Employing of Clustering Algorithm CWN-PAM in Mobile Network Planning

Manal El Harby
Lamiaa Fattouh Ibrahim
Department of Computer Sciences
Faculty of Computer and Informations Technology, King Abd El Aziz University
Jeddah, Saudi Arabia
lfattouh@mailer.eun.eg

Abstract

With the rapid development in mobile network we need effective network planning tool to satisfy the need of customers. However, deciding upon the optimum placement for the base stations (BS) to achieve best services while reducing the cost is a complex task requiring vast computational resource. This paper addresses antenna placement problem or the cell planning problem, involves locating and configuring infrastructure for mobile networks. The Cluster Partitioning Around Medoids (PAM) original algorithm has been modified and a new algorithm M-PAM (Modified-Partitioning Around Medoids) has been proposed by the authors in a recent work [1]. In the present paper, the M-PAM algorithm is modified and a new algorithm CWN-PAM (Clustering with Weighted Node-Partitioning Around Medoids) has been proposed to satisfy the requirements and constraints. Implementation of this algorithm to a real case study is presented. Results demonstrate the effectiveness and flexibility of the modifying algorithm in tackling the important problem of mobile network planning.

1. Introduction

The design objective of early mobile radio systems was to achieve a large coverage area by using a single, high powered transmitter with an antenna mounted on a tall tower. While this approach achieved very good coverage, it also meant that it was impossible to reuse those same frequencies throughout the system, since any attempts to achieve frequency reuse would result in interference. Faced with the fact that government regulatory agencies could not make spectrum allocations in proportion to the increasing demand for mobile services, it became imperative to restructure the radio telephone system to achieve high capacity with limited radio spectrum while at the same time covering very large areas [2].

Cellular telephony is designed to provide communications between two moving units, called mobile stations (MSs), or between one mobile unit and one stationary unit, often called a land unit [3]. A service provider must be able to locate and track a caller, assign a channel to the call, and transfer the channel from base station to base station as the caller moves out of range. Each cellular service area is divided into regions called cells. Each cell contains an antenna and is controlled by a solar or AC power network station, called the base station (BS). Each base station, in turn, is controlled by a switching office, called a mobile switching center (MSC). The MSC coordinates communication between all the base stations and telephone central office.

Cell planning is challenging due to inherent complexity, which stems from requirements concerning radio modeling and optimization. Manual human design alone is of limited use in creating highly optimized networks, and it is imperative that intelligent computerized technology [4], Tuba Search TS [5], [6] and Genetic Algorithm GA [7] have been successfully deployed in mobile network designs. Clustering analysis is a sub-field in data mining that specializes in techniques for finding similar groups in large database [8]. Its objective is to assign to the same cluster data that are more close (similar) to each other than they are to data of different clusters. The application of clustering in spatial databases presents important characteristics. Spatial databases usually contain very large numbers of points. Thus, algorithms for clustering in spatial databases do not assume that the entire database can be held in main memory. Therefore, additionally to the good quality of

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