Efficient Mobile Network Planning Algorithm in the Presence of Obstacles

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Abstract – **The size and complexity of today's mobile networks is continuously growing, and with it the cost of planning and operating these networks. Network planning and engineering have to reach a delicate balance between cost, network performance, and up-time of business critical services. With this 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 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 by modified the original density-based Spatial Clustering of Applications with Noise algorithm. The density-based Spatial Clustering of Applications with Noise original algorithm has been modified and a new algorithm Clustering Density Base in Presence of Obstacles has been proposed by the authors to solve the problem of obstructs in Mobile Network Planning. 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 problems of mobile network planning.**

Keywords - clustering techniques; network planning; cell plannin; mobile network

I. INTRODUCTION

The network planning process has to consider a variety of constraints including: policy of administrations, planning objective, etc., there is no universal method that is applicable to all network planning problems. Due to the complexity of this process, artificial intelligence (AI) [1][3], clustering techniques [3][8], Ant-Colony-Based algorithm [3][9] have been successfully deployed in wire network planning. Tabu Search TS [10], genetic algorithm (GA) [11] and clustering techniques [12][13][14] have been successfully deployed in mobile network planning. But no algorithm is proposed to solve the problem of obstructs. In many countries, 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 [15]. 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 is used to create appropriate network designs [16].

Data mining is an expanding area of research in artificial intelligence and information management. The objective of data mining is to extract relevant information from databases containing large amounts of information. Typical data mining and analysis tasks include classification, regression, and clustering of data, determining parameter dependencies, and finding various anomalies from data.

Clustering analysis is a sub-field in data mining that specializes in techniques for finding similar groups in large database [17]. 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 clustering, their scalability to the size of the database is of the same importance [18]. In spatial databases, objects are characterized by their position in the Euclidean space and, naturally, dissimilarity between two objects is defined by their Euclidean distance [19].

This paper introduces the spatial clustering to solve the Mobile Networking Planning problem. Section 2 discusses main phases used in radio network planning. In Sections 3, the DBSCAN Clustering algorithm is reviewed. In Section 4, CDBPO (Clustering Density Base in Presence of Obstacles) is fully described. A case study is presented in Section 5. In Section 6, a comparison between the proposed method and other methods is presented. Conclusion and future work are presented in Section 7.

II. MAIN PHASES USED IN RADIO NETWORK PLANNING

The radio network planning process can be divided into different phases [20]. At the beginning is the Preplanning phase. In this phase, the basic general properties of the

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