Dynamic allocation algorithm of electromagnetic spectrum in complex electromagnetic environment

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Abstract: In order to realize dynamic allocation of electromagnetic spectrum in complex electromagnetic environment, a dynamic allocation algorithm of electromagnetic spectrum in complex electromagnetic environment based on spatial dynamic feature matching is proposed. The method comprises the following steps of: constructing an associated beam characteristic analysis model for dynamic allocation of electromagnetic spectrum in a complex electromagnetic environment; detecting electromagnetic spectrum characteristics in the complex electromagnetic environment by adopting a spectrum characteristic decomposition method; performing association dimension analysis according to high-order statistical characteristic quantity distribution attributes of electromagnetic spectrum data in the complex electromagnetic environment; extracting fuzzy correlation characteristic quantities and association distribution attribute sets of electromagnetic spectrum data in the complex electromagnetic environment; Combined with electromagnetic spectrum load mining method, statistical analysis of dynamic allocation of electromagnetic spectrum in complex electromagnetic environment is carried out, fuzzy correlation fusion model of dynamic allocation of electromagnetic spectrum in complex electromagnetic environment is established, multi-scale wavelet decomposition method is used for feature extraction in dynamic allocation of electromagnetic spectrum in complex electromagnetic environment, feature extraction and classification model of dynamic allocation of electromagnetic spectrum in complex electromagnetic environment are established, large data fusion method is used for pattern matching and spatial dynamic spectrum resource allocation of dynamic allocation of electromagnetic spectrum in complex electromagnetic environment, and optimization of dynamic allocation of electromagnetic spectrum in complex electromagnetic environment is realized according to spectrum convergence result. The simulation results show that the method has better adaptability for dynamic allocation of electromagnetic spectrum in complex electromagnetic environment, higher accuracy for allocation of electromagnetic spectrum resources, and improved the ability of electromagnetic spectrum detection and feature analysis in complex electromagnetic environment.

1. Introduction

With the development of the electromagnetic spectrum distribution data structure in the complex electromagnetic environment, the database is constructed by adopting the electromagnetic spectrum data structure method in the complex electromagnetic environment to improve the data storage and detection capability. In the design center of the electromagnetic spectrum database in the complex electromagnetic environment, the dynamic distribution of the electromagnetic spectrum in the complex electromagnetic environment is required, the dynamic distribution of the electromagnetic spectrum in the complex electromagnetic environment is established, and the dynamic distribution model of the electromagnetic spectrum in the complex electromagnetic environment is established[1]. Combined with the graph pattern structure analysis method, the dynamic allocation of electromagnetic spectrum in complex electromagnetic environment is carried out, and the research on the dynamic allocation method of electromagnetic spectrum in complex electromagnetic environment is of great significance in realizing the design of electromagnetic

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spectrum database and data information detection in complex electromagnetic environment[2-4]. The dynamic allocation of electromagnetic spectrum in complex electromagnetic environment is based on the detection of frequent items of graph data. The graph mode decoupling model of dynamic allocation of electromagnetic spectrum in complex electromagnetic environment is established by using the method of correlation beam feature analysis. This paper proposes a dynamic allocation algorithm of electromagnetic spectrum in complex electromagnetic environment based on spatial dynamic feature matching. A correlation beam characteristic analysis model for dynamic allocation of electromagnetic spectrum in complex electromagnetic environment is established[5]. MySQL is taken as a database to construct a visualization system for electromagnetic spectrum data in complex electromagnetic environment to realize dynamic allocation of electromagnetic spectrum in complex electromagnetic environment. However, the traditional method carries out dynamic allocation of electromagnetic spectrum in complex electromagnetic environment, but the adaptability of traditional method for dynamic allocation of electromagnetic spectrum in complex electromagnetic environment is not high. Therefore, this paper proposes a dynamic allocation algorithm of electromagnetic spectrum in complex electromagnetic environment based on spatial dynamic characteristic matching. Firstly, a fuzzy correlation fusion model for dynamic allocation of electromagnetic spectrum in complex electromagnetic environment is established, and a multi-scale wavelet decomposition method is adopted to extract features in the dynamic allocation process of electromagnetic spectrum in complex electromagnetic environment. Secondly, a feature extraction and classification model for dynamic allocation of electromagnetic spectrum in complex electromagnetic environment is established. Finally, simulation experiments are carried out to demonstrate the superior performance of the method in improving the dynamic allocation capability of electromagnetic spectrum in complex electromagnetic environment.

2. Detection and characteristic analysis of electromagnetic spectrum data in complex electromagnetic environment

A. Detection of electromagnetic spectrum data in complex electromagnetic environment

In order to realize dynamic distribution of electromagnetic spectrum in complex electromagnetic environment based on spatial dynamic feature matching, spectrum feature decomposition method is required to detect electromagnetic spectrum features in complex electromagnetic environment, correlation dimension analysis is carried out according to high-order statistical feature distribution attributes of electromagnetic spectrum data in complex electromagnetic environment, fuzzy correlation feature quantity and correlation distribution attribute set of electromagnetic spectrum data in complex electromagnetic environment are extracted[6]. The fuzzy correlation characteristic quantity and classification attribute characteristic of electromagnetic spectrum data under complex electromagnetic environment are extracted, and the optimal dynamic allocation of electromagnetic spectrum data under complex electromagnetic environment is completed[7]. The information attribute chain model of electromagnetic spectrum data under complex electromagnetic environment is established by using the joint analysis method of point, line and plane elements, the fuzzy decision characteristic distribution function of dynamic allocation of electromagnetic spectrum data under complex electromagnetic environment is established, and the optimal dynamic allocation and information detection of electromagnetic spectrum data under complex electromagnetic environment are carried out by using the adaptive optimization method[8]. The attribute linked list of electromagnetic spectrum data in complex electromagnetic environment is established, and the spatial distribution structure model of electromagnetic spectrum data in complex electromagnetic environment is obtained as shown in figure 1.

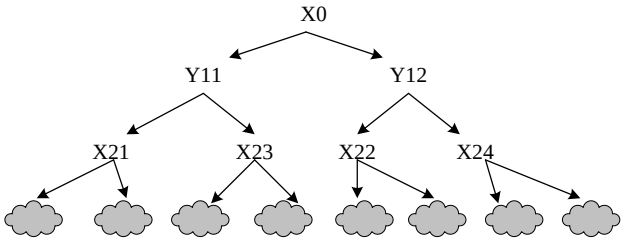

Figure .1 Spatial distribution structure model of electromagnetic spectrum data in complex electromagnetic environment

According to the electromagnetic spectrum data analysis model in the complex electromagnetic environment shown in figure 1, the electromagnetic spectrum information in the complex electromagnetic environment is detected by adopting the block region fusion and feature matching method, the characteristic distribution set of the electromagnetic spectrum information in the complex electromagnetic environment is established, the fuzzy spectrum convergence model is established by adopting the multiple regression analysis method, the adaptive learning of the dynamic allocation of the electromagnetic spectrum in the complex electromagnetic environment is carried out, the quantitative analysis model of the dynamic allocation of the electromagnetic spectrum in the complex electromagnetic environment is established, and the statistical function of the dynamic allocation of the electromagnetic spectrum in the complex electromagnetic environment is obtained as follows:

$$\begin{aligned} &\min F = R^2 + A\sum_i \xi_i \\ &s.t : \| \phi(x_i) - o \|^2 \le R^2 + \xi_i \ and \ \xi_i \ge 0, i = 1,2,... \end{aligned} \tag{1}$$

$$\begin{aligned} &\max \sum_i \alpha_i K(x_i, x_i) - \sum_i \sum_j \alpha_i \alpha_j K(x_i, x_j) \\ &s.t : \sum_i \alpha_i = 1 \ and \ 0 \le \alpha_i \le A, i = 1,2,... \end{aligned} \tag{2}$$

The above formula is expressed as a set of constraint index parameters for evaluating the dynamic allocation of electromagnetic spectrum under complex electromagnetic environment, ω is a standard normal distribution function, R is a decoupling characteristic quantity for the dynamic allocation of electromagnetic spectrum under complex electromagnetic environment, and the dynamic allocation of electromagnetic spectrum under complex electromagnetic environment is carried out by combining the ambiguity detection method[9].

B. Detection of electromagnetic spectrum characteristics in complex electromagnetic environment

According to the fuzzy characteristic distribution set of electromagnetic spectrum dynamic distribution in complex electromagnetic environment[10], the adaptive dynamic distribution of electromagnetic spectrum data in complex electromagnetic environment is carried out:

$$\begin{aligned} &\lambda = \frac{1}{1 + \alpha(\frac{\partial S}{\partial t})^2} \\ &\hat{k}_\mu(t+1) = \hat{k}_\mu(t) + Q(t+1) \\ &\qquad \times [\frac{\partial \hat{F}_\mu / Mg}{\partial t} - \frac{\partial S}{\partial t} \hat{k}_\mu(t)] \end{aligned} \tag{3}$$

Wherein:

$$Q(t+1) = P(t+1)\frac{\partial S}{\partial t} \tag{4}$$

$$P(t+1) = \frac{1}{\lambda}[P(t) - \frac{P^2(t)(\frac{\partial S}{\partial t})^2}{\lambda + P(t)(\frac{\partial S}{\partial t})^2}]$$

$$\frac{\partial S}{\partial t} = \frac{r}{v_c}\frac{\partial \omega_w}{\partial t} \tag{5}$$

In the formula, λ represents a large data ambiguity distribution factor for dynamic distribution of electromagnetic spectrum under complex electromagnetic environment, $\hat{F}_\mu$ is a

statistical characteristic component for dynamic distribution of electromagnetic spectrum under complex electromagnetic environment, ω_w is an adaptive weighting factor for dynamic distribution of electromagnetic spectrum under complex electromagnetic environment, statistical analysis of dynamic distribution of electromagnetic spectrum under complex electromagnetic environment is carried out by combining an electromagnetic spectrum load mining method, a fuzzy correlation fusion model for dynamic allocation of electromagnetic spectrum in complex electromagnetic environment is established, a graph model for dynamic allocation of electromagnetic spectrum in complex electromagnetic environment is designed by combining statistical analysis methods, and the expression of the statistical analysis model for dynamic allocation of electromagnetic spectrum in complex electromagnetic environment is as follows:

$$\frac{d\boldsymbol{z}(t)}{dt} = F(\boldsymbol{z}) \tag{6}$$

Set $f(s_i) = \left(f(x_1), f(x_2), ..., f(x_n)\right)$. The subspace scheduling model of electromagnetic spectrum distribution in complex electromagnetic environment is constructed as $P(n_i) = \{p_k \mid pr_{kj} = 1, k = 1, 2, \cdots, m\}$, and the associated feature quantity of dynamic distribution of electromagnetic spectrum in complex electromagnetic environment is carried out, and the electromagnetic spectrum feature detection in complex electromagnetic environment is carried out[11].

Establishing association rule distribution sets R^N and X^N for dynamic allocation of electromagnetic spectrum under complex electromagnetic environment, and obtaining the association distribution relation of electromagnetic spectrum under complex electromagnetic environment as follows:

$$\begin{cases} \dfrac{\partial \pi_R}{\partial w} = -(\lambda_2 - 1)F(\bar{q}_R^s - y(e))(\dfrac{h}{2}\dfrac{\partial q}{\partial w} + q + w\dfrac{\partial q}{\partial w}) \\ -q + (\varphi p - w - \dfrac{h}{2})\dfrac{\partial q}{\partial w} - \varphi p F(q - y(e))\dfrac{\partial q}{\partial w} \\ \dfrac{\partial \pi_R}{\partial e} = -(\lambda_2 - 1)F(\bar{q}_R^s - y(e))(\dfrac{h}{2}\dfrac{\partial q}{\partial e} + w\dfrac{\partial q}{\partial e} + \alpha g'(e)) \\ +(\varphi p - w - \dfrac{h}{2})\dfrac{\partial q}{\partial e} - \varphi p F(q - y(e))(\dfrac{\partial q}{\partial e} - y'(e)) - \alpha g'(e) \end{cases} \tag{7}$$

$\frac{\partial q}{\partial w}$ and $\frac{\partial q}{\partial e}$ are substituted into the matching model of electromagnetic spectrum in complex electromagnetic environment, and decoupling analysis of dynamic allocation of electromagnetic spectrum in complex electromagnetic environment is carried out to improve convergence of dynamic allocation of electromagnetic spectrum in complex electromagnetic environment[12].

3. Optimization of dynamic distribution of electromagnetic spectrum in complex electromagnetic environment

A. Analysis of spatial dynamic spectrum resource distribution characteristics

By dynamically allocating semantic correlation feature quantities of electromagnetic spectrum data in complex electromagnetic environment and combining fuzzy attribute feature detection method, statistical detection of electromagnetic spectrum data set in complex electromagnetic environment is realized, statistical analysis of dynamic allocation of electromagnetic spectrum in complex electromagnetic environment is carried out by combining electromagnetic spectrum load mining method[13], fuzzy correlation fusion model of dynamic allocation of electromagnetic spectrum in complex electromagnetic environment is established, and feature segmentation model of electromagnetic spectrum data in complex electromagnetic environment is established, and calculation formula is defined as:

$$\begin{bmatrix} d_1 \\ d_2 \\ d_3 \\ \cdots \\ d_N \end{bmatrix} = \begin{bmatrix} d_{11}, d_{12}, d_{13} \ldots d_{1N} \\ d_{21}, d_{22}, d_{23} \ldots d_{2N} \\ d_{31}, d_{32}, d_{33} \ldots d_{3N} \\ \cdots \\ d_{N1}, d_{N2}, d_{N3} \ldots d_{NN} \end{bmatrix} * \begin{bmatrix} w_{i1} \\ w_{i2} \\ w_{i3} \\ \cdots \\ w_{iN} \end{bmatrix} \quad (8)$$

Among them, w_{ij} is the global weighted value of dynamic distribution of electromagnetic spectrum data in complex electromagnetic environment of the first point, and STARMA(1,1) statistical analysis model of electromagnetic spectrum data in complex electromagnetic environment is constructed to carry out optimization control of dynamic distribution of electromagnetic spectrum data in complex electromagnetic environment. Its calculation formula is:

$$D(d_i, d_j) = \frac{d_i . d_j}{\|d_i\| \times \|d_j\|} \quad (9)$$

Wherein, d_i and d_j are fuzzy regular feature quantities for dynamic allocation of electromagnetic spectrum data in complex electromagnetic environment. Statistical information analysis method is adopted to establish the associated feature distribution set for dynamic allocation of electromagnetic spectrum data in complex electromagnetic environment, which is expressed as:

$$P(K = T \,|\, R = 1) = \frac{P(K = T) P(K = 1 \,|\, K = T)}{P(R = 1)} \quad (10)$$

Wherein

$$P(K = T) = \frac{|C|}{|s|} \quad (11)$$

$$P(R = 1 \,|\, K = 1) = \frac{NB}{|C|} \quad (12)$$

$$P(R = 1) = \frac{NS}{|S|} \quad (13)$$

In the formula, NB is a closed frequent item set of spatial dynamic spectrum resource distribution characteristics, and NS is a spatial dynamic spectrum resource distribution characteristic distribution domain in the semantic segmentation domain S.

B. Dynamic distribution of electromagnetic spectrum output in complex electromagnetic environment

The large data fusion method is adopted to carry out pattern matching and spatial dynamic spectrum resource allocation of electromagnetic spectrum dynamic allocation in complex electromagnetic environment. At the characteristic point i, the electromagnetic spectrum distribution set in complex electromagnetic environment at time T is obtained and expressed as t, wherein $(w_{1,j}, w_{2,j}, \cdots, w_{tj})$ is expressed as the number of electromagnetic spectrum data in complex electromagnetic environment, w_{tj} is the weighting coefficient of electromagnetic spectrum data dynamic allocation in complex electromagnetic environment, and the standard error coefficient is obtained by semantic dynamic feature segmentation method.

$$STDf_{i,j} = \frac{Freq_{i,j}}{\max_l Freq_{i,j}} \quad (14)$$

In which $\max_l Freq_{i,j}$ is the fuzzy constraint feature quantity for dynamic allocation and optimization of electromagnetic spectrum data in complex electromagnetic environment. A storage module and an information query module for dynamic allocation of electromagnetic spectrum data in a complex electromagnetic environment are established, a multi-scale wavelet decomposition method is adopted for feature extraction in the dynamic allocation process of electromagnetic spectrum in the complex electromagnetic environment, a feature extraction and classification model for dynamic allocation of electromagnetic spectrum in the complex electromagnetic environment is established, and a dynamic allocation output is obtained:

$$Idf_i = \log(\frac{w_{i,j}N}{n_i}))$$ (15)

Wherein

$$w_{i,j} = tf_{i,j} \times Idf_i$$ (16)

A feature extraction method of electromagnetic spectrum data in complex electromagnetic environment is adopted for dynamic allocation of electromagnetic spectrum in complex electromagnetic environment[14-16].

4. Simulation experiment and result analysis.

In order to verify the application performance of the method in realizing dynamic distribution of electromagnetic spectrum data in complex electromagnetic environment, Matlab is used for simulation test analysis. The number of sensing nodes for electromagnetic spectrum sampling in complex electromagnetic environment is 80, the distribution set of frequent items is 80, the spatial dimension of electromagnetic spectrum data distribution in complex electromagnetic environment is 12, and the time delay for information sampling is 1.4 ms. according to the above simulation parameter settings, dynamic distribution of electromagnetic spectrum data in complex electromagnetic environment is carried out, and the time domain distribution of data sampling is obtained as shown in figure 2.

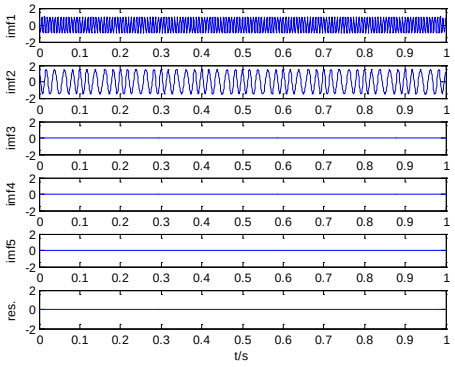

Figure.2 Time-domain distribution of electromagnetic spectrum in complex electromagnetic environment

Taking the data shown in figure 2 as the research object, the mode matching and spatial dynamic spectrum resource allocation of electromagnetic spectrum dynamic allocation in complex electromagnetic environment are carried out by big data fusion method. according to the spectrum convergence results, the dynamic distribution optimization of electromagnetic spectrum dynamic allocation in complex electromagnetic environment is realized, and the dynamic distribution output is obtained as shown in figure 3.

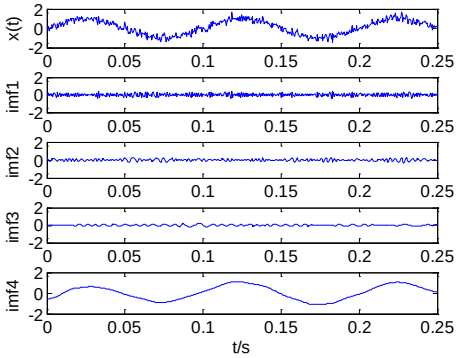

Figure.3 Dynamic distribution and output of electromagnetic spectrum data under complex electromagnetic environment

According to the analysis of figure 3, the method of this paper has better convergence of characteristics for dynamic allocation of electromagnetic spectrum data in complex electromagnetic

environment. the accuracy of dynamic allocation of data by different methods is tested. the comparison results are shown in table 1. According to the analysis of table 1, the method of this paper has higher accuracy for dynamic allocation of electromagnetic spectrum data in complex electromagnetic environment.

Table 1 Precision comparison of data dynamic distribution

Number of iterations	Proposed method	Reference[4]	Reference[6]	Reference[7]
100	0.921	0.834	0.834	0.732
200	0.945	0.847	0.848	0.836
300	0.965	0.921	0.854	0.867
400	0.998	0.936	0.934	0.912
500	0.999	0.958	0.957	0.937

5. Conclusions

This paper presents an algorithm for dynamic allocation of electromagnetic spectrum in complex electromagnetic environment based on spatial dynamic feature matching. Using multiple regression analysis method, a fuzzy spectrum convergence model is established to carry out adaptive learning of dynamic allocation of electromagnetic spectrum in complex electromagnetic environment. Combined with statistical analysis method, a graph model of dynamic allocation of electromagnetic spectrum in complex electromagnetic environment is designed. Through semantic dynamic feature segmentation method, a storage module and an information query module of dynamic allocation of electromagnetic spectrum data in complex electromagnetic environment are established. Multi-scale wavelet decomposition method is adopted to extract features in the process of dynamic allocation of electromagnetic spectrum in complex electromagnetic environment. The research shows that the method proposed in this paper has better adaptability and higher dynamic allocation accuracy for dynamic allocation of electromagnetic spectrum in complex electromagnetic environment.

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