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# Distributed GA (Genetic Algorithm) Implementation with ABSN Framework for Analysis and Disease Prediction

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***Abstract:*** ***Wireless sensor network (WSN) is the huge area of research in association with the medical field for delivering various kinds of medical application which uses WSN as major part of the application but the goings on researches are still suffering from efficient and the flexible data management techniques. This area of research is still having lack of effective, flexible, scalable and secure information management. In the medical vast amount of sensitive data is generated which needs secure and authorize access but all the existing framework cannot completely resolves this problem. Although they did very important contribution in this area of research and try to provide very promising solution but still require huge enhancement to provide effective service. The major shortcomings of existing solution are security, scalability and lack of resources which leads to less availability of resources. Wireless sensor network is used to monitor to patient health status and transmit real time monitoring report on the storage server which is used by healthcare professional to provide better and fast response so it needs fast and secure transmission and retrieval of the information. In the medical field providing response on different emergency situation is also very important concern so an effective emergency management scheme is required for handling various kinds of emergency situations. In this paper we are providing a framework which provides effective data management as well provide functionality of disease prediction and cure suggestion in the absence of expertise with the help of hadoop implementation of genetic algorithm for the data classification. In this paper we also use DABE (Distributed Attribute based encryption) for flexible and fine grained access control for fast and secure data retrieval.***

***Index Terms:*** ***WSN, hadoop, healthcare, cloud computing, data management, access control, Genetic algorithm.***

## I. INTRODUCTION

The rapid growth of wireless sensor network in the field of healthcare and medical leads us to the development of the small sensor nodes which is capable to sense various physiological symptoms of the human body and transmit them and process them effectively and collectively the group of these sensor nodes are called body sensor network (BSN) in which small sensors nodes are implanted in the human body for the monitoring his/her health condition which leads to better service in the form of rapid response on emergency situation and proper patient heath monitoring.

Huge amount of research work is done in the field of monitoring patient medical condition and provide better response in emergency and normal situation with less cost [1, 2, 3]. The proposed research work architecture is composed of the cloud platform for scalable storage and analysis using hadoop implementation of genetic algorithm for classification of various data, (BSN) body sensor network, gateway and graphical user interface for monitoring figure 1 shows all the basic components of the architecture. The sensor nodes are implanted on the body of the patient and collect data for different medical parameters and all collected data is forwarded to cloud storage via gateway which plays a role of rely nodes for monitoring system with the help of any network infrastructure backbone such as wifi, ADSL or by a satellite network. The major issue of storage scalability due to huge amount of data is generated by the medical field application and the generated data and data collected is mostly heterogeneous type in nature and due to high frequency data generation by the sensor nodes needs scalable storage which increases on demand and we also take care of sensitivity and privacy of patient health information [4, 5]. In our previous research work we provide a flexible cloud based storage in this we are focusing on the classification of data on various symptoms and predict the probability of having a particular disease and possible cure for disease in absence of the expert.

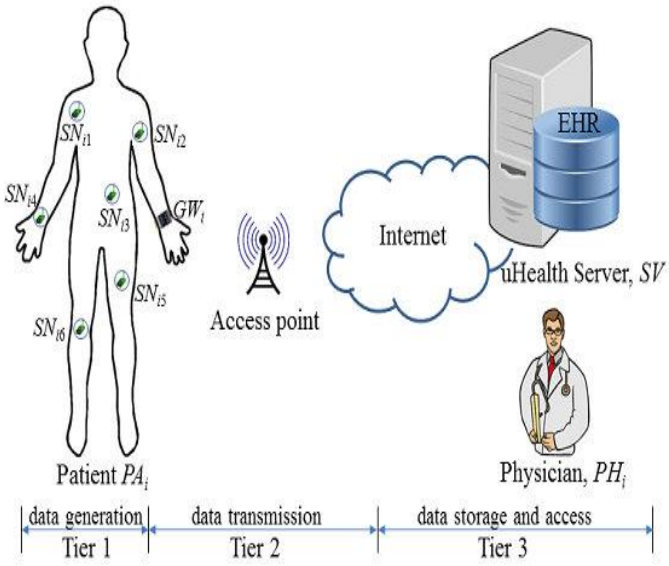


**Figure 1: Basic architecture of BSN with monitoring system**

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We use multi-level security with the help of access policy for accessing the patient information from the cloud storage but the policy are so complex which increases the problem of the overhead and cope up with the complex polices with efficient and flexible access control polices is a challenging task. Although huge amount of research is done in this area only some of them are effective [6]. Managing emergency situation is also one of the very challenging tasks. BSN (body sensor network) is means collection of real time patient health monitoring with the help of wireless sensor nodes which are capable of communication via gateway and provides report to medical professionals. In the emergency situation we need a flexible security policy which can provide fine grained access control of data without violating security because additional or temporary staff is used in the emergency situation.

In this proposed work we use the genetic algorithm hadoop implementation for the classification of the collected and drawing meaningful result from classified data such as disease prediction or suggesting cure as per level of disease in the absence of the expert. Genetic algorithm is used to drawing selection from the huge search space. GA provides ease of processing large datasets and delivers us best solution of the problem from search space figure 2 shows basic genetic algorithm. First step of the genetic algorithm to select the best option from the search space and then perform the combination of the bits and pieces of the good parents and hypothesize on new, possibly better children with a random shuffle of itself afterward mutation of random amendment of string revolutionize a gene miniature progress of the neighborhood by itself a random walk.

```
START

Generate initial population.
Assign fitness function to all individuals.

DO UNTIL best solution is found

    Select individuals from current generation
    Create new offsprings with mutation and/or breeding
    Compute new fitness for all individuals
    Kill all unfit individuals to give space to new offsprings
    Check if best solution is found

LOOP

END
```

**Figure 2: Basic algorithm structure for GA (genetic algorithm)**

## II. LITERATURE REVIEW

Cloud computing offers on demand resources such a storage capacity and processing powers and this leads to a virtualization of huge data storage space or processing capability [7, 8] undeniable for supervision data gathered by BSN. Cloud computing provides easy and flexible storage, processing and allocation of data which is collected by the sensor node from the patient body at any place and at anytime with the help of medical application. The idea of combining wireless sensor network with the cloud computing is in the early phases of the research because some of the very new research work addresses all the challenges which arises when we try to establish a connection between cloud infrastructure and network the minority of the research papers tell us that cloud computing to diverse WSN applications for providing various industry supervision [9], collecting data of the patient using BSN monitoring the various level of energy[10] and one of the most important area is monitoring of the environment [11]. Conversely, the entire research works describe preface works and unnoticed the challenge which comes out by integration of cloud computing to wireless sensor network. In [12], the authors anticipated a novel architecture of cloud based architecture of wireless body area network (WBAN) amid its fundamental query processing algorithm for secure and powerful storage, energy-efficient and real-time data processing. This work combined cloud and WBAN (i.e. medical WSN) to address several challenges of WBAN but did not tackle the issues of confidentiality of sensitive data and access control on untrusted cloud. Another approach to tackle the challenges of data management on WSNs, called the distributed database for sensor networks is studied in [13]. This approach focuses on how to manage the large amount of sensed data in an energy-efficient way.

Genetic algorithm comes under the division of the evolutionary algorithm [14] and these algorithms are widely used for numerous numbers of domains such as biology, chemistry and scheduling [15]. In genetic algorithms are used to find nearest most advantageous solution in the complex search [16]. The parallel implementation of genetic algorithm is improve efficiency and processing speed which leads to fast result in less time [17]. The parallel genetic algorithm divides the problem into multiple sub problems as treat as individual and start process them parallel which not only cause for fast processing but also enhance the capacity of handling more and more complex problem. In this proposed work we integrated hadoop implementation of genetic for the classifying data and predict useful result with our existing work of "A-BSN: Cloud based Secure Framework for Effective Data Management and Analysis using Hadoop" for increasing the accuracy of the result.

## III. PROPOSED METHODOLOGY

In this paper we embedded the GA (genetic algorithm) for the data mining to predict the disease in our existing work which provides fine grained access control policy for accessing data now we empower our framework to predict and classify on the basis of symptoms of collected data and tell about of the disease probability. In the proposed architecture of analysis data is extracted from the cloud storage and pass to parallel implementation of GA (Genetic algorithm) using mapreduce below show algorithm for mapreduce implementation of the GA (Genetic Algorithm) for the various factions.


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```
function Distributed_GA()
  t = 0                          /* index of generation */
  P[0] = a1[0], …, au[0]         /* initialization */
  Evaluation(a1[0],…,an[0])
  while not T(P[t]) do
    P'[t] = Mutation(Crossover(P[t]))
    Evaluation(a'1[0],…,a'n[0])
    <Communication>
    P[t+1] = Selection(P'[t])
    t = t + 1
  endwhile
return Optimum(P[t])
```

Distributed GA (Genetic Algorithm)

```
function mapper(key, value)
  /* translation */
  P= a1[0], …, au[0]= Individual(value)
  /* perform evaluation */
  P'=Evaluation(a'1[0],…,a'n[0])
  /* Submit intermediate results */
  Emit(default_key, P')
```

GA (Genetic Algorithm) Map phase.

```
function reducer(key, value_list)
  i = 0          /* index variable */
  foreach value in value_list
    P[i]= a1[i], …, au[i]= Individual(value)
    i++
  /* perform local selection */
  P' = Selection(P)
  /* submit local optimum individuals*/
  foreach individual in P'
    Emit(individual, 1)
```

Reduce operation phase 1

```
function final_reducer(key, value)
  /* translation */
  P= a1[0], …, au[0]= Individual(key)
  /* submit global optimum individuals*/
  Emit(P, 1)
```

Final Reduce step

```
procedure MapReduce_GA()
  t = 0                          /* index of generation */
  P[0] = a1[0], …, au[0]         /* initialization */
  Evaluation (a1[0],…,an[0])
  while not T(P[t]) do
    P'[t] = Mutation(Crossover(P[t]))
    SendToScheduler(P'[t])
    P[t+1] = ReceiveFromScheduler(t)
    t = t + 1
  endwhile
return P[t]
```

Final coordination operation

## PERFORMANCE ANALYSIS

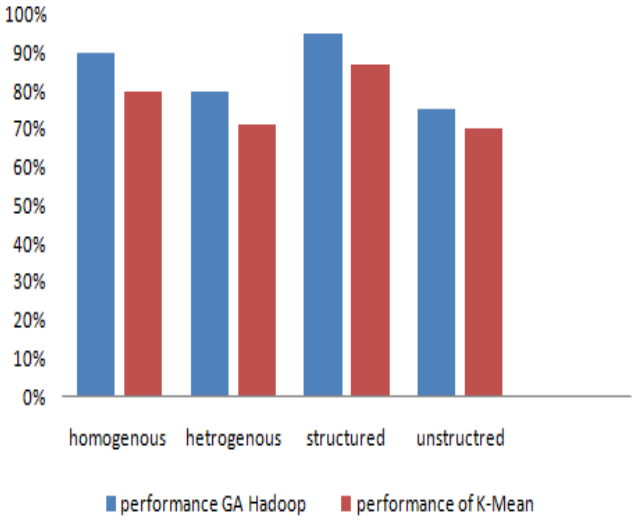


**Figure 3: Performance of GA and K-Mean on Hadoop**


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## IV. CONCLUSION

This proposed work is the extension of my previous "A-BSN: Cloud based Secure Framework for Effective Data Management and Analysis using Hadoop" in this we use GA (genetic algorithm) for the classification of data and getting more accurate result of disease prediction and cure suggestion in the absence of the specialist and it also helps in improving services in the various medical department in which the ratio of patient wellness is low. In future we can add some more complex function to improve performance of GA. Distributed implementation provides ease of parallel execution which leads fast and enhance performance.

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