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SURVEY ON AN IMPROVED EVOLUTIONARY ALGORITHM FOR EFFECTIVE OPTIMIZED NETWORK DESIGN

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Abstract

Network style involves many areas of engineering and science. Laptop networks, electrical circuits, transportation issues, and biological process trees square measure some examples. In general, these issues square measure NP-Hard. So as to modify the complexness of those issues, many methods are proposed Aiming to beat this downside; various representations of spanning trees are developed. This text proposes a secret writing for generation of spanning forests by biological process algorithms. we tend to propose a brand new system, known as node-depth-degree illustration (NDDR), and that we demonstrate that mistreatment this secret writing, generating a brand new spanning forest needs average time. Experiments with AN Ea supported NDDR applied to large-scale instances of the degree-constrained minimum spanning tree downside have shown that the implementation adds little constants and lower order terms to the theoretical sure.

Keywords: Network design, Network design problems Loss reduction, switching operation.

1. Introduction

The system of systems philosophy dictates an expansion of a traditional design methodology to encompass an integrated view of a system during the design process. Traditional approaches to sub-system design Focus on a particular discipline and analyse the best design given sub-system performance targets. In the competitive market of telecommunication services, the ability to meet Quality of Service requirements in a cost-effective manner has become crucial for the business of telecommunication service providers and network operators[2][22]. Since architectural redesign efforts are extremely time consuming and thus expensive, there is a critical need for efficient techniques to support the proper design decisions.

Due to the increasing complexity of communication infrastructures, many design problems have become extremely complex, and have to deal with a variety of complicating side constraints the presence of multiple objectives, noise, dynamically changing parameters, large solution space that in many cases cannot be handled effectively by the existing optimization techniques[6]. On the other hand, an important and convenient aspect of IC system design problems is that there is no critical need for real-time split-second decision making. Most network design problems (NDPs) are NP-hard. Several approximation algorithms have been investigated but no constant-factor approximation scheme was found for relevant NDPs [11]. Some NDPs include restrictions that significantly increase the difficulty of finding a feasible solution. Examples include multiple criteria demand uncertainty and demand that depends on network topology [11]. In order to deal with complex using NDPs, several populations based met heuristics have been investigated and have produced relevant results. A major class of such heuristics is formed by evolutionary algorithms (EAs) [18]. In general, an EA takes the graph that models a NDP and, during its execution, generates and keeps a large set of potential solutions represented by spanning forests (often with only one tree) of the graph. This way EAs investigate the search space in breadth and avoid local optima.

2. RELATED WORK

2.1 On spanning-tree recombination

The key algorithms concerned within the recombination-based organic process software system developed for coming up with electrical distribution networks. Specialize in the spatial property drawback of large-scale networks and on the specificities of its search area [6]. The difficulties in handling topology constraints and gift each the geno-type and also the operators to beat such difficulties. The operator's area unit designed to method significant topological data as geno-type substructures and switches the rituality and property into genetic transmissible properties. First, a theoretical example is conferred parenthetically necessary variations between alternative common approaches and also the approach taken [17] [19]. Then, a true electrical trade application is conferred parenthetically the power of the approach to handle large-scale distribution network issues.

2.2 Evolutionary approach and fuzzy sets

The service restoration (SR) drawback in electrical distribution networks is handled victimisation associate organic process strategy (ES) with a fuzzy definition of the conflicting objectives. The conventional operation standing permits the device of tie-switches, of condenser banks and cargo affiliation [5]. Once a permanent fault happens, a similar device action is performed with the aim of restoring the service within the involved areas. The standing of those remotely governable parts is that the Boolean improvement variables for the SR drawback [23]. Besides this, here the SR drawback is handled in a very multiple objectives (MO) formulation. Indeed, the ability losses' term is taken into account as an extra objective to be reduced, alongside the first objective of maximising the amount of equipped hundreds. Generally, the MO formulations of associate improvement drawback needs singular expressions for the world objective operate [9]. during this specific case, the used atomic number 99 approach essentially needs the definition of a 'global performance' index, that comes on the idea of the fuzzy sets theory, outperforming the weighed add formulation of a similar drawback.

2.3 Node location

Their work included battlefield location and network element selection. Later, in the results in were improved upon with enhancements to the objective function, efficiency gains and additional heuristics.

2.3.1 Local access networks

In the context of local access network design Router showed that genetic algorithms could be used to place concentrators in the network, used problem-specific operators and an integer representation. Chard ire studied similar location problems for concentrators for computer terminals, among others [1]. Celli et al. studied the positioning of concentrators for metropolitan area networks (MANs) with a genetic algorithm to demonstrate that parallelization and a proper choice of variables speed up the algorithm used [8]. Webb et al. employed a genetic algorithm with heuristic repair for the selection of backbone nodes in a ring/star transport network. They showed the topologies resulting from true economic cost models, instead of the classical distance-cost models.

2.3.2 Radio networks

For radio networks, a key problem is the proper positioning of locations for antennas and receivers. Moreover, in they also found some other heuristics to be less well performing [16]. Gondim tackled the problem of associating cells to switching centres with a genetic algorithm. Zimmermann et al. used EC techniques to address the antenna placement problem. Tang et al used a multi-objective genetic algorithm for determining the number of locations and their places in a wireless local area network (WLAN).

2.3.3 Integrated Transportation Network

The design of a transportation system has focused on one of the two sys- teams that comprise the transportation architecture, the vehicle or the network design[3] [7]. However, to define a systems level architecture for a transportation system, it is necessary to expand the system definition during the design process to include the network definition, the vehicle architecture, and the operations, which couple the vehicle and the network. The transportation architecture is decomposed into these fundamental sub-systems by classifying the decisions required to define each sub-system.

3. SYSTEM ARCHITECTURE

3.1 Node-depth-degree representation

Network design involves several areas of engineering and science. Computer networks, transportation problems, and phylogenetic trees are some examples; In order to deal with the complexity of these problems, some alternative strategies have been proposed.

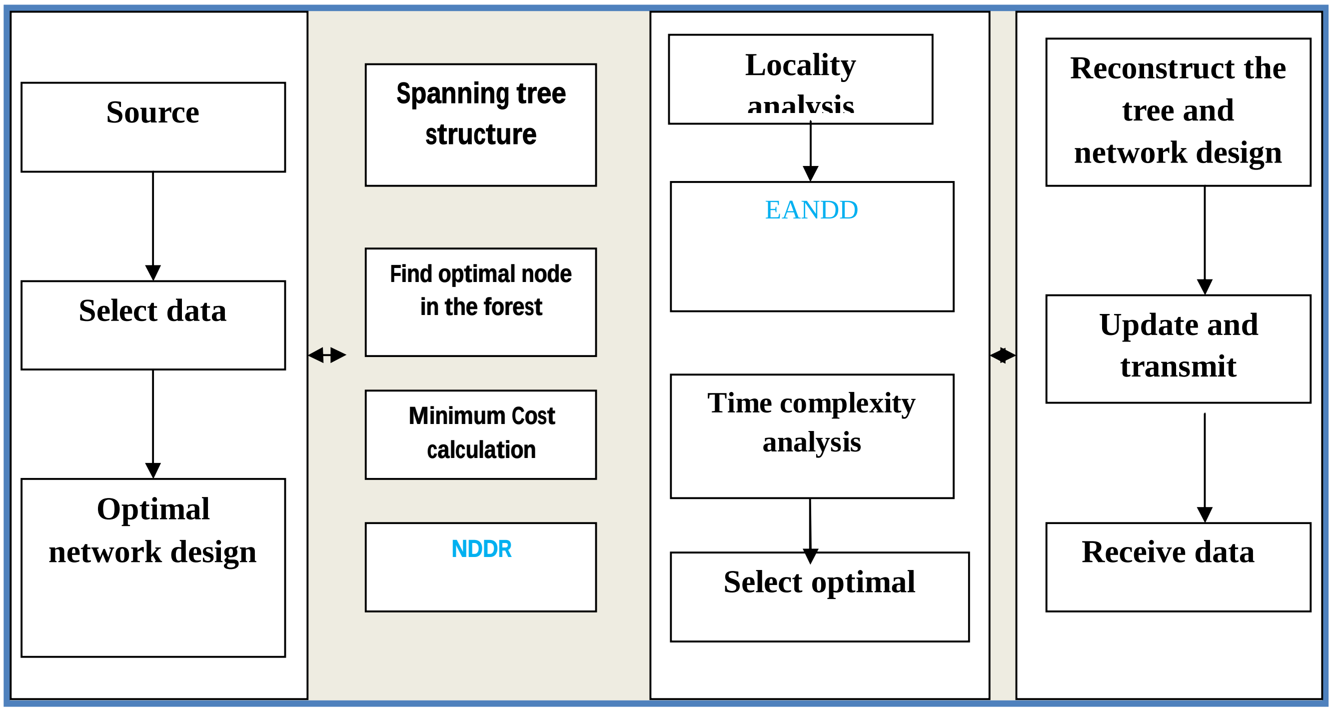

Figure.1 Components of a Data Forest effective optimized network design

Drawback, alternative a representation of spanning trees has been developed for this article proposes an encoding for generation of spanning forests by evolutionary algorithms[19] [20]. The proposal is evaluated for degree-constrained minimum spanning tree problem.

This section presents Operations 1 and 2 to generate new spanning forests (Fig1). They produce the FR of a spanning forest *Fh* of a graph *G* from an existing FR of a spanning forest *Fg* of *G*. The effect of both operations is to transfer a sub tree from some tree *T* from to another tree *T*to in the forest. This type of tree modification has been extensively employed in other areas, such as genetic programming and phylogenetic tree reconstruction. The operations of the encoding we propose innovate fundamentally in the quality with which they perform tree modifications.

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By “quality” we mean the NDDR properties pointed out in Section I[3]. It is also important to highlight that, unlike tree modification procedures developed for specific areas; NDDR handles aspects that may vary significantly from a NDP to another.

3.2 Evolutionary Algorithms

A major challenge to solving such problems is to capture possibly all the (representative) equivalent and diverse solutions. In this work, we formulate of generality, a bi-criteria bi- constrained communication network topological design problem. Two of the primary objectives to be optimized are network delay and cost subject to satisfaction of reliability and flow constraints.

This is a *NP-hard* problem so we use a hybrid approach for initialization of the population along with Evolutionary Algorithms [7] [19]. Furthermore, the two objective optimal solutions are not known *a priori*. Therefore, we use a multi objective EA which produces diverse solution space and monitors convergence;

The flow of the algorithm is as follows:

Step 1: Generate the initial population of size *s* by the method of section 3.2. Calculate the fitness of each candidate network in the population using eq. 2 and Jan’s upper bound [2] as R(**x**), except for the lowest cost network with $R_U(\mathbf{x})$ R_o. For this network, $\mathbf{x}_{BEST}$, use the Monte Carlo estimation of R(**x**) in eq. 2. Generation, *g*, = 1.

Step 2: Select two candidate networks. An elitist ranking selection with stochastic remainder sampling without replacement is used.

Step 3: To obtain two children, apply crossover to the selected networks and mutation to the children.

Step 4: Determine the 2-connectivity of each new child. Use the repair algorithm on any that do not satisfy 2-connectivity.

Step 5: Calculate $R_U(\mathbf{x})$ for each child using Jan’s upper bound and compute its fitness using.

Step 6: If the number of new children < *s*-1 go to Step 2.

Step 7: Replace parents with children, retaining the best solution from the previous generation.

Step 8: Sort the new generation according to fitness. *i* = 1 to *s*.

a) If Z ($\mathbf{x}_i$) < Z($\mathbf{x}_{BEST}$), then calculate the reliability of this network using Monte Carlo simulation, else go to Step 9.

b) $\mathbf{X}_{BEST} = \mathbf{x}_i$. Go to Step 9.

Step 9: If $g = g_{MAX}$ stop, else go to Step 2 and $g = g+1$.

3.3 Encoding

In the encoding scheme chosen, every chromosome encodes a possible topology for interconnecting the given nodes [10]. A constant length bit string representation was used to represent the chromosome. Every possible link is assigned an integer and the presence of that link is signalled by the presence of that integer in the ordered string. The scheme for the integer assignment is arbitrary. The first network includes all possible links using the arbitrarily assigned labels defined above. The second network contains ten links, using the same labelling scheme. Node degree is defined as the number of links which emanate from a given node.

3.4 Evaluation

We use Pareto-rank based EA implementation. The Pareto rank [11] of each individual is equal to one more than the number of individuals dominating it in the multi objective vector space[1] [2]. All the non-dominated individuals the assigned rank one. The values of the two objectives to be minimized (cost and average delay) are used to calculate the rank of the individual. The spanning tree is implemented through the depth-first search algorithm by Hop croft and Ullman which grows a tree from a randomly chosen node. Links selected randomly from the co-tree set of links which are not yet used in the tree are added to the spanning tree to increase connectivity.

3.5 Optimal network design

Computer communications network design problems, such they faced by hospitals, universities, research centers, water distribution systems, and the topology is fixed because of geographical and physical constraints or the existence of an existing system the topology is known, a reasonable approach to design is to select components among discrete alternatives for links and nodes to maximize reliability subject to cost of this problem is NP-hard with the added complication of a very computationally intensive objective function.

4. SYSTEM MODULES

4.1 Server

This module used only for the client interaction. We have to configure and the first configuration is node configuration then next to register the node information for login the server. Enter the node name, ip address, and port address then submit our information [6] [12]. The routing configuration is used for possible degree of node or path to be selected. We continue previous IP address or enter the new IP address for router configures [9] [13]. Next path consecutively select and save in this database. Routing configurations select some of route for Routing 1, routing 2 and routing 3 and so on. Configuration process to submit successfully, then display the resource view that contain the all path of root node to leaf node [23]. In this server next connect to the client function

4.2 Node Configuration

In data communication, a physical network node may either be a data communication equipment (DCE) such as a modem, hub, and bridge or switch; or a data terminal equipment (DTE) such as a digital telephone handset, a printer or a host computer, router, a workstation or a server. If the network in question is a LAN or WAN, every LAN or WAN node that are at least data link layer devices must have a MAC address, typically one for each network interface controller and possesses. Examples are computers, packet switches, modems with Ethernet interface and wireless LAN access points.

4.3 Routing Configuration

A router is a device that forwards data packets between computer networks, creating and overlay internetwork. A router is connected to two or more data lines from different networks [7]. The data packet when comes in one of the lines, the router reads for address information in the packet to determine its ultimate destination, then using information for its routing table or routing policy, is a directs the packet to the next network on its journey. Routers perform the "traffic directing" functions on the Internet and data packet is typically forwarded from one router to another through the networks that constitute the internetwork until it reaches its destination node [10] [15].

4.4 Topology construction

Logical topology and also referred to as signal topology is the arrangement of devices on a computer network and how they communicate with one another devices are connected to the network through the actual cables that transmit data, or the physical structure of a network, is called the physical topology for Physical topology and defines how the systems are physically connected to represents the physical layout of the devices in network Where, the Logical topology defines how the systems communicate across the physical topologies[18] [22]. Logical topologies are bound to network protocols and describe how data is moved across the network.

4.5 Monitor

It will only display and monitor the resource view and then client connect also access this shortest path routing .Client is the processor of node and routing configuration method to connect beyond the sql server [1].

Client is also same as login based on server, the node ip address and port number to be select. Client prepare for send message then file name will be select , node 1 and node 2 can be selected mandatory for selecting the path can be sent successfully. Finally routers are analysis. This way to we perform node-depth-degree representation.

4.6 Experiment Result

We collected data of mass communication networks of different cities to carry out the simulation. We used the data which was used by the researchers in their previous work. We tested the algorithm for networks with up to 36 nodes, and convergence to an optimal Pareto front was observed. We conducted the experiments with many sets of random populations, and analysed many sets of results. We also compared results with those obtained from other approaches namely exhaustive search and the Branch Exchange heuristic. In the following subsections, we include a few representative results.

5. CONCLUSION

Many solution strategies for NDPs require special algorithms to efficiently produce spanning forests. This paper presented a FR called NDDR and operations that enable the simultaneous generation and manipulation of a set of forests. The purpose of NDDR was to support the development of EAs that work with a large number of potential solutions to NDPs and broadly explore the search space. The main advantage of NDDR was its $O(\sqrt{n})$ time complexity, which enabled the development of EAs for solving large-scale and real-time NDPs. In our experiments, an EA using NDDR was able to find adequate solutions for the dc- MSTP faster than GAES, which was the most efficient EA for the problem found in the literature

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