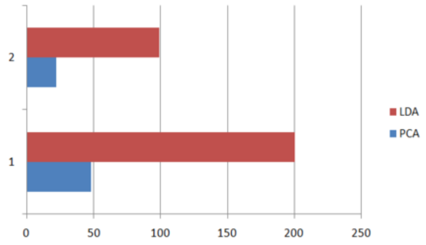

Figure 8. Algorithm Analysis Graph

Table 2. Algorithm Analysis Table

Algorithm	**Sample class**	**Classification**
PCA	48	22
LDA	200	99

6. Conclusion

Thus the evaluation of preprocessing module is completed successfully and results are tested using MATLAB IDE. The proposed work is further improved by developing a trust evaluation model using deep learning neural network in next phase.

References

[1] Truong NB, Lee H, Askwith B, Lee GM. Toward a trust evaluation mechanism in the social internet of things. Sensors. 2017 Jun;17:1-18.

[2] Chen C, Yan X. Optimization of a multilayer neural network by using minimal redundancy maximal relevance-partial mutual information clustering with least square regression. IEEE transactions on neural networks and learning systems. 2014 Jul 17;26(6):1177-87.

[3] Kerrache CA, Calafate CT, Lagraa N, Cano JC, Manzoni P. RITA: RIsk-aware Trust-based Architecture for collaborative multi-hop vehicular communications. Security and Communication Networks. 2016 Nov 25;9(17):4428-42.

[4] Zheng K, Zheng Q, Chatzimisios P, Xiang W, Zhou Y. Heterogeneous vehicular networking: A survey on architecture, challenges, and solutions. IEEE communications surveys & tutorials. 2015 Jun 1;17(4):2377-96.

[5] Pham TN, Yeo CK. Adaptive trust and privacy management framework for vehicular networks. Vehicular Communications. 2018 Jul 1;13:1-2.

[6] Souissi I, Azzouna NB, Berradia T. Towards a Self-adaptive Trust Management Model for VANETs. In International Conference on Security and Cryptography 2017 Jul 24 (pp. 513-518).

[7] Kerrache CA, Lagraa N, Calafate CT, Cano JC, Manzoni P. T-VNets: A novel trust architecture for vehicular networks using the standardized messaging services of ETSI ITS. Computer Communications. 2016 Nov 1;93:68-83.

[8] Lap-fu Y. Environmental planning and economic efficiency of green cities based on improved neural network and satellite remote sensing. Arabian Journal of Geosciences. 2021 Jul;14(14):1-9.

[9] Wang N, Er MJ, Han M. Generalized single-hidden layer feedforward networks for regression problems. IEEE transactions on neural networks and learning systems. 2014 Jul 15;26(6):1161-76.

[10] Gazdar T, Belghith A, AlMogren AS. DTCF: A distributed trust computing framework for vehicular ad hoc networks. KSII Transactions on Internet and Information Systems (TIIS). 2017;11(3):1533-56.

[11] Manvi SS, Tangade S. A survey on authentication schemes in VANETs for secured communication. Vehicular Communications. 2017 Jul 1;9:19-30.

[12] Dhanalakshmi B, SaiRamesh L, Selvakumar K. Intelligent energy-aware and secured QoS routing protocol with dynamic mobility estimation for wireless sensor networks. Wireless Networks. 2021 Feb;27(2):1503-14.