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Research Paper

DECENTRALIZED HYPOTHESIS TESTING IN WIRELESS SENSOR NETWORKS:BINARY HYPOTHESIS TESTING

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Wireless sensor networks are prone to node misbehavior arising from tampering by an adversary (Byzantine attack), or due to other factors such as node failure resulting from hardware or software degradation. In this paper, we consider the problem of decentralized detection in wireless sensor networks in the presence of one or more classes of misbehaving nodes. Binary hypothesis testing is considered where the honest nodes transmit their binary decisions to the fusion center (FC), while the misbehaving nodes transmit fictitious messages. The goal of the FC is to identify the misbehaving nodes and to detect the state of nature. We identify each class of nodes with an operating point (false alarm and detection probabilities) on the receiver operating characteristic (ROC) curve. Maximum likelihood estimation of the nodes' operating points is then formulated and solved using the expectation maximization (EM) algorithm with the nodes' identities as latent variables. The solution from the EM algorithm is then used to classify the nodes and to solve the decentralized hypothesis testing problem. Numerical results compared with those from the reputation-based schemes show a significant improvement in both classification of the nodes and hypothesis testing results. We also discuss an inherent ambiguity in the node classification problem which can be resolved if the honest nodes are in majority.

Keywords: Vectors, Testing, Wireless sensor networks, Sensors, Collaboration, Estimation, Maximum likelihood detection,
INSPEC: Controlled Indexing
Wireless sensor networks, binary decision diagrams, expectation-maximisation algorithm
INSPEC: Non-controlled Indexing
Reputation-based schemes, wireless sensor networks, decentralized hypothesis testing, misbehaving nodes, node misbehavior, adversary tampering, Byzanthine attack, node failure, hardware degradation, software degradation, binary hypothesis testing, binary decisions, fusion center, fictitious messages, operating point, false alarm, detection probability, receiver operating characteristic curve, maximum likelihood estimation, expectation maximization

INTRODUCTION

Wireless sensor networks (WSNs) consist of a large number of tiny battery-powered sensors that are densely deployed to sense their environment and report their findings to a central processor (fusion center) over wireless links. Due to size and energy constraints, sensor nodes have limited processing, storage and communication capabilities. In a large network of such sensors many nodes may fail due to hardware degradation or environmental effects. While in some cases a faulty node stops operating altogether, in other cases it may be misbehaving and reporting false data as in the case of stuck-at faults.

Wireless Sensor Network (WSN) is the most standard services employed in commercial and industrial applications, because of its technical development in a processor, communication, and low-power usage of embedded computing devices. The WSN is built with nodes that are used to observe the surroundings like temperature, humidity, pressure, position, vibration, sound etc. These nodes can be used in various real-time applications to perform various tasks like smart detecting, a discovery of neighbor node, data processing and storage, data collection, target tracking, monitor and controlling, synchronization, node localization, and effective routing between the base station and nodes.

A Wireless Sensor Network is one kind of wireless network includes a large number of circulating, self-directed, minute, low powered devices named sensor nodes called motes. These networks certainly cover a huge number of spatially distributed, little, battery-operated, embedded devices that are networked to caringly collect, process, and transfer data to the operators, and it has controlled the capabilities of computing & processing. Nodes are the tiny computers, which work jointly to form the networks.

The sensor node is a multi-functional, energy efficient wireless device. The applications of motes in industrial are widespread. A collection of sensor nodes collects the data from the surroundings to achieve specific application objectives. The communication between motes can be done with each other using transceivers. In a wireless sensor network, the number of motes can be in the order of hundreds/ even thousands. In contrast with sensor n/ws, Ad Hoc networks will have fewer nodes without any structure.

Wireless Sensor Network Architecture

The most common WSN architecture follows the OSI architecture Model. The architecture of the WSN includes five layers and three cross layers. Mostly in sensor n/w we require five layers, namely application, transport, n/w, data link & physical layer. The three cross planes are namely power management, mobility management, and task management. These layers of the WSN are used to accomplish the n/w and make the sensors work together in order to raise the complete efficiency of the network. Please follow the below link for: Types of wireless sensor networks and WSN topologies.

Applications Used

Area monitoring

In area monitoring, the WSN is deployed over a region where some phenomenon is to be monitored. A military example is the use of sensors to detect enemy intrusion; a civilian example is the geo-fencing of gas or oil pipelines.

Air pollution monitoring

Wireless sensor networks have been deployed in several cities to monitor the concentration of dangerous gases for citizens. These can take advantage of the ad-hoc wireless links rather than wired installations, which also make them more mobile for testing readings in different areas.

Greenhouse monitoring

Wireless sensor networks are also used to control the temperature and humidity levels inside commercial greenhouses. When the temperature and humidity drops below specific levels, the greenhouse manager must be notified.

Machine health monitoring

Wireless sensor networks have been developed for machinery condition-based maintenance (CBM) as they offer significant cost savings and enable new functionalities. In wired systems, the installation of

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enough sensors is often limited by the cost of wiring.

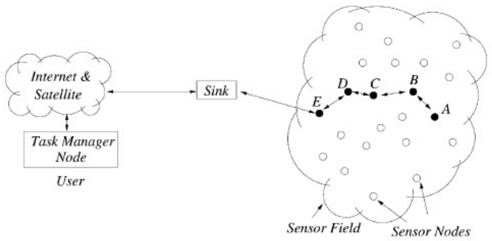
Water/wastewater monitoring

There are many opportunities for using wireless sensor networks within the water/wastewater industries. Facilities not wired for power or data transmission can be monitored using industrial wireless I/O devices and sensors powered using solar panels or battery packs and also used in pollution control board.

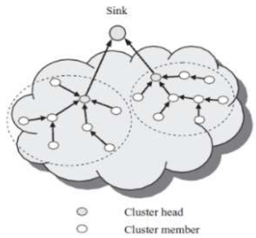
Agriculture

Wireless network frees the farmer from the maintenance of wiring in a difficult environment. Gravity feed water systems can be monitored using pressure transmitters to monitor water tank levels, pumps can be controlled using wireless I/O devices and water use can be measured.

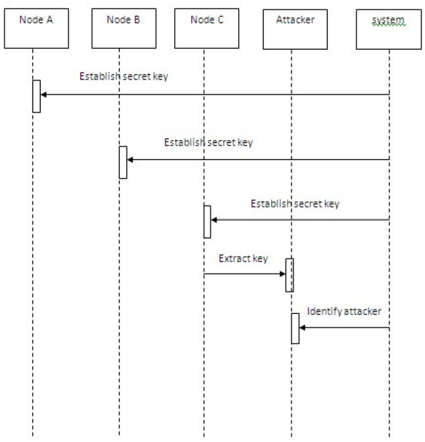
WSN Communication Architecture



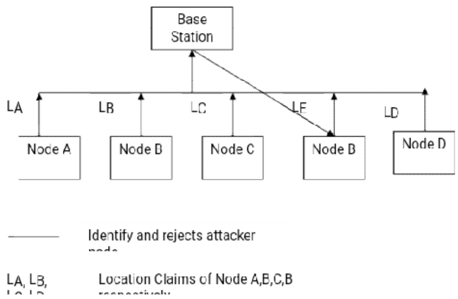
Multihop Clustering Hierarchy



Sequence Diagram



System Architecture

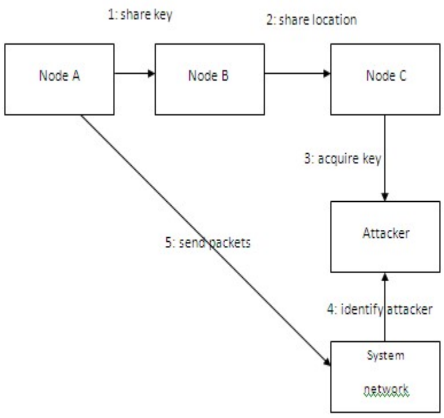


Software Requirement Specification

Functional requirements

1. Normal node in wireless sensor network is constructed in such a way that, it has its own id and key.
2. Sensor node forwards the data to base station
3. Every mobile sensor node's movement is

Collaboration Diagram



physically limited by the system configured maximum speed.

4. Attacker node is the replica node, which is created by adversary; this is known as replica node attacks.
5. A mobile replica node ul, which has the same ID and secret key of normal mobile node u.
6. victim and the attacker are using the same ID to transmit data packets
7. Attack detection is identified as statistical significance testing problem, where the null hypothesis is: H0 : normal (no attack).
8. For each user u select a set su of up to m distinct items from u's search history in S

Non Functional Requirements

Area	Codes & Standards / Realistic Constraints
Economic	This project is very economical as it only depends on the software components to be downloaded from the internet
Performance	This project Performance is high when compared with other file transfer mechanisms
Reliability	This project provides reliability because of the efficient usage of TCP protocol
Security	This project focuses on applying security concepts for authenticating the application.
Manufacturability	This project can be easily replicated. This requires complete schematics, complete and documented code listings, JSP, produced in a file format accessible by software available at JAVA

Results

Having received the messages from all the nodes, the FC will detect the hypothesis using a judicious decision rule.

It is assumed that there may be more than one class of misbehaving nodes. To show that from the point of view of the FC each class can be identified with a (operating) point on the receiver operating characteristic (ROC) that corresponds to the decision rule of the sensor nodes in that class. First estimate the operating points of each class. For a fixed hypothesis vector, formulate this problem as a maximum likelihood estimation problem with latent variables which correspond to the class identity of the nodes. This problem is then solved using the expectation maximization algorithm. Following this step to detect the class identity of each node and also detect the hypothesis vector.

Testing

After finishing the development of any computer based system the next complicated time consuming process is system testing. During the time of testing only the development company can know that, how far the user requirements have been met out, and so on. Software testing is an important element of the software quality assurance and represents the ultimate review of specification, design and coding. The increasing feasibility of software as a system and the cost associated with the software failures are motivated forces for well planned through testing.

Conclusion

The problem of decentralized detection is considered in the presence of one or more classes of misbehaving nodes. The fusion center first estimates the nodes' operating points (false alarm and detection probabilities) on the ROC curve and then uses this estimation to classify the nodes and to detect the state of nature. This problem is solved in the framework of expectation maximization algorithm. Numerical results are presented that show the proposed algorithm significantly outperforms the reputation-based methods in classification of the nodes as well as the detection of the hypotheses. The estimated operating points are compared to the Cramer–Rao lower bound which shows the efficacy of the proposed method.

REFERENCE

1. M. Franceschelli, A. Giua, and C. Seatzu, "Decentralized fault diagnosis for sensor networks," in Proc. IEEE Int. Conf. Autom. Sci. and Eng., 2009 (CASE 2009), Aug. 2009, pp. 334–339.

2. P. Varshney, Distributed Detection and Data Fusion, 1st ed. New York: Springer-Verlag, 1997.

3. S. Marano, V. Matta, and L. Tong, "Distributed inference in the presence of Byzantine sensors," in Proc. 40th Asilomar Conf. Signals, Syst. and Computers, 2006 (ACSSC '06), Oct. 29–Nov. 1, 2006, pp. 281–284.

4. S. Marano, V. Matta, and L. Tong, "Distributed detection in the presence of Byzantine attacks," IEEE Trans. Signal Process., vol. 57, no. 1, pp. 16–29, Jan. 2009.

5. M. Abdelhakim, L. E. Lightfoot, and T. Li, "Reliable data fusion in wireless sensor networks under Byzantine attacks," in Proc. Military Commun. Conf., 2011 (MILCOM 2011), Nov. 2011, pp. 810–815.

6. M. Gagrani, P. Sharma, S. Iyengar,V.Nadendla, A. Vempaty, H. Chen, and P. Varshney, "On noise-enhanced distributed inference in the presence of Byzantines," in Proc. 49th Annu. Allerton Conf. Commun., Control, and Comput. (Allerton), 2011, Sep. 2011, pp. 1222–1229.

7. R. Chen, J.-M. Park, and K. Bian, "Robust distributed spectrum sensing in cognitive radio

ISSN 2249-3875

International Journal of Pharmaceutical Erudition

networks," in Proc. IEEE 27th Conf. Computer Commun. (INFOCOM 2008), Apr. 2008, pp. 1876–1884.

8. A. Rawat, P. Anand, H. Chen, and P. Varshney, "Countering Byzantine attacks in cognitive radio networks," in Proc. 2010 IEEE Int. Conf. Acoust. Speech and Signal Process. (ICASSP), Mar. 2010, pp. 3098–3101.

9. P. Anand, A. Rawat, H. Chen, and P. Varshney, "Collaborative spectrum sensing in the presence of Byzantine attacks in cognitive radio networks," in Proc. 2010 2nd Int. Conf. Commun. Syst. and Netw. (COMSNETS), Jan. 2010, pp. 1–9.

10. M. Abdelhakim, L. Zhang, J. Ren, and T. Li, "Cooperative sensing in cognitive networks under malicious attack," in Proc. 2011 IEEE Int. Conf. Acoust., Speech and Signal Process. (ICASSP), May 2011, pp. 3004–3007.