Research on Optimization Retrieval Technology of Multimedia Information Management System Based on Fuzzy Control

Huang Yi-Jia\(^1\), *Lu Xing-hua\(^2\), Chen Yong-Cong\(^1\)

\(^1\)Guangzhou Huali Science and Technology Vocational College, Guangzhou, China
\(^2\)Huali College Guangdong University of Technology, Guangdong Guangzhou, China

*Corresponding author E-mail: xhlu@gdut.edu.cn

Abstract. In order to improve the efficiency of image information retrieval in multimedia information management system, a retrieval technology of multimedia information management system based on fuzzy directivity control is proposed. The retrieval multimedia information management system is decomposed with LGB to realize the image multimedia information feature compression, and the control constraint parameter model of the multimedia information management system is constructed. The fuzzy directivity control method is used to adjust the retrieval category adaptively, and the edge contour feature quantity of the image in the multimedia information management system is extracted. The fuzzy PID control algorithm is used to cluster and fuse the extracted edge contour features of multimedia images, which can realize the accurate retrieval and scheduling of the images in the multimedia information management system. The simulation results show that the proposed algorithm has high precision and zero frame difference in image retrieval in multimedia information management system, which shows good multimedia information management and system control ability.

1. Introduction

In the era of big data, a large amount of multimedia information is stored and transmitted through the multimedia information management system. The multimedia information management system stores huge amounts of audio, video and image information. Image retrieval is the basis of large scale multimedia data access and information index. In multimedia information management system, image retrieval is needed to realize the accurate index of interested image and the accurate access of multimedia information management system\(^1\). Therefore, it has great significance to study the retrieval technology of multimedia information management system in multimedia information management system.

Image retrieval is the basis of multimedia information management system access and scheduling. Image retrieval is also the first step to achieve video retrieval. Image retrieval provides accurate index and annotation for video access and retrieval\(^2\). The traditional methods of image retrieval include manual annotation, text detection, image coding and feature extraction of image texture information. Manual labeling is the automatic standard of text and image information in images by manual method. This method is reliable and simple but inefficient. Text detection is achieved by extracting text information from captured images and videos, and image retrieval by keyword index method\(^3\). The algorithm has high efficiency in image retrieval. However, the method is greatly interfered by overlay text in image indexing, especially the ability of automatic recognition of superimposed text in video.
image is not high, resulting in low retrieval accuracy. Image coding is realized by image vector quantization coding. With the development of information coding technology, this technique has become an important tool for image indexing. However, the computation cost of the algorithm is high, and the real-time performance of image retrieval is not good[4].

Aiming at the above problems, this paper presents a retrieval technology of multimedia information management system based on fuzzy directivity control. The retrieval multimedia information management system is decomposed with LGB to realize the image multimedia information feature compression, and the edge contour feature quantity of the image in the multimedia information management system is extracted. The fuzzy PID control algorithm is used to cluster and fuse the feature quantity of the edge contour of the multimedia image, which realizes the accurate retrieval and information index of the image in the multimedia information management system. Finally, the performance is tested through the simulation experiment.

2. Preliminary knowledge description of image retrieval and preprocessing of image vector quantization coding

2.1 Knowledge description and algorithm design for image retrieval

In the multimedia information management system, in order to achieve the accurate retrieval and access of the objects of interest, it is necessary to extract and classify the information features of the target images. In order to achieve image retrieval, multimedia information is needed. The images in the management system are divided into $33 \times 33$ topologies, and four image retrieval input channels are set up in horizontal direction. In a vertical direction, In the left diagonal direction and the right diagonal direction, the vector quantization feature coding model of the image is constructed with the nearest neighbor as the center[5], $p_i$ is regarded as the edge contour feature quantity of the multimedia image retrieval to guide the evolution of the contour clustering center. In order to initialize the level set function $\phi$, the phase sliding average window with a single retrieval node fitness is obtained. The semantic retrieval images of the four retrieval channels are decomposed in horizontal and vertical directions, and the gradient images in the four retrieval channels are extracted. The input vector values are: $x_1$, $x_2$, $x_3$ and $x_4$, respectively:

$$
\begin{align*}
  x_1 & = p_1 - m \\
  x_2 & = p_2 - m \\
  x_3 & = p_3 - m \\
  x_4 & = m
\end{align*}
$$

(1)

Where, $m$ is the median value of pixel gray value of edge feature, and the multimedia information management system with defined domain, $\Omega$ is a multimedia information management system. The image $I(x, y)$ to be retrieved is divided into regions with different edge contour features by edge contour curve $C$ into regions $R_l$ and $R_r$ with different multimedia image edge contour features. One is the text area in the image, one is the background area of the image. Under the curve length constraint, the regional distribution function of a C-V model fitting image retrieval is obtained as follows:

$$
H = \sum_{r=1}^{l} \sum_{p=1}^{k} (x_{ir} - x_{ip}) (x_{ir} - x_{ip})^T A_{rp}
$$

(2)

The region distribution function of the above image retrieval is taken as the objective function to optimize the solution, the fuzzy directivity control is carried out in each direction of the image retrieval channel, and the image classification retrieval is carried out by combining the data clustering algorithm, according to the above calculation[6].
2.2 Image vector quantization coding preprocessing
In order to retrieve the image information accurately in the multimedia information management system, we need to decompose the retrieved multimedia information management system with LGB to realize the feature compression and coding output of the image. In this paper, we adopt the LBG algorithm to implement the image compression and coding output. In line vector quantization coding, the gradient graph is decomposed by the gradient information feature of the image, and the code vector in the neighborhood is adjusted by self-organizing feature mapping [7]. The realization process of the algorithm is described as follows: the input graph. The image pixel feature vector \( x(t) \), is expressed as a set of wideband strict stationary nonlinear practical training sequences. Firstly, the edge fusion vector quantization spectral center of the image is found, and an initial codebook \( \hat{A}_0 \), is generated by the feature space splitting method to get the whole picture. The edge of the image fuses the element grouping in the vector codebook \( \hat{A}_0 \) and finds the gray histogram of the contour wave domain with the pixel \( j \) as the center. The new codebook is then quantized as the gradient direction sequence of the image. The steps are expressed as follows:

1) Initialization: Given the image edge fusion series \( N \), initialize the multimedia image edge contour feature threshold \( \epsilon \), given the image edge pixel training sequence \( \{x_j\}, j=0,1,\ldots,m-1 \), in an initial \( N \) level symbol \( \hat{A}_0 = \{y_i\}, i=1,2,\ldots,N \) feature decomposition, set \( n=0, D_1 = \infty \).

2) Estimate the interference information parameters of the image \( \hat{A}_i = \{y_i\}, i=1,2,\ldots,N \), find the training sequence \( \{x_j\}, j=0,1,\ldots,m-1 \) of the pixel eigenvectors \( P(\hat{A}_i) = \{s_i\}, i=1,2,\ldots,N \).

\[
D_x = D(P(\hat{A}_i, \hat{A}_0)) = \frac{1}{m} \sum_{j=0}^{m-1} \min \{d(x_j, y)\} \tag{3}
\]

3) The text information points in the image are classified by domain feature points, the text feature clustering space is divided, and the image frame sequence with overlapping text is decomposed by vector quantization.

4) In the domain feature point correlation interval, there exists \( \hat{A}_{n+1} = \hat{x}(s_j) \), set \( n=m+1 \), turn to step (2).

With the above algorithm design, the image vector quantization coding in the multimedia information management system is realized, and the fuzzy directivity control is processed according to the encoding output, and the image retrieval is realized [8].

3. Fuzzy directivity control and retrieval technology of multimedia information management system

3.1 Fuzzy directivity control of image
This paper presents a retrieval technique of multimedia information management system based on fuzzy directivity control. The image quantization coding information of data is extracted by feature extraction and feature compression. The edge contour feature of the image is extracted from the multimedia information management system. The edge wheel of the extracted multimedia image is extracted by fuzzy PID control algorithm [9-11]. Firstly, the image semantic directional feature data acquisition model is constructed. In the access to multimedia information management system, a RGB color image in the multimedia information management system is extracted by semantic state feature information. Edge feature extraction, in which the process of fuzzy directivity control for vector quantization coding of image output is described as: assuming that the time series of input feature information of Chinese text module of image retrieval region is \( x(t), t=0,1,\ldots,n-1 \), the location interval of the coded information is described as:

\[
L = J(w,e) = \sum_{i=0}^{\infty} a_i \{w^T \varphi(x_i) + b + e - y_i\} \tag{4}
\]
In the above semantic information entity model, the pixel samples of the image are trained by self-organizing neural network in the horizontal and vertical gradients, and reasoning under fuzzy rules is carried out[12], and the useful pixel parameter test set $E_{ij} = \{e_1, e_2, \cdots, e_m\}$, is obtained, where $e_i \in \{0, 1\}$, the semantic directivity beam function from the gradient feature difference information is extracted, the output weighting vector is shown as follows:

$$W_i = (H_i - H_{ij}) \omega = \lambda \omega$$ (5)

To determine the size of the window, $1 \times N$, the threshold value of the suspected text pixel input detection function is determined, and calculates its spatial distance from the weighted vector $x(t)$ of all the output pixel feature windows, expressed as:

$$D_i = [x', x', \ldots, x']$$ (6)

Combining the vector quantization coding output of the graph, the semantic directivity characteristic output of the output is obtained as follows:

$$\hat{s}(k/k) = \sum_j^n \hat{x}(k/k)u_j(k)$$ (7)

Based on the above analysis, the fuzzy directivity control of the image is realized.

3.2 Implementation of FCM feature clustering and multimedia information management system retrieval technology

Based on the feature extraction of the edge contour of multimedia image, the output fuzzy directivity control results are processed by data clustering, and the fuzzy C-means clustering algorithm is used to cluster the feature data. Assume that the semantic directional feature data of the image to be retrieved in the input multimedia information management system is a limited data set:

$$G_{acc} = (1 + \mu T)(1 + \lambda T) |G_{old}$$ (8)

The feature set of edge contour of multimedia image encoded by LGB vector quantization contains $n$ clustering feature samples, in which the membership attribute vector of sample $x_i$, $i = 1, 2, \cdots, n$ is:

$$T(g_i) = \frac{1}{\omega_i} \sum_i \omega_i (g_i - g_0)$$ (9)

The fuzzy clustering center matrix for searching for the directivity of fuzzy control in image retrieval at the steady-state periodic points is expressed as follows:

$$V = \{v_j, j = 1, 2, \cdots, c, i = 1, 2, \cdots, s\}$$ (10)

The edge density of the output edge pixel of image retrieval is solved. Under the known $M$ priori knowledge screening models, the initial state of image retrieval is $x'(0) = \hat{x}'(0)$, with the above processing, fuzzy directivity control and FCM clustering method are taken, threshold decision is used to optimize image retrieval and achieve accurate access and image indexing in multimedia information management system.

4. Simulation experiment and result analysis

In order to test the application performance of this algorithm in the realization of image retrieval in multimedia information management system, simulation experiments are carried out. Matlab simulation software is used, the algorithm is programmed. The image acquisition comes from a large multimedia network database, DeepWeb2016, network database, which stores a large amount of video image information. The goal of retrieval is to identify the video image frame. In order to realize the accurate location and index of frame image in video. In the simulation experiment, the maximum iteration number of step size $c = 3$, is retrieved, and the dimension of pixel set $CR = 0.1$, maximum gradient difference $F = 0.5$, region search scale coefficient. In the initial frequency $f_1 = 2.1$ Hz, termination frequency $f_2 = 0.23$ Hz, image retrieval of video frame difference sequence, the external information interference intensity is set to $SNR = -10$ dB, weight coefficient $\omega$ is 0.9. In order to quantitatively analyze the performance of image retrieval, according to the simulation loop mentioned
above, the image retrieval simulation analysis is carried out by setting the environment and parameters, and the image containing text pixels in one frame in the database is tested. The original image and the LGB coding output are obtained by simulation, as shown in figure 1.

![Image to be retrieved](a) Image to be retrieved ![LGB vector quantization coding](b) LGB vector quantization coding

Figure 1. Image acquisition and coding.

Based on the LGB vector quantization coding, the image feature compression is carried out, based on which the fuzzy directivity control and FCM focusing analysis of the image are carried out. On this basis, the fuzzy PID control algorithm is used to cluster and fuse the extracted edge contour feature of multimedia image, thus the accurate image retrieval and information index are realized in the multimedia information management system. To prove the universality of this algorithm, the paper uses the algorithm to simple background image, The complex background image, English text image and vertical text image are retrieved separately, and the output results are shown in figure 2.

![Simple background image](a) Simple background image ![Complex background image](b) Complex background image

Figure 2. Retrieval results under various backgrounds.

By analyzing the above results, we can see that the image retrieval in multimedia information management system based on this method can get the accurate output of retrieval results by fuzzy directivity control, and show a good universality. In order to quantitatively analyze the performance of the algorithm in this paper, the peak signal-to-noise ratio (PSNR) is taken as the test index, and a group of image retrieval is taken as an example. By using the method of this paper and the traditional method, the comparison results are obtained as shown in figure 3. The PSNR of image retrieval output by this algorithm is high, which shows that the precision and quality of image retrieval are better and the performance is superior.

![PSNR performance comparison test](a) Proposed method ![Harris](b) Harris ![Wavelet algorithm](c) Wavelet algorithm

Figure 3. PSNR performance comparison test.
5. Conclusions
In this paper, a retrieval technology of multimedia information management system based on fuzzy directivity control is proposed. The retrieval multimedia information management system is decomposed with LGB to realize the image multimedia information feature compression, and the control constraint parameter model of the multimedia information management system is constructed. The fuzzy directivity control method is used to adjust the retrieval category adaptively, and the edge contour feature quantity of the image in the multimedia information management system is extracted. The fuzzy PID control algorithm is used to cluster and fuse the extracted edge contour features of multimedia images, which can realize the accurate retrieval and scheduling of the images in the multimedia information management system. The simulation results show that the proposed algorithm has high precision and zero frame difference in image retrieval in multimedia information management system, which shows good multimedia information management and system control ability. This method has good application value in image retrieval of information management system.

References
[1] DI W, CRAWFORD M M. View generation for multiview maximum disagreement based active learning for hyperspectral image classification[J]. IEEE Transactions on Geoscience and Remote Sensing, 2012, 50(5):1942-1954.
[2] PAN J, LIU R, SU Z, et al. Kernel estimation from salient structure for robust motion deblurring[J]. Signal Processing: Image Communciation, 2013, 28(9): 1156-1170.
[3] HUANG Miao,WANG Liutao,ZHANG Haichao. Face Recognition Based on Gabor Wavelet Transform and K-L Gaussian Riemannian Manifold Discriminant. Computer Engineering, 2016, 42(9): 208-213.
[4] Bliman P A, Ferrari-Trecate G. Average consensus problems in networks of agents with delayed communications[J]. Automatica, 2013, 44(8): 1985-1995.
[5] RAJAPAKSAHA N, MADANAYAKE A, BRUTON LT. 2D space-time wave-digital multi-fan filter banks for signals consisting of multiple plane waves[J]. Multidimensional Systems and Signal Processing, 2014, 25(1): 17-39.
[6] LI J Y,DANG J W,WANG Y P. Medical image segmentation algorithm based on quantum clonal evolution and two-dimensional Tsallis entropy[J].Journal of Computer-Aided Design & Computer Graphics, 2014, 26(3):465-471.
[7] ORTIZ A, GORRIZ J M, RAMIREZ J, et al. Improving MR brain image segmentation using self-organising maps and entropy-gradient clustering[J]. Information Sciences, 2014, 262(3):117-136.
[8] MEHER S K. Recursive and noise-exclusive fuzzy switching median filter for impulse noise reduction[J]. Engineering Applications of Artificial Intelligence, 2014, 30:145-154.
[9] HSIEH M H, CHENG F C, SHIE M C, et al. Fast and efficient median filter for removing 1-99% levels of salt-and-pepper noise in images[J]. Engineering Applications of Artificial Intelligence, 2013, 26(4):1333-1338.
[10] YUAN Quan, GUO Jiangfan. New ensemble classification algorithm for data stream with noise[J]. Journal of Computer Applications, 2018, 38(6): 1591-1595.
[11] LIU H M, BI X H, YE Z F, et al. Arc promoting inpainting using exemplar searching and priority filling[J]. Journal of Image and Graphics, 2016, 21(8):993-1003
[12] LIN J Y, DENG D X, YAN J, et al. Self-adaptive group based sparse representation for image inpainting[J]. Journal of Computer Applications, 2017, 37(4):1169-1173.