

TITLE

## **Method for intelligently selecting accounting node of blockchain**

### **BACKGROUND OF THE PRESENT INVENTION**

#### **Field of Invention**

5           The present invention relates to fields of blockchain, virtual currency and artificial intelligence, and more particularly to a method for intelligently selecting an accounting node of a blockchain.

#### **Description of Related Arts**

10           In 2009, the enlightenment period of Bitcoin, the miners can easily mine hundreds of Bitcoins in a week merely with the home computer. However, with the rapid growth of the Bitcoin miners and the continuous improvement of the Bitcoin mining hardware, Bitcoin mining has been translated from the experiment made by the temporary worker at home into the large-scale equipment operated by the professionals, in which millions of dollars are invested. Meanwhile, with the progressive increase of the Bitcoin  
15 miners, all the machines work together, which wastes the electric power resource, causing the increasingly prominent energy consumption problem. It is estimated by Morgan Stanley in one published research report that the mining business of Bitcoin consumes about 36 terawatt hours of energy one year, which is equivalent to the total annual energy consumption amount of Qatar. It is also pointed out by the report that: in 2018, the  
20 electric power demand of Bitcoin will increase to more than three times, and the power consumption may be over 125 terawatt hours, which is equivalent to the total annual energy consumption amount of Argentina. The mining principle of Bitcoin is that: the higher computation power, the easier new Bitcoin is mined and transfer transaction is recorded in the account book, which causes the serious waste of the computing resource.

Aimed at the current situation, BM designed the DPoS (Delegated Proof of Stake) system. In the DPoS system, all of the people do not mine together, but several people are assigned as witnesses to be responsible for accounting. In the EOS (Enterprise operation system), twenty-one nodes are selected as the witnesses responsible for accounting alternately. In the above way, the accounting speed is greatly increased; meanwhile, the whole system greatly saves the electric energy. The accounting speed in the DPoS mode is fast and power-saving. However, the human factor plays the leading role in the above manner, which fails to guarantee the decentration. Thus, it is required to develop a method for intelligently distributing the accounting rights or the mining rights, which is able to guarantee the fairness and decentration, and avoid the interference of the human factor.

## SUMMARY OF THE PRESENT INVENTION

An object of the present invention is to provide a method for intelligently selecting an accounting node of a blockchain, which solves problems of conventional mining methods that fairness and decentration cannot be guaranteed and mining efficiency is low due to adopting manual accounting.

Technical solutions adopted by the present invention are described as follows.

A method for intelligently selecting an accounting node of a blockchain comprises steps of:

(1), based on block data, calculating a node capability value of each accounting node;

(2), making statistics of threshold values of the node capability values of every accounting node; and

(3), according to the threshold values, determining a current accounting node, and thereafter randomly selecting other nodes, so as to complete node selection.

Preferably, in the step (1), the node capability value includes a node transaction amount, a node information processing capability, and a total amount of node transaction service charge.

Preferably, the node transaction amount is calculated through following steps of:

(a), calculating the sum of corresponding block numbers, wherein a calculation formula thereof is:

$$O = \sum_{j=1}^{K(i)} L_j,$$

wherein:  $L_j$  is a number corresponding to a block amount  $K(i)$  mined by an  $i^{\text{th}}$  node;  $j \in [1, K(i)]$ ;  $O$  represents the sum of the corresponding block numbers;

(b), calculating a statistical weight, wherein a calculation formula thereof is:

$$\delta_j = \frac{L_j}{O}, \sum \delta_j = 1,$$

wherein:  $\delta_j$  represents the statistical weight;  $O$  represents the sum of the corresponding block numbers; and

(c), calculating the transaction amount of blocks created by the node, wherein a calculation formula thereof is:

$$N_{tr}(i) = \sum_{j=1}^{K(i)} \delta_j * Tr(i)(j),$$

wherein:  $Tr(i)(j)$  is a transaction amount of each block.

Preferably, the node information processing capability is calculated through a following formula of:

$$C(i) = \alpha * S(i) + \beta * Cal(i) + \gamma * Bandwithd(i),$$

5                    wherein:  $C(i)$  represents an information processing capability of the  $i^{\text{th}}$  node;  $S(i)$  represents a current available storage space of the  $i^{\text{th}}$  node;  $Cal(i)$  represents a processor computation speed of the  $i^{\text{th}}$  node;  $Bandwithd(i)$  represents a current network bandwidth of the  $i^{\text{th}}$  node;  $\alpha$ ,  $\beta$  and  $\gamma$  are calculation weights, meeting  $\alpha + \beta + \gamma = 1$ .

10                    Preferably, the total amount of the node transaction service charge is calculated through following steps of:

(aa), calculating a transaction service charge of each block, wherein a calculation formula thereof is:

$$Fee_j = \sum_{a=1}^{Tr(i)(j)} f_a,$$

15                    wherein:  $f_a$  is a service charge of each transaction;  $Tr(i)(j)$  is the transaction amount of each block; a value range of  $a$  meets  $a \in [1, Tr(i)(j)]$ ;  $L_j$  is the number corresponding to the block amount  $K(i)$  occupied by the  $i^{\text{th}}$  node;  $j \in [1, K(i)]$ ; and

(bb), calculating the total amount of the node transaction service charge, wherein a calculation formula thereof is:

$$Fee_{total} = \sum_{j=1}^{K(i)} Fee_j ,$$

wherein:  $K(i)$  is the block amount occupied by the  $i^{th}$  node.

Preferably, the threshold value of the node capability value of each node is calculated through a following formula of:

$$y(i) = w_1 * x_1 + w_2 * x_2 + w_3 * x_3 ,$$

wherein:  $w_1 + w_2 + w_3 = 1$ ;  $y(i)$  is the threshold value of the node capability value of each node;  $x_1$  is the transaction amount of the blocks created by the node;  $x_2$  is the node information processing capability;  $x_3$  is the total amount of the node transaction service charge.

10 Preferably, the step (3) particularly comprises steps of:

(3.1), according to the threshold value  $y(i)$  of the node capability value of each node, assuming a minimum value and a maximum value thereof respectively to be  $y_{min}$  and  $y_{max}$ ; normalizing a region of  $[y_{min}, y_{max}]$  to  $[a_1, b_1]$ ; with an interval of  $c_1$ , dividing the region into  $(b_1 - a_1)/c_1$  categories;

15 (3.2), mapping the threshold value  $y(i)$  into a value  $Class_i$  of a first categorical space, wherein a calculation formula thereof is:

$$Class_i = \frac{y(i)}{y_{max} - y_{min} + 1} ,$$

wherein:  $y_{\min}$  is the minimum value of the threshold value  $y(i)$ ;  $y_{\max}$  is the maximum value of the threshold value  $y(i)$ ;  $y(i)$  is the threshold value of the node capability value of the  $i^{\text{th}}$  node;

(3.3), according to the value  $Class_i$  of the first categorical space, determining a region of  $[n, n+1]$ ; after determining a category of the current node is the  $(n+1)^{\text{th}}$  category, judging whether  $n$  is larger than a categorical threshold  $e_1$ , wherein a value range of  $e_1$  is  $[0, (b_1-a_1)/c_1]$ ; if  $n$  is larger than the categorical threshold  $e_1$ , meaning the current node is a fixed node; otherwise, executing step (ddd);

(ddd), calculating an information processing capability of a non-fixed node, namely the information processing capability of the node except the fixed node, wherein a calculation formula thereof is:

$$z(i) = x_3,$$

wherein:  $z(i)$  is the information processing capability of the non-fixed node;  $x_3$  is the total amount of the node transaction service charge;

(3.4), according to a value of the information processing capability  $z(i)$  of the non-fixed node, assuming a minimum value and a maximum value thereof respectively to be  $z_{\min}$  and  $z_{\max}$ ; normalizing a region of  $[z_{\min}, z_{\max}]$  to  $[a_2, b_2]$ ; with an interval of  $c_2$ , dividing the region into  $(b_2-a_2)/c_2$  categories; and

(3.5), mapping the information processing capability  $z(i)$  of the non-fixed node into a value  $Class2_i$  of a second categorical space, wherein a calculation formula thereof is:

$$Class2_i = \frac{z(i)}{z_{\max} - z_{\min} + 1},$$

wherein:  $z_{\min}$  is the minimum value of the information processing capability  $z(i)$ ;  $z_{\max}$  is the maximum value of the information processing capability  $z(i)$ ;  $z(i)$  is the information processing capability of the non-fixed node;

5 according to the value  $Class2_i$ , determining that a region to which the current node belongs is  $[m, m+1]$  and the current node belongs to the  $(m+1)^{\text{th}}$  category; making statistics of all nodes that  $m$  is larger than a categorical threshold  $e_2$ , wherein a value range of  $e_2$  is  $[0, (b_2-a_2)/c_2]$ , and selecting  $R$  nodes to serve as random nodes, so as to complete the node selection, wherein a value of  $R$  is a random number.

10 In conclusion, the present invention has following beneficial effects with adopting the above technical solutions.

Firstly, according to the present invention, through calculating the node capability values of every node and making statistics of the thresholds values thereof, the current node is determined and other nodes are randomly selected, for completing  
15 selection of the accounting node. Therefore, the node having the strong computation power and great transaction amount is selected for mining and accounting; and the random nodes are placed for increasing the safety of block mining and accounting. The present invention solves the problems of the conventional mining or accounting methods that the fairness and decentration cannot be guaranteed due to adopting the manual node  
20 selection, so that the energy consumption is saved and meanwhile the efficiency and safety of mining and accounting are increased.

Secondly, according to the present invention, the fixed node is intelligently selected to be involved in block mining and accounting, and the mining rights or accounting rights is reasonably distributed, which greatly saves the energy consumption  
25 and meanwhile avoids the risks of hostile attack due to manual selection.

Thirdly, according to the present invention, the node capability value is judged through comprehensively considering the factors such as the mined block amount, the transaction amount included in each block, the current information processing capability of the node and the total amount of the transaction service charge in each block, and the factors such as the computation power, the bandwidth and the participation ability of the past node are fully utilized, so as to decrease the conflict probability of node mining or accounting of the whole blockchain and increase the transaction record processing efficiency of the node, thereby greatly increasing the efficiency of block mining and accounting.

Fourthly, according to the present invention, based on the selection of the fixed node, random nodes are additionally added, which increases the safety of block mining and decreases the possibility of hacker attack.

## BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be illustrated with embodiments and accompanying drawings.

Fig. 1 is a sketch view of node selection according to the present invention.

Fig. 2 is a flow diagram of the present invention.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Except mutually exclusive features and/or steps, all of the features, methods or steps disclosed by the present invention can be combined in any manner.

The present invention is illustrated in detail with Fig. 1 and Fig. 2 as follows.

Based on intelligent analysis of the node to which the block belongs and the transaction data amount included in each block, a method for calculating the node capability value is provided to serve as a selection basis of the accounting node, so as to decrease the node mining conflict probability of the whole blockchain and increase the transaction record processing efficiency of the node. The present invention comprises an accounting node capability value calculation module, a threshold value calculation module and a node selection module.

The node capability value includes a block amount mined by the node, a transaction amount of each block, a current information processing capability of the node, and a total amount of transaction service charge of the node. The information processing capability of the node includes a current processing speed of the node computing center, a current network bandwidth and a current available storage space. The block amount mined by the node means a total amount of the blocks mined by the node from participation to the present. The transaction amount of each block means the data amount of the packaged transaction in one block mined by the node.

The threshold value calculation means making data statistics according to the node capability values of all involved nodes, and an objective function thereof is  $y(i) = w_1 * x_1 + w_2 * x_2 + w_3 * x_3$ ; through training, a group of parameters  $w_1$ - $w_3$  with high robustness are obtained;  $x_1$ ,  $x_2$ , and  $x_3$  respectively represent the transaction amount of blocks created by the node, the node information processing capability, and the total amount of the node transaction service charge;  $y(i)$  represents the threshold value of the node capability value of each node; and another objective energy function  $z(i) = x_3$  exists, wherein  $z(i)$  represents the information processing capability of the non-fixed node, namely the computation power.

For the node selection module, the node capability value  $y$  is calculated according to the current data; if  $y$  is larger than the threshold  $n$  of fixed node selection, the current node is selected as the fixed node and determined as the current accounting

node; the computation power  $z$  of each node in the remaining nodes is calculated; if  $z$  is larger than the threshold  $m$  of random node selection,  $R$  nodes are randomly selected to be involved in block mining, for completing node selection.

#### Preferred embodiment

5           A method for intelligently selecting an accounting node of a blockchain comprises steps of:

(1), based on block data, calculating a node capability value of each accounting node;

10           (2), making statistics of threshold values of the node capability values of every accounting node; and

(3), according to the threshold values, determining a current accounting node, and thereafter randomly selecting other nodes, so as to complete node selection.

15           In the step (1), the node capability value includes a node transaction amount, a node information processing capability, and a total amount of node transaction service charge.

The node transaction amount is calculated through following steps of:

(a), calculating the sum of corresponding block numbers, wherein a calculation formula thereof is:

$$O = \sum_{j=1}^{K(i)} L_j,$$

20           wherein:  $L_j$  is a number corresponding to a block amount  $K(i)$  mined by an  $i^{\text{th}}$  node;  $j \in [1, K(i)]$ ;  $O$  represents the sum of the corresponding block numbers;

(b), calculating a statistical weight, wherein a calculation formula thereof is:

$$\delta_j = \frac{L_j}{O}, \sum \delta_j = 1,$$

wherein:  $\delta_j$  represents the statistical weight;  $O$  represents the sum of the corresponding block numbers; and

5 (c), calculating the transaction amount of blocks created by the node, wherein a calculation formula thereof is:

$$N_{tr}(i) = \sum_{j=1}^{K(i)} \delta_j * Tr(i)(j),$$

wherein:  $Tr(i)(j)$  is a transaction amount of each block.

The node information processing capability is calculated through a following  
10 formula of:

$$C(i) = \alpha * S(i) + \beta * Cal(i) + \gamma * Bandwithd(i),$$

wherein:  $C(i)$  represents an information processing capability of the  $i^{th}$  node;  
 $S(i)$  represents a current available storage space of the  $i^{th}$  node;  $Cal(i)$  represents a  
processor computation speed of the  $i^{th}$  node;  $Bandwithd(i)$  represents a current network  
15 bandwidth of the  $i^{th}$  node;  $\alpha$ ,  $\beta$  and  $\gamma$  are calculation weights, meeting  $\alpha + \beta + \gamma = 1$ .

The total amount of the node transaction service charge is calculated through following steps of:

(aa), calculating a transaction service charge of each block, wherein a calculation formula thereof is:

$$Fee_j = \sum_{a=1}^{Tr(i)(j)} f_a ,$$

wherein:  $f_a$  is a service charge of each transaction;  $Tr(i)(j)$  is the transaction amount of each block; a value range of  $a$  meets  $a \in [1, Tr(i)(j)]$ ;  $L_j$  is the number corresponding to the block amount  $K(i)$  occupied by the  $i^{\text{th}}$  node;  $j \in [1, K(i)]$ ; and

5 (bb), calculating the total amount of the node transaction service charge, wherein a calculation formula thereof is:

$$Fee_{total} = \sum_{j=1}^{K(i)} Fee_j ,$$

wherein:  $K(i)$  is the block amount occupied by the  $i^{\text{th}}$  node.

10 The threshold value of the node capability value of each node is calculated through a following formula of:

$$y(i) = w_1 * x_1 + w_2 * x_2 + w_3 * x_3 ,$$

15 wherein:  $w_1 + w_2 + w_3 = 1$ ;  $y(i)$  is the threshold value of the node capability value of each node;  $x_1$  is the transaction amount of the blocks created by the node;  $x_2$  is the node information processing capability;  $x_3$  is the total amount of the node transaction service charge.

The step (3) particularly comprises steps of:

(3.1), according to the threshold value  $y(i)$  of the node capability value of each node, assuming a minimum value and a maximum value thereof respectively to be  $y_{\min}$

and  $y_{\max}$ ; normalizing a region of  $[y_{\min}, y_{\max}]$  to  $[0, 10]$ ; with an interval of 1, dividing the region into ten categories;

(3.2), mapping the threshold value  $y(i)$  into a value  $Class_i$  of a first categorical space, wherein a calculation formula thereof is:

$$Class_i = \frac{y(i)}{y_{\max} - y_{\min} + 1},$$

wherein:  $y_{\min}$  is the minimum value of the threshold value  $y(i)$ ;  $y_{\max}$  is the maximum value of the threshold value  $y(i)$ ;  $y(i)$  is the threshold value of the node capability value of the  $i^{\text{th}}$  node;

(3.3), according to the value  $Class_i$  of the first categorical space, determining a region of  $[n, n+1]$ ; after determining a category of the current node is the  $(n+1)^{\text{th}}$  category, judging whether  $n$  is larger than 5; if  $n$  is larger than 5, meaning the current node is a fixed node; otherwise, executing step (ddd);

(ddd), calculating an information processing capability of a non-fixed node, namely the information processing capability of the node except the fixed node, wherein a calculation formula thereof is:

$$z(i) = x_3,$$

wherein:  $z(i)$  is the information processing capability of the non-fixed node;  $x_3$  is the total amount of the node transaction service charge;

(3.4), according to a value of the information processing capability  $z(i)$  of the non-fixed node, assuming a minimum value and a maximum value thereof respectively to

be  $z_{\min}$  and  $z_{\max}$ ; normalizing a region of  $[z_{\min}, z_{\max}]$  to  $[0, 10]$ ; with an interval of 1, dividing the region into ten categories; and

(3.5), mapping the information processing capability  $z(i)$  of the non-fixed node into a value  $Class2_i$  of a second categorical space, wherein a calculation formula thereof

5 is:

$$Class2_i = \frac{z(i)}{z_{\max} - z_{\min} + 1},$$

wherein:  $z_{\min}$  is the minimum value of the information processing capability  $z(i)$ ;  $z_{\max}$  is the maximum value of the information processing capability  $z(i)$ ;  $z(i)$  is the information processing capability of the non-fixed node;

10 according to the value  $Class2_i$ , determining that a region to which the current node belongs is  $[m, m+1]$  and the current node belongs to the  $(m+1)^{th}$  category; making statistics of all nodes that  $m > 3$ , and selecting R nodes to serve as random nodes, wherein a value of R is a random number, such as 1, 3 and 5.

The present invention aims at solving the problems of accounting conflict, low  
15 accounting efficiency and energy waste caused by mining calculation of larger number of the miners, and avoiding the problems of unfairness and non-decentration caused by selecting the accounting node with manual voting. Based on the block data and the miner data of various dimensions, the intelligent distribution mechanism of accounting rights or mining rights is adopted; meanwhile, the random distribution of accounting rights or  
20 mining rights is also adopted for avoiding the hacker attack. Therefore, on the premise of guaranteeing the fairness, decentration and safety of the blockchain, the problems of energy waste and low accounting efficiency caused by the mining conflict are solved.

WHAT IS CLAIMED IS:

1. A method for intelligently selecting an accounting node of a blockchain, comprising steps of:

5 (1), based on block data, calculating a node capability value of each accounting node;

(2), making statistics of threshold values of the node capability values of every accounting node; and

(3), according to the threshold values, determining a current accounting node, and thereafter randomly selecting other nodes, so as to complete node selection.

10 2. The method for intelligently selecting the accounting node of the blockchain, as recited in claim 1, wherein: in the step (1), the node capability value includes a node transaction amount, a node information processing capability, and a total amount of node transaction service charge.

15 3. The method for intelligently selecting the accounting node of the blockchain, as recited in claim 2, wherein: the node transaction amount is calculated through following steps of:

(a), calculating the sum of corresponding block numbers, wherein a calculation formula thereof is:

$$O = \sum_{j=1}^{K(i)} L_j,$$

20 wherein:  $L_j$  is a number corresponding to a block amount  $K(i)$  mined by an  $i^{\text{th}}$  node;  $j \in [1, K(i)]$ ;  $O$  represents the sum of the corresponding block numbers;

(b), calculating a statistical weight, wherein a calculation formula thereof is:

$$\delta_j = \frac{L_j}{O}, \sum \delta_j = 1,$$

wherein:  $\delta_j$  represents the statistical weight;  $O$  represents the sum of the corresponding block numbers; and

5 (c), calculating the transaction amount of blocks created by the node, wherein a calculation formula thereof is:

$$N_{tr}(i) = \sum_{j=1}^{K(i)} \delta_j * Tr(i)(j),$$

wherein:  $Tr(i)(j)$  is a transaction amount of each block.

4. The method for intelligently selecting the accounting node of the blockchain, as  
10 recited in claim 2, wherein: the node information processing capability is calculated through a following formula of:

$$C(i) = \alpha * S(i) + \beta * Cal(i) + \gamma * Bandwithd(i),$$

wherein:  $C(i)$  represents an information processing capability of an  $i^{th}$  node;  
 $S(i)$  represents a current available storage space of the  $i^{th}$  node;  $Cal(i)$  represents a  
15 processor computation speed of the  $i^{th}$  node;  $Bandwithd(i)$  represents a current network bandwidth of the  $i^{th}$  node;  $\alpha$ ,  $\beta$  and  $\gamma$  are calculation weights, meeting  $\alpha + \beta + \gamma = 1$ .

5. The method for intelligently selecting the accounting node of the blockchain, as recited in claim 2, wherein: the total amount of the node transaction service charge is calculated through following steps of:

(aa), calculating a transaction service charge of each block, wherein a calculation formula thereof is:

$$Fee_j = \sum_{a=1}^{Tr(i)(j)} f_a ,$$

wherein:  $f_a$  is a service charge of each transaction;  $Tr(i)(j)$  is a transaction  
 5 amount of each block; a value range of  $a$  meets  $a \in [1, Tr(i)(j)]$ ;  $L_j$  is a number  
 corresponding to a block amount  $K(i)$  occupied by an  $i^{th}$  node;  $j \in [1, K(i)]$ ; and

(bb), calculating the total amount of the node transaction service charge,  
 wherein a calculation formula thereof is:

$$Fee_{total} = \sum_{j=1}^{K(i)} Fee_j ,$$

10 wherein:  $K(i)$  is the block amount occupied by the  $i^{th}$  node.

6. The method for intelligently selecting the accounting node of the blockchain, as  
 recited in claim 2, wherein: the threshold value of the node capability value of each node  
 is calculated through a following formula of:

$$y(i) = w_1 * x_1 + w_2 * x_2 + w_3 * x_3 ,$$

15 wherein:  $w_1 + w_2 + w_3 = 1$ ;  $y(i)$  is the threshold value of the node capability value  
 of each node;  $x_1$  is the transaction amount of blocks created by the node;  $x_2$  is the node  
 information processing capability;  $x_3$  is the total amount of the node transaction service  
 charge.

7. The method for intelligently selecting the accounting node of the blockchain, as recited in claim 6, wherein: the step (3) particularly comprises steps of:

(3.1), according to the threshold value  $y(i)$  of the node capability value of each node, assuming a minimum value and a maximum value thereof respectively to be  $y_{\min}$  and  $y_{\max}$ ; normalizing a region of  $[y_{\min}, y_{\max}]$  to  $[a_1, b_1]$ ; with an interval of  $c_1$ , dividing the region into  $(b_1 - a_1)/c_1$  categories;

(3.2), mapping the threshold value  $y(i)$  into a value  $Class_i$  of a first categorical space, wherein a calculation formula thereof is:

$$Class_i = \frac{y(i)}{y_{\max} - y_{\min} + 1},$$

10 wherein:  $y_{\min}$  is the minimum value of the threshold value  $y(i)$ ;  $y_{\max}$  is the maximum value of the threshold value  $y(i)$ ;  $y(i)$  is the threshold value of the node capability value of an  $i^{\text{th}}$  node;

(3.3), according to the value  $Class_i$  of the first categorical space, determining a region of  $[n, n+1]$ ; after determining a category of a current node is the  $(n+1)^{\text{th}}$  category, judging whether  $n$  is larger than a categorical threshold  $e_1$ , wherein a value range of  $e_1$  is  $[0, (b_1 - a_1)/c_1]$ ; if  $n$  is larger than the categorical threshold  $e_1$ , meaning the current node is a fixed node; otherwise, executing step (ddd);

(ddd), calculating an information processing capability of a non-fixed node, namely the information processing capability of the node except the fixed node, wherein  
20 a calculation formula thereof is:

$$z(i) = x_3,$$

wherein:  $z(i)$  is the information processing capability of the non-fixed node;  
 $x_3$  is the total amount of the node transaction service charge;

(3.4), according to a value of the information processing capability  $z(i)$  of the non-fixed node, assuming a minimum value and a maximum value thereof respectively to be  $z_{\min}$  and  $z_{\max}$ ; normalizing a region of  $[z_{\min}, z_{\max}]$  to  $[a_2, b_2]$ ; with an interval of  $c_2$ , dividing the region into  $(b_2 - a_2)/c_2$  categories; and

(3.5), mapping the information processing capability  $z(i)$  of the non-fixed node into a value  $Class2_i$  of a second categorical space, wherein a calculation formula thereof is:

$$Class2_i = \frac{z(i)}{z_{\max} - z_{\min} + 1},$$

wherein:  $z_{\min}$  is the minimum value of the information processing capability  $z(i)$ ;  $z_{\max}$  is the maximum value of the information processing capability  $z(i)$ ;  $z(i)$  is the information processing capability of the non-fixed node;

according to the value  $Class2_i$ , determining that a region to which the current node belongs is  $[m, m+1]$  and the current node belongs to the  $(m+1)^{th}$  category; making statistics of all nodes that  $m$  is larger than a categorical threshold  $e_2$ , wherein a value range of  $e_2$  is  $[0, (b_2 - a_2)/c_2]$ , and selecting  $R$  nodes to serve as random nodes, so as to complete the node selection, wherein a value of  $R$  is a random number.