

EFFICIENT COMPARISON BASED SELF DIAGNOSIS USING BACKPROPAGATION ARTIFICIAL NEURAL NETWORKS

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Abstract: In this paper, a comparison based diagnosis model is used for system-level fault diagnosis in a network. In comparison based diagnosis model, tasks are made to pair of nodes and their outcomes are compared by neighbouring nodes. In this comparison it is possible for the situation like faulty nodes can incorrectly claim that fault-free nodes are faulty or that faulty ones are fault-free. So to overcome this, a new diagnosis approach is proposed which uses neural networks to solve the fault identification problem using partial syndromes. Results obtained using partial syndrome method will show that neural-network-based diagnosis approach provide good results making it an alternative to existing diagnosis algorithms.

Key Words: system-level fault-diagnosis, comparison models, partial syndromes, neural networks.

I. INTRODUCTION

In the past two decades, the technique of artificial neural networks (ANN) is growing mature, as a data-driven method, which provides a totally new perspective to fault diagnosis. In self-diagnosable large-scale distributed systems and loosely coupled multiprocessor and multicomputer systems are composed of hundreds of interconnected processing nodes. In order to detect faults, each node is assumed to test and to be tested by other nodes of the system. From the results of the tests, nodes need to be diagnosed as faulty or fault free. This problem is known as the system level fault diagnosis problem. The system level diagnosis problem has been extensively studied in the last three decades.

In this paper, a totally different approach based on artificial neural network (ANNs) is used for solving the system-level diagnosis problem. Different comparison models and the generalized comparison model are considered. Note that the GCM is a general class of the testing models, and hence, the new ANNs-based diagnosis approach could be easily applied to these models as well with minor adaptations. ANNs have been successfully applied to a broad spectrum of applications including medical, industrial, financial, data mining, etc. In particular, ANNs have been also used to solve various fault diagnosis problems but this is the first time where ANNs are used to solve the system-level fault diagnosis. The neural network diagnosis approach is one of the few diagnosis algorithms that have been devised for the GCM-based fault identification problem. This new type of diagnosis approach could be important in the design of future generations of dependable systems.

II. RELATED WORK

MouradElhadef et.al.,[1] explained the system-level self-diagnosis in multiprocessor and multicomputer systems using the comparison approach. S.Chessa et.al.,[2] described about the fault identification in ad-hoc networks. Ad-hoc networks, i.e. networks of mobile, are gathering growing interest in the scientific community. M. Meireles et.al.,[3] described about the theoretical aspects of NNs related to their relevance for industrial applications. J.Zhou He et.al.,[4] introduced a new model called Fault Instance Model, to represent the fault diagnosis(FD). A novel neural algorithm, FANNC, was used in this paper. X.Yan et.al.,[5] developed an $O(n \times \Delta^3 \times \delta)$ diagnosis algorithm for general MM* diagnosable systems, which is remarkably superior to the fastest known diagnosis algorithm. Δ and δ denote the maximum and minimum degrees of a node, respectively. compared by a node (the comparator). K. Abrougui et.al.,[6] presented a new parallel algorithm to solve the problem of self-diagnosis of multiprocessor systems under the generalized comparison model. M. Elhadef et.al., [7] described about solving the system level diagnosis problem using the symmetric comparison model. M. Elhadef et.al.,[8] presented a novel approach using genetic algorithms as a key element in designing an efficient fault diagnosis algorithm of multiprocessor systems under comparison models. Each bit does not have an equal chance to undergo mutation. M. Elhadef et.al.,[9] explained how artificial immune systems

(AIS) can be used for fault diagnosis in large multiprocessor systems containing several hundred nodes. In diagnosable systems each fault set can be uniquely identified by one of its consistent syndromes (the antigen's molecular structure). M. Elhadeif et.al.,[10] described a novel fault identification approach for system-level fault diagnosis under the PMC model. Here diagnosis algorithm adapted the biological metaphor of swarm intelligence as a heuristic search mechanism to identify faulty nodes in a distributed or parallel computing network. M. Elhadeif et.al.,[11] developed a new distributed self-diagnosis protocol, called Adaptive-DSDP (Distributed self-diagnosis algorithm). For MANETs and WMNs that identifies both hard and soft faults in a finite amount of time. The problem of self-diagnosis of wireless mesh networks (WMNs) and mobile ad-hoc networks (MANETs) was done using the comparison approach.

III. PROBLEM DESCRIPTION

In this paper, a new diagnosis approach using neural networks is used to solve the fault identification problem using partial syndromes. The problem of efficiently identifying the set of faulty nodes when not all the comparison outcomes are available to the diagnosis algorithm at the beginning of the diagnosis phase is called partial syndromes. In this context when one node in a network requests for the same file more than once, it is considered to be faulty and its performance is said to be degraded.

IV. EXISTING SYSTEM

For fault identification, existing system used two comparison approaches: Symmetric comparison and Asymmetric comparison. In both models it is assumed that two fault-free nodes give matching (0) results while a faulty and a fault-free node give mismatching (1) outcomes.

The two models differ in the assumption on tests involving a pair of faulty nodes. In the symmetric model, both test outcomes (0/1) are possible, while in the asymmetric model two faulty nodes always give mismatching outputs (1). Furthermore, new approach called Generalized Comparison Model (GCM) was used for self-diagnosis.

In GCM approach the comparator node can be one of the two nodes under comparison. Then Broadcast Comparison Model (BCM), in which two nodes under comparison broadcast their outputs to all nodes in the system.

V. PROPOSED SYSTEM

For system level self-diagnosis, proposed system introduces a new diagnosis approach using neural networks to solve this fault identification problem using partial syndromes. The problem of efficiently identifying the set of faulty nodes when not all the comparison outcomes are available to the diagnosis algorithm at the beginning of the diagnosis phase called partial syndromes.

A. PROPOSED SYSTEM ARCHITECTURE

Fig. 1 represents the overall flow of the project. System will connect to monitoring node. Then it will collect all the information from each system. After this, comparators will calculate the fault rate. It is based on the random access, omitting one node and omitting one group.

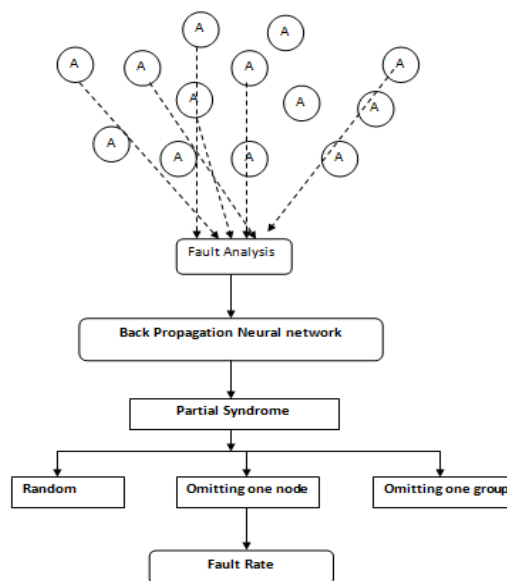


Fig. 1 System Architecture

Steps involved are:

- ❖ Create client and monitor nodes

Here the System and monitor Nodes are selected. Each node will connect to the monitor node. Every System gets the system name, system port number and monitor system IP address.

System level fault Diagnosis

Here all the transaction (sending and receiving files) are monitored. If any miss behavior is identified, some alert or message is sent to monitoring system.

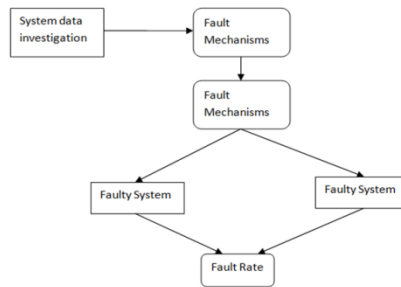


Fig. 2Faut Diagnosis

- ❖ Simple Comparison Model

In this comparison model one is a comparator and another two is comparable system. Assume that a set of jobs is assigned to pairs of distinct units, and the results are compared.

- ❖ BPNN Algorithm Implementation

The back propagation algorithm will get the all comparison output and analyses whether a node is faulty or fault free.

- ❖ Partial Syndrome Implementation

Here three cases are considered in identifying the faulty nodes

VI. SYSTEM DESIGN

To implement the system level fault diagnosis, a single monitoring node (centralized server) and a set of six client nodes are created. All the client/system nodes can access upload, download and search process. The comparator node gets the system status of the node under comparison and sends system report to monitoring node.

B. OBJECT DIAGRAM

Fig. 3 shows the object diagram which consists of four object components. First one is system, it is having two attributes. Second component is monitor having IPaddress and port number. Third component is comparator containing system one details and system two details.

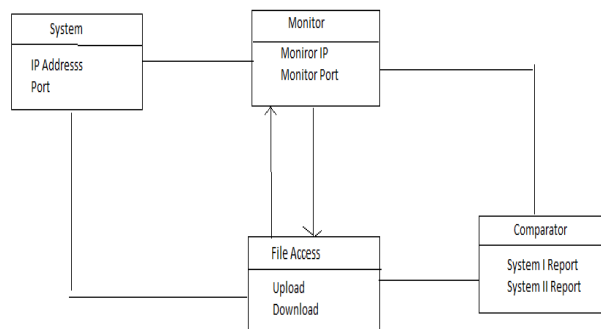


Fig. 3 Object Diagram

C. STATE DIAGRAM

Fig. 4 shows the state diagram which represents the overall flow of the process. Each system contains file access. It is divided into three parts. Every system file access status will be maintained in monitoring system.

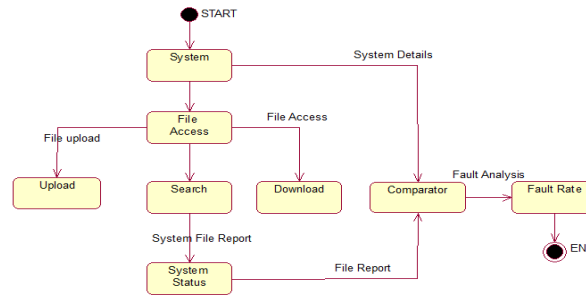


Fig. 4 State Diagram

D. COLLABORATION DIAGRAM

Fig. 5 shows the collaboration diagram which represents the flow of process. Each system will connect to monitoring node. Monitoring node will collect all the information from each system. After this comparators will Calculate the fault rate.

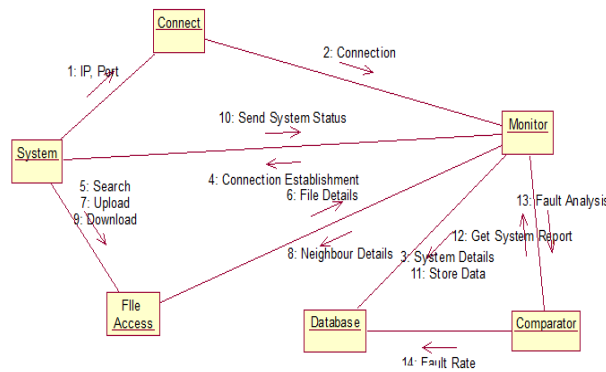


Fig. 5 Collaboration Diagram

VII. EXPECTED RESULTS

Fig. 6 shows the monitor node. Monitor system keeps the system details of all the client nodes in the database. As shown in the fig. 7.1, monitoring system contains different windows to show the system status and group status. Each group consists of two client nodes and there are three groups, hence monitoring node will keep track of all the six nodes and accordingly will identify the nodes that are faulty using the BPNN based algorithm and details provided by the comparator node.

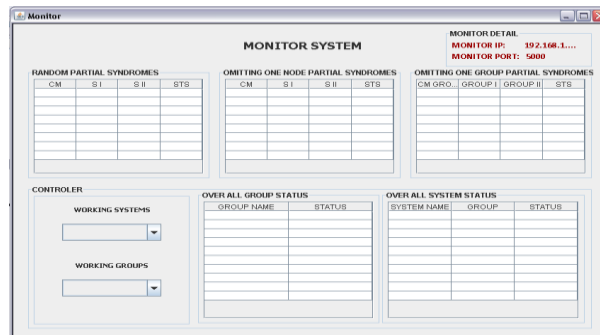


Fig. 6. Monitor Node

Fig. 7.a, b, c shows the steps involved in creating client node S1 shown in fig.8. In this project, three groups are used, each group consisting of two nodes. Every node can access file upload, download and search process. Each node can share the uploaded file with the neighboring nodes. All the details regarding the file upload, download, file sent and received by each node will be maintained by the comparator node.

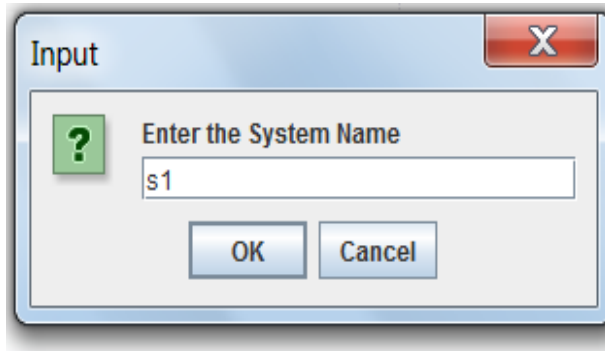


Fig. 7(a)

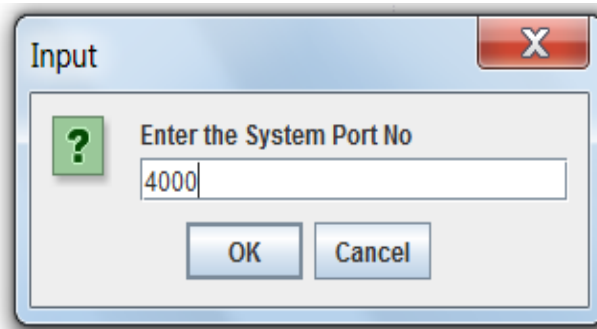


Fig. 7(b)

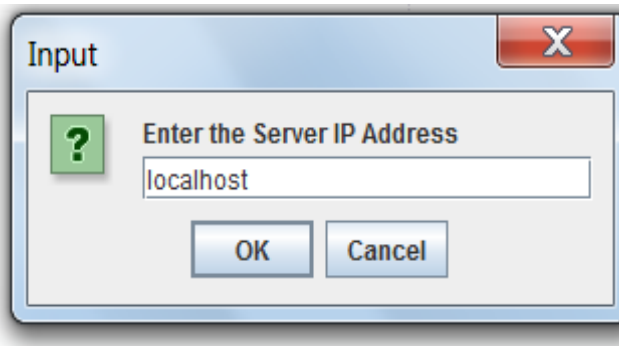


Fig. 7(c)

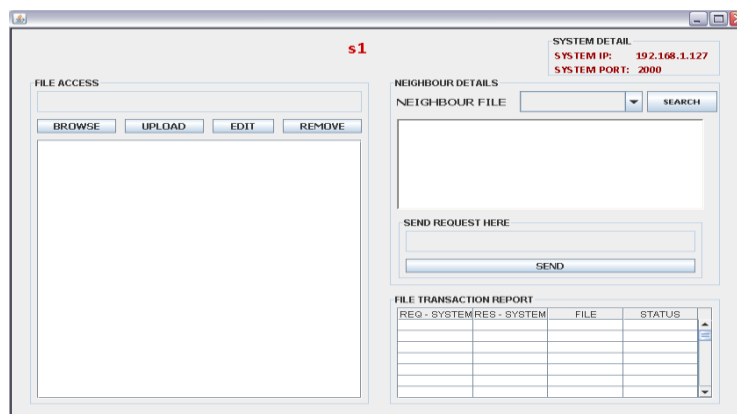


Fig. 8 Client Node S1

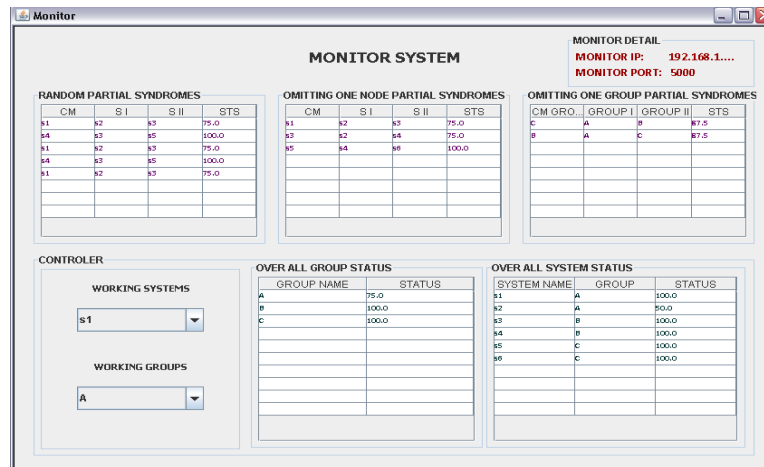


Fig. 9 Performance analysis

VIII. CONCLUSION

The back propagation neural network-based diagnosis approach presented in this paper aims at solving the well-known system-level diagnosis problem using simple comparison model and the partial syndromes. Nodes considered are the network connected PCs and a node is regarded as faulty if it requests for the same file more than one time. Accordingly its performance is said to be degraded. The back propagation algorithm is implemented in the monitor module and the monitor system keeps track of faulty and fault less nodes. Faulty nodes are omitted either randomly or in groups, where each group contains two nodes.

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