

# Application of clustering algorithm in communication base station construction

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## Abstract

**At present, it is the golden age of 5G development. The difficulty of 5G technology lies not only in the technical breakthrough, but also in the construction of base stations. In the process of actual base station construction, in order to better solve the problem of base station coverage, the coverage is usually clustered. To solve the problem of poor signal coverage, we should not only consider the actual geographical distribution of distance, but also consider the service needs of different weak coverage areas. In this paper, the location and traffic of weak coverage points are clustered. Through the comparison of AP clustering algorithm and adaptive AP clustering algorithm, the results show that the clustering quality and operation efficiency of adaptive AP clustering algorithm have been greatly improved. Combined with this method, the corresponding implementation scheme for the construction of 5G base station is proposed.**

## Keywords

**Site selection; clustering algorithm.**

## 1. Introduction

At present, it is in the era of 5G technology development. 4G communication has been difficult to maintain people's normal communication needs. The promotion of 5G technology is imminent. The difficulty of 5G development lies not only in the breakthrough of 5G technology, but also in the construction of base stations. As a country with a large population base, China's demand for communication is more stringent than that of other countries. At present, China has achieved 4G national communication, so many 4G base stations have been set up in many places. Therefore, how to gradually build 5G base stations in existing places and do not affect 4G base stations is of great importance. At present, many methods of building base stations have emerged, from another point of view, this paper puts forward the corresponding solutions to the construction of base stations in the way of clustering.

## 2. Introduction of clustering algorithm

### 2.1. Selection of clustering algorithm

In the process of establishing base stations, in order to better solve the problem of weak coverage, the weak coverage areas are usually clustered, and the close weak coverage areas are clustered into one class, so as to implement different base station establishment schemes for different areas. However, in order to solve the problem of poor signal coverage more conveniently, it is often not enough to only consider the actual geographical distribution of distance. It is also necessary to consider the demand of demand points in different weak coverage areas. Classifying the points with close distance and equal demand into one category can often solve the problem of base station construction more accurately.

For traditional clustering methods, such as k-means algorithm, the number of clusters is set by the user. Different numbers often produce different local optimal solutions due to the sensitivity of clustering centers, which will lead to the results full of subjectivity [1]. Compared

with k-means algorithm, AP clustering algorithm only avoids these problems, and is simpler and more efficient than general algorithms. For the original AP clustering algorithm, the bias parameter  $P$  and damping factor  $\lambda$  Different choices will produce clustering accuracy and convergence speed. Because the general AP algorithm generally has a fixed value range, for the array with large amount of data, this method will not only reduce the accuracy of clustering results, but also affect the convergence of the algorithm.

In reference [2], the adaptive algorithm is optimized. Using the improved algorithm, the optimal bias parameter can be obtained by interfering with the bias parameter  $p$  with a fixed step size. When the oscillation occurs due to the large amount of data, the algorithm will also adjust the oscillation, and finally reduce the impact of the AP clustering algorithm due to the parameter value. However, because it is difficult to define what is a large amount of data and do not find the relevant threshold value, this paper selects AP clustering algorithm and adaptive AP clustering algorithm to cluster the data. Through the result comparison and time complexity analysis, we can get the optimal scheme and the final clustering result.

### 2.2. AP clustering algorithm

AP clustering algorithm is similar to the way of nearest neighbor transmitting data. Through the continuous transmission of information between different data, through the continuous update and iteration of messages, the center of clustering is selected, and finally the optimal clustering result is obtained. Here, the coordinates and business volume of the weak coverage point are regarded as the data set  $X=\{x_1, x_2, x_3\}$ , to be clustered. Each data set is composed of the X coordinate, y coordinate and industrial volume of the point. The specific results are shown in Figure 1:

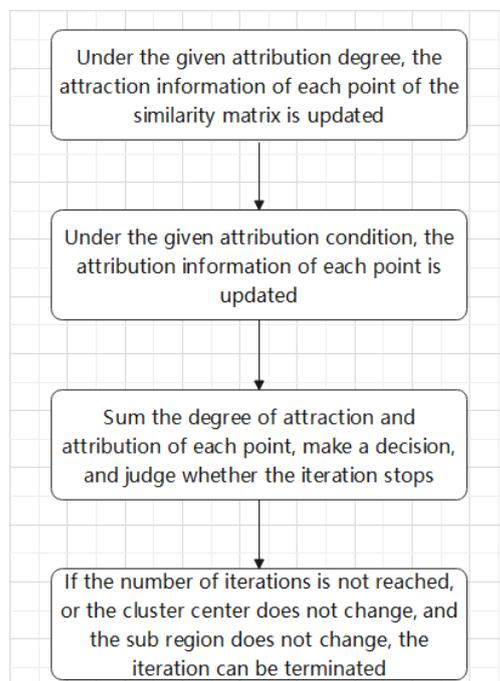


Figure 1: AP clustering algorithm

### 2.3. Adaptive AP clustering algorithm

Adaptive AP clustering algorithm improves two aspects on the basis of AP clustering algorithm. The first is the improvement of the number of clusters. By setting a value of  $P$  [3], the number of clusters obtained in the algorithm is iterated continuously. By continuously reducing the value of  $P$  according to the step size, some columns of  $k$  values are obtained, and the optimal clustering effect is obtained through the contour coefficient [4]. Secondly, through continuous change  $\lambda$  To eliminate the impact of shock, the concept of shock degree is introduced to detect

whether shock occurs [5]. The greater the shock, the more severe the algorithm shock. On the contrary, the smaller the shock. When shock occurs, increase the  $\lambda$  Value to reduce the oscillation and repeat until the end of the algorithm. The specific process is shown in Figure 1:

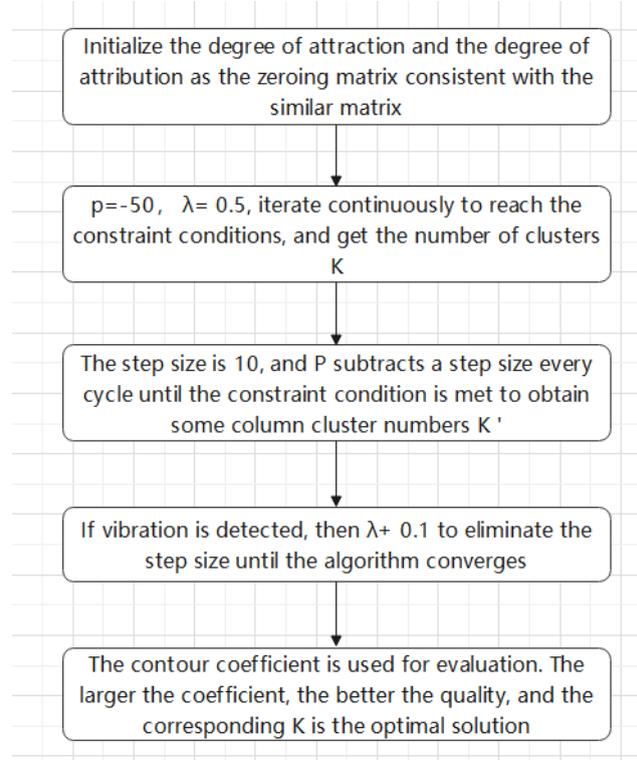


Figure 2: adaptive AP clustering algorithm

### 3. Application of clustering algorithm in communication

In order to test the application of clustering algorithm in the selection of communication base stations, this paper selects and establishes the weak coverage points through the existing base station data. When clustering the weak coverage points, this paper first excludes some relatively independent points in location. However, in order to more conveniently solve the problem of poor signal coverage, it is necessary to consider not only the clustering in geographical location, but also the clustering according to the needs of traffic, Therefore, the input of the above clustering algorithm is coordinates and traffic. After solving the AP clustering algorithm, the specific clustering results are compared with the AP clustering algorithm in Table 1.

Table 1 Comparison of clustering algorithm results

| Algorithm type                   | $\lambda$ | p    | n  | sil   | Number of iterations |
|----------------------------------|-----------|------|----|-------|----------------------|
| AP clustering algorithm          | 0.5       | -50  | 48 | 0.457 | 1865                 |
| Adaptive AP clustering algorithm | 0.9       | -120 | 20 | 0.765 | 55                   |

According to the data in Table 1, the damping factor of AP clustering algorithm is 0.5, the bias parameter is - 50, the number of clusters of AP is 48, and the number of clusters of adaptive AP is 20. The clustering quality of adaptive AP is 0.765, which is also significantly higher than that of AP is 0.457, which proves that AP clustering algorithm greatly improves the accuracy of clustering. The number of iterations of AP is much greater than that of adaptive AP, so it shows

that the convergence speed of adaptive AP is significantly faster than that of AP. It can be concluded that the accuracy and clustering effect of adaptive AP algorithm have been improved, and the running speed has also been improved. Fig. 3 and Fig. 4 are the coordinate comparison diagrams of AP clustering algorithm and adaptive AP clustering algorithm respectively.

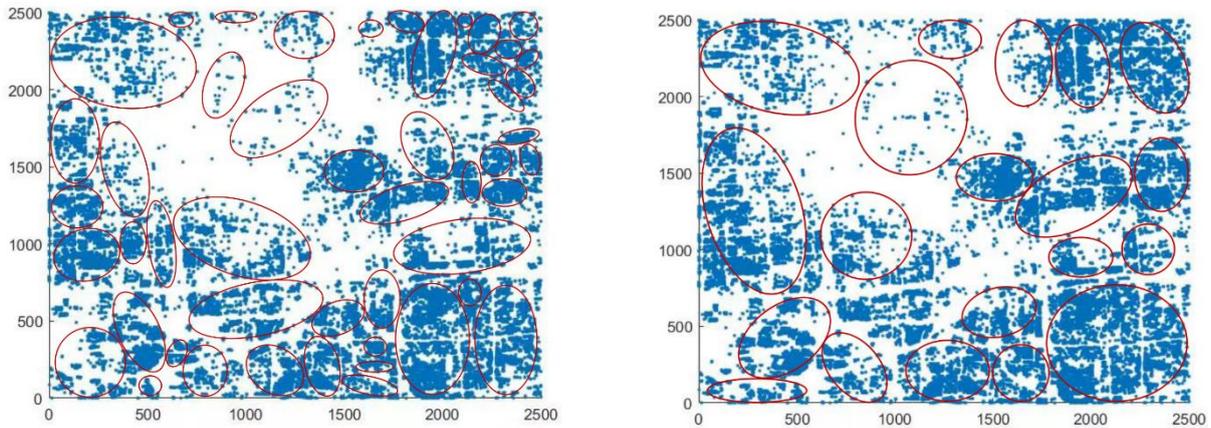


Figure 3 clustering results of AP algorithm Figure. 4 clustering results of adaptive AP algorithm It can be seen from the figure that for adaptive AP clustering, the number of base stations planned is more and the area of base stations covered is the largest. It can be concluded that when the weak coverage area is too large, the first consideration for this kind of demand should be to meet the communication needs of users. Therefore, adaptive clustering algorithm can be selected. This algorithm not only reduces the impact of shock, but also can make a more comprehensive response to the base stations with large weak coverage points, When the weak coverage area is small, AP clustering can be selected, which can not only achieve comprehensive coverage, but also make the number of base stations relatively small.

#### 4. Conclusion

As an important part of the new base station, 5G will cover more fields and wider coverage than any previous base station. The growing demand for communication and the huge demand for the connection of all things are important driving forces for the development of 5G. At present, it is an important period for 5G base station construction, so a good base station construction scheme is of great significance for the comprehensive application of 5G technology. In the actual work of base station construction, in order to better solve the problem of weak coverage, it is necessary to cluster the weak coverage points, cluster the weak coverage points close together, and get the weak coverage areas. In this way, different weak coverage areas can be managed separately, so that the problem of weak coverage can be solved better. Therefore, from this point of view, this paper puts forward the corresponding scheme for the addition and construction of base stations through ap clustering and adaptive AP clustering, and gives relevant suggestions.

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