Soft Computing Tool for Disaster Management

M. Mohana Priya
(PG Student) Department of Civil Engineering
Dhirajlal Gandhi College of Technology
Salem, India.

Dr. Gulshan Taj M. N. A
(Associate Professor) Department of Civil Engineering
Dhirajlal Gandhi College of Technology
Salem, India.

Abstract:- **Disaster management is the creation of plans through which communities reduce vulnerability to hazards and hope with disasters. It does not avert or eliminate the threats; instead it focuses on creating plans to decrease the impact of disasters. Events covered by disaster management includeactsof terrorism,industrial sabotage, fire, natural disasters, public disorder, industrial accidents, and communication failures. These emergency operations involve a variety of challenging optimization problems, for which evolutionary computation methods are well suited. In such cases, genetic algorithm is the good choice due to its unorthodox search algorithms. Genetic Algorithms are adaptive methods which may be used to solve different categories of optimisation problems. In this paper application of genetic algorithm for disaster mitigation and sustainable development has been reviewed with reference to some literature articles. Future scopes of such algorithms to address the various natural disaster problems are addressed in brief.**

keywords:- Genetic algorithm, natural hazards, disaster management.

I. INTRODUCTION

Natural disasters usually results in loss of life as well as severe damage to property and the surrounding environment. Therefore, it is important to perform effective emergency plans to tackle these natural disasters. Natural disaster may occur anytime, therefore precautionary steps are essential. A natural disaster scenario is not only dynamic but also highly complicated in terms of resources. When disaster occurs probability of destruction of Communications systems is very high. Most of nodes stop working and may create blockage in maintain connectivity.In disaster scenario connectivity as quality of service should be guaranteed in order to achieve required level of disaster management. The purpose of conducting a Risk Assessment Analysis is to know the threat of damage, liability, loss, or other negative occurrence caused by internal or external vulnerabilities. It is also used to identify the flood risk in certain areas using risk factors such as the area's urbanized area ratio, literacy rate, mortality rate, and percent of population under poverty, radio/TV penetration and the state of structural and non-structural measures. The objective of this work was to propose a distributed approach based on a genetic algorithm for modelling and solving the problem of contingency planning in case of disaster by planning disaster relief distribution by maximizing the number of people saved, avoiding delays in the relief distribution and maximizing the useful equipment life which saves costs.

II. GENETIC ALGORITHM

Genetic Algorithms (or simply GAs) are powerful and widely applicable stochastic search and optimization methods based on the concepts of natural selection and natural evaluation. Genetic algorithms work on two types of spaces alternatively: coding space and solution space, or in other words, genotype space and phenotype space. Genetic operators work on genotype space, while evolution and selection work on phenotype space. The selection is the link between chromosomes and the performance of decoded solutions. The mapping from genotype space to phenotype space has a considerable influence on the performance of genetic algorithms. The genetic algorithms provide a directed random search in complex landscapes. There are two important issues with respect to search strategies: exploration (investigate new and unknown areas in search space) and exploitation (make use of knowledge of solutions previously found in search space to help in find better solutions). This can be done by making genetic operators perform essentially a blind search.

Genetic algorithm starts with a set of solutions (represented by chromosomes) called population. Solutions from one population are taken and used to form a new population. Its motivation is hope that the new population will be better than the old population. Solutions which are selected to form new solutions (offspring) are selected according to their fitness-the more suitable solution has a higher chance to reproduce. However, this depends on the selector operator used. The next phase is the crossover phase wherein the selected individuals are mated pair by pair to form a new offspring. Finally, some of the offspring are mutated. This is repeated until some condition (e.g. no. of populations or improvement of the best solution) is satisfied.

III. RESEARCH STUDIES REPORT ON APPLICATION OF GENETIC ALGORITHM IN DISASTER MANAGEMENT

In the field of flood management, GAs have been used in the design of flood control structures (Wallace & Louis, 2003), model calibration (Lan, 2001), flood plain management (Karamouz, Abesi, Moridi, & Ahmadi, 2009), and flood forecasting (Mukerji, Chatterjee, & Raghuwanshi, 2009). This study aims to expand this list to include flood disaster management. GAs is computerized search and optimization methods which mimic the principles of natural evolution.

All disaster management plans begin with the identification of risk. This is true whether we are concerned with earthquakes, storms, floods or other natural hazards. Risk

is an indicator of how prone a specific area is for a natural hazard to turn into a disaster and is a function of three factors which is defined by this equation:

- Hazard
- Vulnerability
- Exposure,

A. A Mobile Disaster Management System Using the Android Technology

Jovilyn Therese B. Fajardo, Carlos M. Oppus, reported that One common scenario during disasters is that the activity of rescue and relief is not well-coordinated. For this reason, there is a need for a system that will help in the efficient provision of rescue and relief to disaster-affected areas. Since the use of smart phones is gaining interest in people, the disaster management system was implemented as a smart phone application using Google's Android operating system. The disaster management system Android application known as MyDisasterDroid determines the optimum route along different geographical locations that the volunteers and rescuers need to take in order to serve the most number of people and provide maximum coverage of the area in the shortest possible time. Genetic algorithm was applied for optimization and different parameters were varied to determine the most optimum route.

B. Distributed Genetic Algorithm For Disaster Relief Planning

K. Zidi, F. Mguis, P. Borne, K. Ghedira studied the world continues to witness the vulnerability of natural and artificial disasters on human well-being is constantly under threat. Often, disaster response was characterized by excessive centralization and short-term nature of the emergency chain coupled with a lack of reliable information. In addition, sources the supply distribution nodes, and extended distribution points must be quickly putted in place, sometimes because of the topographical difficult situations of pickups and deliveries. In several times, organizations and agencies have negotiated with governments and administrations, military access, municipal authorities and organizations, therefore, it appeared that crises and disasters create circumstances and extraordinary conditions for those who seek to manage relief and rescue operations. It's the case of inefficiency, waste, and lack of planning and logistical capacity limited disaster was cited. These criticisms were also applied to the disaster relief operations, for example, in the aftermath of Hurricane Katrina in 2005. Such an investigation was crucial for improving real-time response and effectively to the consequences of disasters as well. Other crises where relief goods such as water, food, first aid and so must be rapidly distributed to reduce human suffering and save lives. It appeared that, some parameters must be taken into consideration to better understand the situation of the typical distribution of disaster relief. Resources of the fleet of vehicles and emergency equipment were generally insufficient; the affected area was often a poor logistics infrastructure (eg, bad and damaged roads, warehouses, ports, etc.) and desperate people who may be dispersed to different nodes (feeding sites and/or distribution) over a large area. Therefore, it is difficult for both relief workers and logisticians to rapidly develop effective and efficient distribution plans. Second, fleet management with interest on routing, planning, pickup and delivery are often the main decisions to be taken by the logisticians and the relief's effective allocation and satisfaction of requests place were also to be taken in consideration. These decisions are important for the distribution of relief because of "life or death." This requires fast delivery with strict limit

C. Metaheuristics In Flood Disaster Management And Risk Assessment

Vena Pearl Bongolana, Florencio C. Ballesteros (Et.al) studied thata conceptual area is divided into units or *barangays*, each was allowed to evolve under a physical constraint. A risk assessment method is then used to identify the flood risk in each community using the following risk factors: the area's urbanized area ratio, literacy rate, mortality rate, poverty incidence, radio/TV penetration, and state of structural and non-structural measures. Vulnerability is defined as a weighted-sum of these components. A penalty‟ was imposed for reduced vulnerability. Optimization comparison was done with MATLAB‟s Genetic Algorithms and Simulated Annealing; Results showed „extreme‟ solutions and realistic designs, for simulated annealing and genetic algorithm, respectively. GA and SA program iteration runs produced the following optimal arrangements for the 36 barangays, broken-down by their „traits‟ or chromosomes as:

- It allowed 2 poor barangays along the diagonal, flood prone area. This gives us insight on designing housing.
- For flood plains which is a special concern in the Philippines with high poverty cidence; It assumes 9 units to be compliant to rules and regulations and placed worst offenders away from floodplains; and
- Iteration runs consumed two and half days.

D. Coupling Artificial Neural Networks And Genetic Algorithms In Redesigning Existing Cities For Flood Resistance

Gene Oliver Cruz1, Florencio Ballesteros, Jr.1, Ariel Blanco reported to minimize economic losses caused by a disaster, it is important to assess the communities' vulnerabilities and plan ahead before a disaster strikes. This paper explores the use of neural networks and genetic algorithms as support tools for an integrated urban development and disaster risk reduction planning and decision making. Historical data havebeen collected from the cluster of cities and municipalitieswhich includes Marikina City, Quezon City, San Mateo,Antipolo City, Cainta and Pasig City. This is primarily due to the inability of the localgovernment to retain historical information, particularly inthe 1990s where computers were not yet widely used to storedata. Most documents were kept in hard copies and retainedfor a certain period of time, for example, five years afterwhich these are disposed. As a result, additional work iscarried out in tracing back historical land use pattern throughdifferentiating available data sets and focusing only in areaswhere changes occurred.The number of parameters or attributes to be consideredin land use planning and disaster risk management is abundant. Some of these attributes take first precedence over the others and some of these attributes may not be significant at all. For a human to process all available

information, it would take much time and effort and by the time results are derived new sets of change have occurred. The research intends to verify the usability of identified problem solving methods in obtaining valuable information for planning and decision making in an integrated holistic approach. The research also recognizes that the computational requirements may be extremely resource consuming. Assuch, the research intends to further investigate in the future the use of other computational methods to compare which are more efficient.

E. Performance Evaluation of Wireless Sensor Network using Genetic Algorithm

Prof. S. D. Chavan , Dr. A. V. Kulkarni, Neeta Patil, This article presents evolutionary computation approach i.e. genetic algorithm for improving performance of wireless sensor network in disaster conditions. A successful disaster management requires fast synchronization of existing resources. At time of disaster, wireless sensor network becomes very complex. In such conditions Connectivity among nodes should be maintained. In disaster scenarios due to constrained and mobile conditions it becomes difficult to maintain connectivity. In this paper we propose Genetic Algorithm for performance enhancement of wireless sensor network in disaster condition since number of parameters is considered, a genetic algorithm and the network simulator NS-2 is proposed for simulation. It helps for optimizing connectivity in disaster scenario. We have outlined design challenges first followed by Genetic algorithm as proposed approach for disaster Management. It is seen that performance of wireless sensor network becomes better and parameters are enhanced.

IV. CONCLUSION

A disaster management system that facilitates the logistics for the rescue and relief operations during a disaster. In this paper, the rate of risk was assessed first, after which GA was applied to reduce the scale of risk. It was shown through an example that GA is effective in reducing the IS risk in organizations and also we have presented an overview of genetic algorithm for optimizing connectivity in disaster scenario. We have outlined design challenges first followed by Genetic algorithm as proposed approach for disaster Management.

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