



# Mobile Communication Network Channel Allocation Method Based on Big Data Technology

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**Abstract.** In mobile communication systems, the purpose of channel allocation is to maximize the use of spectrum resources. The existing channel allocation is at the cost of frequent channel reallocation, so its practical application is not strong. Aiming at the problems of inaccurate allocation results and high bit error rate of traditional channel allocation methods, a channel allocation method based on big data technology is proposed and designed. This method makes use of the advantages of big data technology to discretize the channel data of mobile communication network. According to the requirements of the channel discretization standard and allocation algorithm of mobile communication network, it optimizes the channel allocation algorithm and realizes the effective channel allocation of mobile communication network. The validity of big data channel allocation method is confirmed by experimental demonstration and analysis. In the mobile communication network channel allocation, the allocation accuracy is high, and the allocation error is almost zero, which is better than the traditional method, and the allocation time is much lower than the traditional method. It shows that this method can realize the effective allocation of mobile network channel, and the allocation result is very reliable, which can guarantee certain network security.

**Keywords:** Big data technology · Mobile communication network · Channel allocation · Discretization processing · Allocation algorithm

## 1 Introduction

In the mobile communication system, the problem of rational allocation and optimal utilization of resources is collectively referred to as channel allocation problem [1], and its purpose is to make maximum use of spectrum resources. There are three existing channel allocation schemes: channel fixed allocation algorithm, dynamic channel allocation algorithm and hybrid channel allocation algorithm [2]. These algorithms require more or less network-wide and system-wide information, often at the expense of frequent channel redistribution, and are often not very practical.

In recent years, big data technology is widely used in the solution of combinatorial optimization problems. Big data technology is to introduce a big self-feedback item [3], introduce big data technology in channel allocation to construct a big data channel allocation network, and draw on the data distribution strategy to carry out the channel allocation process of the mobile communication network [4]. However, there have been more or less deficiencies in the research process, resulting in the channel optimization technology not being effectively optimized and innovated. In reference [5], a dynamic subcarrier allocation algorithm for PLC channel based on adaptive genetic algorithm is proposed. The algorithm combines genetic algorithm and water injection algorithm to allocate the dynamic subcarriers of OFDM system by using the better global search ability of genetic algorithm. The new algorithm first cross operates the individuals in the population to obtain two new subgroups, The simulation results show that the performance of the improved genetic algorithm is greatly improved, the system transmission rate is faster, and the channel capacity is larger, but this method has the problem of inaccurate distribution results. In reference [6], an improved tree structure is proposed to solve the channel conflict in laser communication. Firstly, the mechanism of data transmission and channel switching in the network is analyzed, and the probability of channel conflict is identified by using the continuous idle time slots. Then, the average number of time slots and the conflict matrix are derived according to the tree decomposition method. Finally, the channels in the laser communication are reasonably allocated to each link based on the conflict matrix to improve the channel conflict and network performance. The experimental results show that the time slot simulation value of this method is closer to the theoretical value, which can improve the data throughput of laser communication, but this method has the problem of high bit error rate.

Based on this, this paper proposes and designs a channel allocation method for mobile communication networks based on big data technology.

## 2 Design of Big Data Channel Allocation Method

When designing the big data channel allocation method, the channels of the mobile communication network are first classified, and the mobile communication network with the same channel characteristics is discretized. Secondly, the channel allocation algorithm is introduced, and the calculation process of the algorithm is optimized to simplify the calculation steps of the algorithm. Finally, according to the requirements of the mobile communication network channel discretization standard and the allocation algorithm, the channel allocation process of the mobile communication network is performed. The channel allocation process of mobile communication network based on big data technology is shown in Fig. 1.

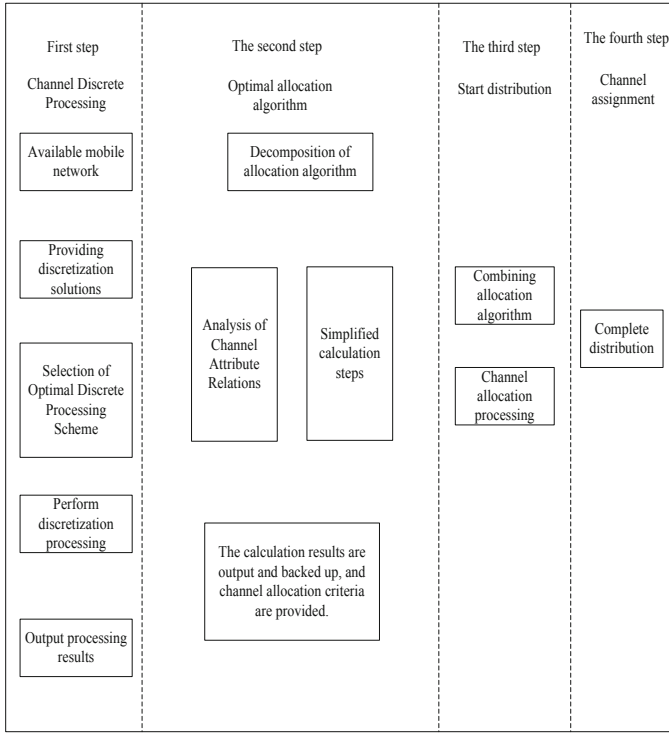


Fig. 1. Big data channel allocation flow chart.

### 2.1 Channel Discretization

In any cellular mobile communication network, the first step is to divide a given wireless spectrum into a set of discrete, interference-free channels. All of these channels can be used simultaneously in the service area and can guarantee the reception quality of certain signals. In order to divide a limited wireless spectrum into such channels, the big data-based channel allocation method employs various techniques such as frequency division, time division, and code division. A good distribution scheme can increase the capacity of the mobile communication network, reduce the overall overhead of the mobile communication network, and attract users by providing better services. Big data technology divides the spectrum into a number of discrete frequency bands, and splits the channel into several discrete time intervals called time slots to achieve the purpose of separating channels [7]. For a given mobile communication network, the determinant of determining the total number of channels available to it is the level of signal quality received from each channel. Some of these channels are used as signaling channels for establishing communication between the mobile station and the base station, and another portion is used to carry the provided services, that is, as a traffic channel.

Inspired by the literature [8], the channel data in each mobile communication network is divided into one classification member, and the discretization processing method is used to divide different channel data, thereby obtaining the distribution relationship among channel members. Thus, the discretization processing results of  $m$  channels are obtained, and the function expression of the channel discretization processing is as follows:

$$E = \frac{A}{2} \sum_{i=1}^n \left( \sum_{q=1}^m V_i - d_i \right) \quad (1)$$

Where,  $E$  represents the result of channel discretization processing;  $A$  represents a mobile communication network node;  $V_i$  represents a proportional parameter of discretization processing; and  $d_i$  represents a standard discrete value.

After the channel discretization processing result is obtained, the mobile communication networks with discrete features are multiplexed. As long as  $V_i - d_i \geq A$  is satisfied, the influence of the channel can be directly increased; If  $V_i - d_i < A$ , the above discretization process is repeated, and the value of  $\sum_{q=1}^m$  is continuously adjusted until  $V_i - d_i \geq A$ .

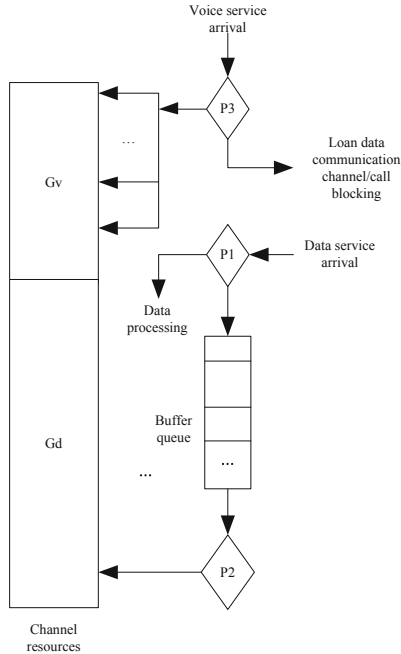
The quality of channel received signals and co-channel interference caused by channel multiplexing are the most important factors [9]. Therefore, the purpose of improving the channel discretization characteristics is to achieve the characteristics of wireless propagation path loss between the co-channel networks.

Let  $\frac{A}{2} \sum_{i=1}^n \geq 0$  denote a set of channel data that uses the same network to communicate with each other. Because of the wireless signal propagation loss, when the value of  $i$  increases,  $\frac{A}{2} \sum_{i=1}^n < 0$  or  $\frac{A}{2} \sum_{i=1}^n = 0$  occurs. Therefore, it is necessary to reasonably control the value range of  $i$  to minimize the propagation loss of the wireless signal to ensure the accuracy of the channel discretization processing result.

The channel discretization processing result of the mobile communication network is output and saved, so as to improve the accurate data foundation for the design and optimization process of the next channel allocation algorithm, thereby ensuring the superiority of the channel allocation algorithm.

## 2.2 Channel Allocation Algorithm Design

The mobile communication network channel algorithm based on big data technology firstly defines the service as priority and non-priority. The real-time service takes precedence over the non-real-time service, and the total number of different types of service channels will be different. The big data based channel allocation algorithm has the function of channel borrowing.



**Fig. 2.** Structure diagram of the big data channel allocation algorithm.

For example, when a voice service arrives but there is no voice channel allocation temporarily, the service will borrow data channel resources, thus reducing the blocking rate of the voice service. The structure of the channel allocation algorithm based on big data technology is shown in Fig. 2.

According to the operation structure of the big data channel allocation algorithm shown in Fig. 2, and compared with the general dynamic channel allocation strategy, the operation rules of the channel borrowing function are obtained, and the specific calculation process is as follows:

- (1) The initial channel resources of the voice and data services are allocated by the system [10]. When the channel is allocated to the access users, the channel number assigned to the voice starts from the two ends, the channel number assigned to the voice is from small to large, and the data service is reversed.
- (2) When the arriving voice service has no channel resources available, if the data channel resource is idle, the data channel numbered to the minimum value may be borrowed; If there is no idle channel, the voice traffic is blocked for communication [11, 12].
- (3) When the data service arrives and the buffer queue is non-empty and there is free space, that is,  $0 \leq k \leq B$ , the buffer queue waits. If the buffer queue is full, the data service can borrow idle voice channel resources.

For the convenience of research, the transmission of the source when studying the mobile communication network adopts the *on/off* model. The voice and data services

adopt a similar model. The transmission feature of this model is to generate the service data frame and the rate  $R \geq 0$  in the  $T_0$  time [13]. The transmission rate  $R = 0$  in the  $T_{off}$  time,  $N$  represents the total number of channels. Since the buffer queue is set in the channel allocation policy, buffer queue  $B$  needs to set a threshold. If the  $B$  value is too large, the delay of the queue will be increased. If it is too small, the data loss rate will increase and the throughput of the system will be affected. Therefore, the condition that the single-column queue buffer capacity must satisfy is as follows:

$$B_T \geq NRT_{on} - NR/E \quad (2)$$

The problem of allocating this mobile communication network channel is then converted to a simple problem of finding the minimum channel function. According to the Markov state transfer principle, the channel allocation standard matrix of the mobile communication network is obtained as follows:

$$S = \left\{ (i, j, 0) \left| \begin{array}{l} 0 \leq i + j \leq C, \\ 0 \leq j \leq C \leq B_T \end{array} \right. \right\} \quad (3)$$

Where,  $S$  represents the channel allocation standard function matrix range of the mobile communication network;  $i, j$  are the calibration parameters of the Markov state transition principle, and no orientation analysis is performed;  $C$  represents the buffered queue channel value.

The allocation of each channel characteristic in the mobile communication network system is identical, that is, the total number of channels of each mobile communication network is the same and the service type is the same. Then, when the new call arrival rate and the packet arrival rate respectively meet the parameters, the calculation process of the channel allocation of the mobile communication network is realized [14].

So far, the design process of the channel allocation algorithm of the mobile communication network is completed.

### 2.3 Mobile Communication Network Channel Allocation Implementation

According to the channel discretization processing result of the above mobile communication network, referring to the allocation algorithm in the literature, combined with the big data technology, the design and optimization process of the channel allocation algorithm of the big data mobile communication network is carried out based on the allocation algorithm [15].

First, the initial allocation of channels is performed according to the vertex coordinates of the channel discretization process, that is,  $f(i, j) = ia + Sj$  is satisfied, where  $j = (2x - 1)a$ , and  $x \geq n + 1, a \geq 1$ . The initial allocation results of the network channel are shown in Table 1.

**Table 1.** Channel initial allocation results.

i/j	-2	-1	0	1	2
-5					a+2b
-4				(x-4)a+2bS	a+b
-3			(2x-4)a+(2S+1)b	(x-3)a+bS	(2x-3)a+2 b S
-2		(x-3)a+(S+1)b	(2x-3)a+(2S+1)b	(x-2)a+ bS	(2x-2)a+2b S
-1	(2x-3)a+(S+1)b	(x-2)a+(S+1)b	2(x-2)a+(2S+1)b	(x-1)a+ bS	(2x-1)a+2 bS
0	(2x-2)a+(S+1)b	(x-1)a+(S+1)b		Xa+ bS	a-b
1	b	xa+(S+1)b	a	x+1)a+bS	2a-b
2	a+b	(x+1)a+ bS	2a	(x+2)a+bS	
3	2a+b	(x+2)a+(S+1)b	3a		
4	(2a+3)+Sb	(x+3)a+Sb			
5	(2x+2)a+(S-1)b				

According to the initial allocation result shown in Table 1, the big data allocation algorithm is introduced, which simplifies a series of insignificant calculation steps. The optimal allocation process of multiple channels in the field of cellular mobile communication networks is realized directly by allocating the channel data arriving at the current time in the mobile communication network [16, 17]. In the allocation result matrix, there must be a channel  $P$ , which has an allocation criterion in any mobile communication network, so the channel is used as an optimal allocation channel. After all the channels are optimized to the optimal standard, the allocation is performed again to realize the optimal initial allocation process of the channels in the mobile communication network.

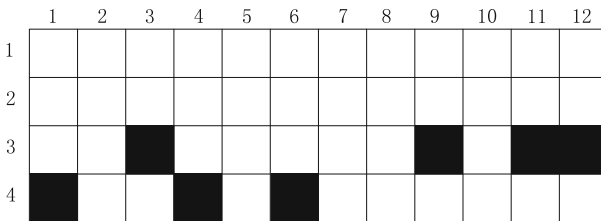
Based on the optimal initial allocation, the channel allocation in each mobile communication network in the algorithm model is set. A mobile communication network has  $S_1$  downlink channels and is divided into two parts: a voice channel and a data protection channel. The  $S_n$  channels are reserved as data channels for the protection service to compensate for the data packet loss rate. The  $S^1 \sim S_n$  channels are then used as voice channels. When the voice channel is idle, the data service can borrow the  $S_n$  channel for data transmission. Once a voice call request arrives and the available voice channel set is found to be empty, the data service should immediately release the borrowed voice channel, stop the transmission in the voice channel, and continue to queue in the data buffer. In addition, a queuing buffer is set for the voice service, so that the handover call preferentially occupies the voice buffer to ensure handover priority.

So far, the design of the algorithm is completed. Further consider the threshold of the voice queue buffer, set to  $S_p$ . When the number of queues in the buffer exceeds  $S_v$ , the system will unconditionally block a new call. For handover call queuing, the threshold is set to  $S_n (S_p \leq S_v)$ . If the number of handover call queues in the buffer exceeds  $S_n$ , the algorithm will refuse to accept the new mobile communication network channel assignment.

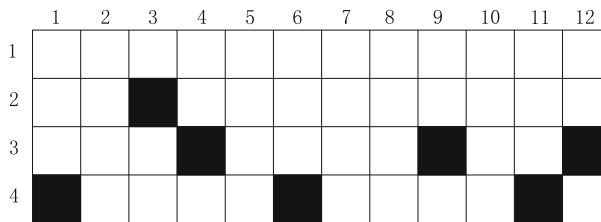
### 3 Simulation Experiment Demonstration and Analysis

In order to ensure the effectiveness of the channel allocation method of mobile communication network based on big data technology designed in this paper, the simulation experiment demonstration analysis is carried out. Set the experimental object to the channel data of a mobile communication network, and perform a distribution demonstration experiment. During the experiment, the initial allocation results of the channel are shown in Table 1.

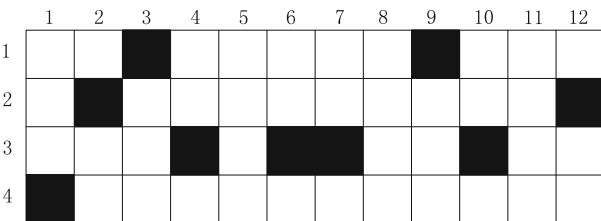
In order to ensure the validity of the experiment, the traditional channel allocation method and the big data-based channel allocation method are used to compare and experiment, and the channel allocation accuracy of the two methods is statistically analyzed. The experimental results are shown in Fig. 3.



(a) Large data channel allocation results



(b) Optimal channel allocation results



(c) Traditional channel allocation results

Fig. 3. Comparison of experimental argumentation results.

According to the analysis of Fig. 3, the channel allocation method based on big data is more suitable for the allocation standard of the optimal allocation result in the process of allocating the channel of the mobile communication network; There is only a distribution bias in the (3, 3), (3, 4), (4, 11) network, and the allocation types of (3, 3), (3, 4) are consistent, and the final allocation result is not affected. Therefore, the channel assignment result of only one network element is not optimal. However, the distribution result of the traditional channel allocation method is quite different from the optimal allocation result. There is obvious distribution difference between the allocation type and the network structure, and the allocation type is almost unconnected. Therefore, it can be concluded that the big data-based channel allocation method designed in this paper not only improves the allocation type of channel data in mobile communication networks, it also improves the stability and accuracy of the distribution process, and gradually aligns the distribution results with the optimal distribution results, and has extremely high effectiveness and practical promotion significance.

In order to further verify the effectiveness of the method in this paper, the bit error rate is taken as the index to compare the reference [5] method, the reference [6] method and the method in this paper. The results are shown in Fig. 4.

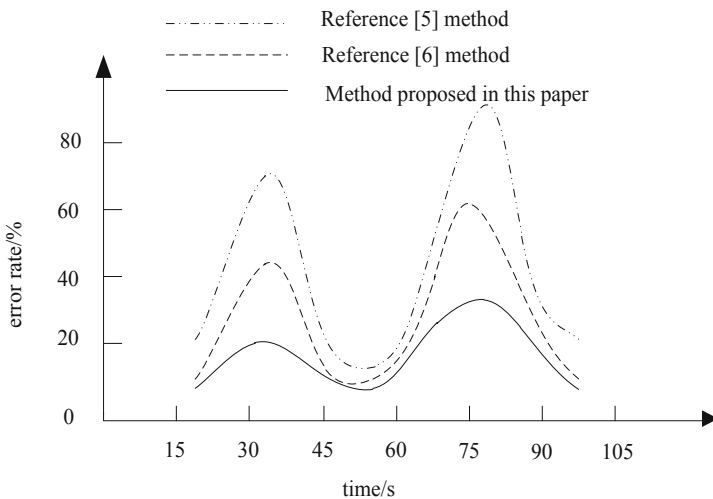
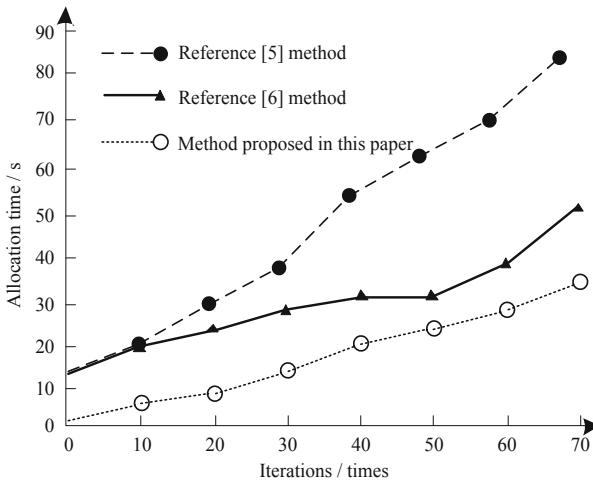


Fig. 4. Error rate comparison results of different methods.

It can be seen from Fig. 4 that the maximum BER of the method in this paper is less than 30%, while the maximum BER of the method in reference [5] method is 80% and that of the method in reference [6] method is about 60%. It can be seen from the analysis of Fig. 4 that the error rate of channel allocation in this method is significantly lower than that in reference [5] method and reference [6] method, which shows that the allocation result obtained by this method is more reliable. This is because this method

uses the advantages of big data technology to discretize the channel data of mobile communication network, so as to optimize the channel allocation process of mobile communication network.

In order to further verify the application effect of this method, the channel allocation time is taken as the index to compare the allocation effect of different methods. The results are shown in Fig. 5.



**Fig. 5.** Comparison results of allocation time of different methods

It can be seen from Fig. 5 that it takes the most time to allocate the mobile communication network channel by using the method of reference [5], and the maximum time consumption exceeds 80 s; the maximum time consumption of the method in reference [6] is more than 50 s. In comparison, the allocation time of the method in this paper is relatively low, indicating that the allocation efficiency of the method is higher. Channel allocation is realized in time.

## 4 Conclusion

This paper analyzes and designs the channel allocation method of mobile communication network based on big data technology. Relying on the advantages of big data technology, the mobile communication network channel is discretized, and the allocation steps are simplified, and the big data channel allocation method is designed. The experimental results show that the big data channel allocation method designed in this paper has extremely high efficiency. When the channel is allocated, the allocation accuracy is greatly improved, and the allocation error can be effectively reduced, and the allocation time can be saved. It is hoped that the research in this paper can provide theoretical basis and reference for the channel allocation method in China's mobile communication network.

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