



A Review on Self Organizing Map based Data Aggregation Algorithm in Wireless Sensor Networks

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Abstract- This paper discuss regarding the data aggregation in wireless sensor network. we've compared two completely different techniques specifically Distributed Detection in Neural Network primarily based Multihop Wireless device Network and AdWAS: adaptive Weighted Aggregation scheme for Single-hop and Multi-hop Wireless sensor Network. Among the two distributed detection in neural network offers better result than the other technique when the two are compared in terms of accuracy of detection.

Keywords- Review, Data Aggregation, ANN based DA, AdWAS, and Wireless Sensor Network

I. INTRODUCTION

Lately an effective configuration of a Wireless sensor Network has turned into a main zone of examination. A sensor could be a gadget that reacts and distinguishes some kind of contribution from both the physical or natural conditions, similar to weight, heat, light, and so forth. The output of the sensor is usually an electrical signal that's transmitted to a controller for additional process. Aggregation scheme for tree network, the projected Neural Network primarily based wireless sensor network approach ends up in a major improvement in detection accuracy without much energy losses because of communication and computation overhead[1].

Data Aggregation in Wireless Sensor Network

With advance in technology, Wireless sensor networks composed of small and price effective sensing devices equipped with wireless radio transceiver for surroundings observation became possible. The key advantage of exploitation these tiny devices to observe the surroundings is that it doesn't need infrastructure similar to electrical mains for force supply and wired lines for web associations with assemble data, nor need human connection while sending. These sensor hubs will screen the surroundings by gathering information from their surroundings, and work agreeably to send the information to a base station, or sink, for analysis. the most goal {of data|of knowledge|of information} aggregation algorithm is to collect and mix information in a vitality prudent way so organize lifespan is expanded. The algorithmic rule uses a graph structure to represent information and may add or take away neurons to be told dynamic non-stationary pattern sets [4]. wireless sensor systems (WSN) give a dynamically appealing procedure of data social event in circulated framework models and element access by means of remote availability to better approach to their goals.

Self Organizing Maps

So far we've checked out networks with supervised training techniques, during which there's a target output for every input pattern, and also the network learns to provide the desired outputs. we now turn to unsupervised training, during which the networks learn to create their own classifications of the training data without external facilitate. to try and do this we've got to assume that class membership is generally outlined by the input patterns sharing common features, which the network will be ready to determine those features across the range of input patterns. the most objective of the sector of network forensics consists of gathering proof of illegal acts from a networking infrastructure [6]. One fundamentally intriguing class of unsupervised framework depends on aggressive learning, amid which the yield neurons contend amongst themselves to be enacted, with the outcome that only one is actuated at anybody time. This actuated neuron is named a champ takesall neuron or simply the triumphant neuron. Such competition is prompted/actualized by having horizontal restraint associations (negative criticism ways) between the neurons. The outcome's that the neurons are compelled to mastermind themselves. For evident reasons, such a system is named a Self Organizing Map (SOM).

The self-organisation method involves four major components:

Initialization

The entire association weights are instated with little arbitrary qualities. Rivalry For each and every enter pattern, the neurons compute their respective values of a discriminant perform which provides the foundation for competition. The targeted neuron with the smallest price of the discriminant perform is said the winner.

Cooperation

The profitable neuron determines the spatial area of a topological neighbourhood of excited neurons, thereby supplying the foundation for cooperation among neighbouring neurons.

Adaptation

The excited neurons scale back their individual values of the discriminant function on the subject of the enter pattern by way of suitable adjustment of the related connection weights, such that the response of the winning neuron to the subsequent software of a equivalent input pattern is enhanced.

II. LITERATURE REVIEW

Author	Paper Name	Proposed	Merits	Demerits
Ren et al. [1]	A Privacy Enhanced Data Aggregation Model	This paper proposes an more advantageous privateness-retaining competencies aggregation scheme, which balances the laborious project of extracting low cost data worth and preserving capabilities privateness even with incomplete or malicious data presentence. They proposed an innovative encryption algorithm to keep knowledge privateness whilst it'll furnish comfortable knowledge evaluation between the encrypted knowledge. Moreover, they defined a effective and efficient aggregation operator to fuse the encrypted data with no decryption through at ease expertise assessment and density headquartered advantage mining. The proposed aggregation scheme can do away with each and every ordinarily malicious and redundant potential previous than aggregation so that it should furnish a strong aggregation have an effect on with out scarifying know-how privateness. Moreover they mentioned the scheme performance in phrases of aggregation accuracy, distribution recuperation ability and aggregation effectivity. The test effect showcase that this scheme may give cheap aggregation values, get better the understanding distribution well even beneath 50% malicious readings, far more robust than the mainly used aggregation whilst it has just right aggregation effectivity with above 80% redundant information casting off.	<ul style="list-style-type: none"> • Better resilience against skew-aggregation. • can provide data aggregation on ciphered data without decryption • reasonable aggregation results in terms of accuracy and efficiency • suitable for data aggregation on dense data set, such as Ubiquitous Network data aggregation 	<ul style="list-style-type: none"> • Needs High Sensor Precision thus increasing the cost. Slow data aggregation Model • Does not work with Binary Sensor Data Model
Ganegedara et al.[2]	Redundancy reduction in self-organising map merging for scalable data clustering	The authors proposed a redundant neuron reduction algorithm for self-organising maps which improves the effectivity of the merging approach. They established that the proposed algorithm has turbo efficiency over the Parallel GSOM algorithm. Self-organising maps are largely used for exploratory competencies evaluation. Immoderate processing energy requirement for tremendous scale data clustering is a key crisis with self-organising maps. Despite the fact that a quantity of serial methods have been developed to cut down the time requirement, algorithms that could utilise disbursed computing outperforms serial algorithms for processing giant datasets.	<ul style="list-style-type: none"> • reduce the level of redundancy using the quantization error • higher efficiency • increases the scalability of the parallel GSOM algorithm 	<ul style="list-style-type: none"> • loss of clustering accuracy

		An effective dispensed procedure is to divide the dataset into partitions, train a self-organising map on each and every partition and merge the maps to variety a single map representing the entire knowledge set. The lately proposed Parallel GSOM algorithm has proven that parallel computation can tremendously scale back training time for self-organising maps. On the other hand, if the specific clusters inside the dataset are disbursed throughout a couple of partitions, the persona trained maps might comprise redundant neurons. Presence of redundancy raises the time requirement for the merging process. Reduction of redundant neurons would curb the time consumption of the merging system thereby bettering the effectivity of the whole knowledge clustering approach.		
<i>Tan et al. [3]</i>	Mapping of finite-element grids onto parallel computers using neural networks	LSOM (load-balancing self-organising map), a neural community founded on Kohonen's self-organising map, is proposed for the drawback of mapping finite detail process (FEM) grids to allotted reminiscence parallel pcs with mesh interconnection networks. The elaborate international ordering produced with the help of LSOM is mixed with the regional refinement Kernighan-Lin algorithm (LSOM-KL) to acquire the answer. LSOM-KL accomplished a load imbalance of minimize than zero.1%, and a low quantity of hops, similar to outcome obtained with most most commonly used recursive bisection strategies.	<ul style="list-style-type: none"> • Minimum communication Cost 	<ul style="list-style-type: none"> • Slow Convergence
<i>Lang et al.[4]</i>	The plastic self organising map	A novel extension to Kohonen's self-organising map, called the plastic self organising map (PSOM), is provided. PSOM is in contrast to some other community seeing that the truth that it most effective has one phase of operation. The PSOM does now not go via a coaching cycle prior than trying out, similar to the SOM does and its variations. Every pattern is for this reason dealt with identically at all times. The algorithm makes use of a graph constitution to represent advantage and can add or eliminate neurons to gain knowledge of dynamic nonstationary sample sets. The neighborhood is established on an actual world radar software and an artificial nonstationary predicament.	<ul style="list-style-type: none"> • used to track dynamic non-stationary data. 	<ul style="list-style-type: none"> • Continuous learning is not possible
<i>Hsu et al. [5]</i>	Enhanced topology preservation of Dynamic Self-Organising Maps for data visualisation	Unsupervised knowledge discovery utilising Self Organising Maps (SOM) has been effectually utilized in acquiring unbiased and visualisable outcome. A establishing (or Dynamic) Self Organising Maps (GSOM) is an elevated version of the ordinary SOM with adaptive map dimension and controllable unfold. In experiments a GSOM without doubt has	<ul style="list-style-type: none"> • Improves topographic quality of GSOM 	<ul style="list-style-type: none"> • GSOM has significantly higher topographic error than SOM. • Inability to form a grid lattice

		significantly larger topographic error than SOM with same quantisation error. This may occasionally even be undesirable in circumstances the place, topology upkeep is foremost, hence on this paper the authors proposed an algorithm to aid the setting up of the dynamic self-organising map in attaining higher topographic exceptional at the same time keeping and even making enhancements to stage of quantisation error. Results have proven improvement of topographic error when evaluating to GSOM, and have higher topology renovation than non-topologically optimised SOM with equal map dimension.		
Palomo et al. [6]	Visualisation of network forensics traffic data with a self-organisingmap for qualitative features	The self-organising map has been utilized to web page viewers potential, to be used as a instrument in community forensics. Additionally, the proposed SOM takes into consideration the qualitative factors that are present in the viewers information, in addition to the quantitative elements. The web page viewers knowledge was once clustered and visualised and the results had been then analysed. The outcome display that this manner may also be utilized to aid within the comprehension of digital forensics and to facilitate the search for anomalous behaviour inside the network atmosphere.	<ul style="list-style-type: none"> Better and faster search feature of anomaly 	<ul style="list-style-type: none"> High computation cost

III. DISTRIBUTED DETECTION IN NEURAL NETWORK BASED MULTIHOP WIRELESS SENSOR NETWORK

A Neural group based understanding aggregation process to comprehend the binary actions in a multi-hop wi-fi Sensor network has been proposed. They envisioned every node in a community as a unit of neuron which will get trained through using the neural group established back propagation algorithm. As compared to the LMS centered Adaptive Weighted Aggregation scheme for tree community, the proposed Neural network established wi-fi sensor community method results in a significant growth in detection accuracy with no a lot vigor losses due to the fact that of communication and computation overhead. Additionally the assessment the detection accuracy of the proposed Neural neighborhood based scheme with that of the non-adaptive Bayesian technique which requires apriori abilities of the sensor's effectivity indices.

IV. ADWAS: ADAPTIVE WEIGHTED AGGREGATION SCHEME FOR SINGLE-HOP AND MULTI-HOP WIRELESS SENSOR NETWORK

They proposed a novel Adaptive Weighted Aggregation Scheme (AdWAS) for famous person as good as tree topology. They when put next the efficiency of the proposed adaptive weighted aggregation scheme with present one bit non-adaptive aggregation schemes. In non-adaptive schemes, reasonable versions in the topology or effectivity indices necessitate recalculation of the initial setup. Nevertheless, within the proposed adaptive scheme we effortlessly have acquired to first-class tune the weights beginning from the earlier tailor-made weights to make amends for any small version within the topology. Furthermore, there is also occasionally any performance degradation when using AdWAS. This without doubt makes the adaptive setup further attractive.

V. ISSUES AND CHALLENGES

After studying the different papers presented by different authors few issues and challenges are open to us. The issues are presented in form of points as given below:

- The first issue is the accuracy of binary detection in WSN.
- The binary detection scheme is utilized in cost effective projects and these projects need better detection accuracy at lower implementation cost.
- By lowering the cost of sensors, we need to lower the precision of the sensor which generates false alarm.
- Algorithms like AdWAS provide less accuracy with low precision sensors and as the precision of the sensor is increased, the accuracy improves.

- ANN shows promising results in case of binary detection using data aggregation but does not achieve high accuracy unless trained on large data range.
- Thus, ANN requires high cost of training.

VI. RESEARCH GAPS

After analyzing the problems, the following challenges remain.

- There is a need for faster algorithms with no a priori knowledge to detect a binary event with high accuracy.
- The algorithms with a priori knowledge perform better but have high cost of implementation. Thus there is a need for algorithms which requires no a priori knowledge.
- Existing solution that utilized the network as neural network requires high training cost for training with sensor of different precision rate. Thus, we need an algorithm that can learn in a unsupervised environment.

These gaps point at a solution that is unsupervised, and need no a priori knowledge of the domain. The answer to these problems is Self Organizing maps. A SOM can be deployed in the region and can learn the environment effectively without high training cost. This allows us for a self sufficient algorithm which can learn and perform without much interference from human. Thus our research will be focused on SOM based Data Aggregation for Binary detection in WSNs.

VII. CONCLUSION

We regarded the situation of efficient aggregation in wireless sensor community (WSN) for occasion detection utility and the obstacle of binary event detection for an unbalanced tree topology based multi hop wi-fi sensor community used to be approached utilizing the greatly used Neural community Backpropagation algorithm. A Least imply square (LMS) founded Adaptive Weighted Aggregation Scheme (AdWAS) for WSN with famous person as good as tree topology. For big name topology, the proposed AdWAS efficiency could be very close to that of the CV rule which is the most excellent resolution fusion rule and provides first-rate influence in phrases of effectivity where as in case of dispensed Detection in Neural community headquartered Multihopwi-fi Sensor community the proposed scheme gives higher outcome in terms of accuracy of detection as in comparison with the AdWAS scheme with reasonably an identical computation and communication rate.

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