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Ornamental Fish Image Retrieval System

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Abstract. There are a lot of kinds of fishes in the aquarium. When you prepare to buy fish in the aquarium, you always want to get the fish.s information firstly. But you usually have no idea to describe the fish. Using the keyword .fish.or .aquarium. will get more result that we don.t need. The system offers content-based image search and retrieval.
In this paper, the system which takes picture as input the image of ornamental fish. Segmenting the region do Tamura texture feature, Auto-correlation, color feature extraction. Analysis of three features results on a database of 410 fish images to 44 different kinds. The system has content-based image retrieval for the ornamental fish. It different searching process with traditional images retrieval of ornamental fish. The traditional images retrieval offer the several profile, user choose the closest. Then user selections the fish belong of subjects. Query to find relevant information.it difficult to the condition set with no relevant professional knowledge. The system can solve this problem. Just enter a picture of ornamental that the system can query target information. Even if user doesn.t need have professional, user can use the system quick search information about fish.

Keywords: image retrieval, fish, tamura, autocorrelation

1. Introduction

When humans descript images, they always try to define the different features of the same image. It brings about searching more error result. Hope between the different of image can get same feature for identification. Content-based image retrieval (CBIR) analyzes content of the images such as keywords. Image retrieval technology has a variety of features for acquisition image. The features of image are associated with colors, shapes, textures, or any other information.

QBIC and Visual SEEK [1] are features of multimedia data, content-base of color, texture and shape, etc. And for effective classification, index and multimedia database have reached and discussed. Visual SEEK queries image and video information of international tool. The system provides querying of images by manually captures regions. It improves accuracy with relative spatial location information.

CBIR method is useful in the many filed including biology.In the plant system [2], users use plant image run semi-automatically segmentation of plant part. The region analyzes features by color, shape and texture, too.

In this work and we are interested in issues that are the study of ornamental fishes. User can use the system without the professional knowledge. First, it needs to do segmentation image to the fish from the background. The features of Fish have eyes, gills, fin, tail and other part, etc. Second, analyze the extraction of feature. Finally, the result matches between the images. Before user searches, the database has 410 fish images. And then user can search from the database. If the database doesn.t have the information, they can add new information for the system. It needs the clear snapshot of the fish which is given for query. However, the pictures have a complex problem, including illumination, out of focus, point of view, and the hindrance. Because the system is automation, we just need the high-resolution and the clear photos.

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The paper is organized as follow. In the next section, we present the proposal for content-based description. In section 3, the system architecture. And explanation of the collected database and result will be presented in section 4. Finally in section 5, there are the futures work and discussed.

2. Methodology

The image retrieval of system is analyzed and presented in flowchart in Fig.1

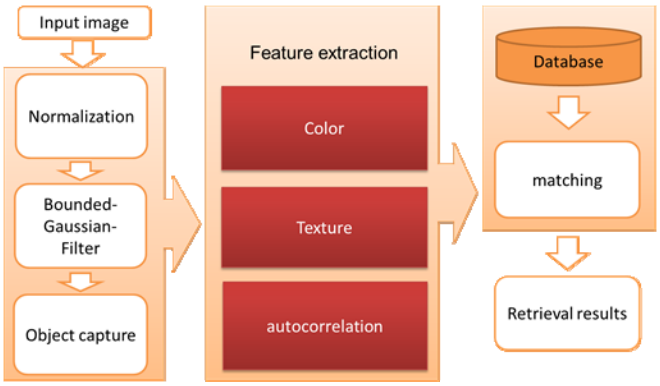

Fig. 1: System flowchart.

The system gets a query of image. The image should be adjusted to normalization, and then semi-automatically click selection body parts of fish extract. Before extracting the features, the image should do some preprocess steps. There are an eye, a caudal fin, a pectoral and body in extraction. Extractions of images are analyzed using color, texture, autocorrelation. For instance, the fish tail is different to the difference fish. The tail maybe is blue and red alternate or other color. Texture can be difference to between the different kinds of fish. After the feature is analyzed on fish image, it would record the information and save to database. In the follow, we explain our approach.

3. System Architecture

3.1. Normalization

To take the fish from picture is not an easy task. Chase the fish swimming speed, or aquarium lighting, shelter and other factor etc. However, the fish is alive. The swimming orientation of fishes would not be under control. The different distance when you takes pictures of fish for the features extraction. So the picture must first be adjusted to the same angle of view. The size of fish is adjusted to lock the head and tail the distance.

3.2. Feature extraction

Feature extraction parts of system are including color, texture and sift textures. When users upload image of the fish, the system first step is normalization. And then extracted information by image color feature, texture, and sift feature values. And eigenvalue stored in the database for easy retrieval comparison. The following is the feature extraction description:

ColorFeature[3] is the most direct perception of visual on fish Identification. It used in image retrieval on the technology widely. In image classification, the system can use color feature to filter through the data base. For example, the color of fish is blue or red, and the fish-scale of the body usually can distinguish fish commonly. In many other studies, we used 8-bits color and color histograms to match between two images. Usually we use 8-bits to record and instance the color. Color is divided into 256 of palette. RGB is 8-bits through the reduction. Then the statistics and record the histogram higher value of value, calculate the area rate. The color feature recorded color and rate into the database, as shown.

Texture feature analysis is a very important in the image. The texture is not like pixel-base color feature, and it is the need to include number of pixel area of statistics. So feature has the rotation invariance. But the image can affect from light and reflecting the situation. Sift is the texture of fish cannot tell more, will cause the texture of different species of fish to cause the error. So the texture is an important feature. Tamura [4, 5] captures the textures when compared with other results. Most people perceive to tell it. We chose to use Tamura to do capture the texture. The four characteristics (coarseness, contrast, directionality and line-likeness) for the fish's texture are more evident; particularly in the first three components of the image retrieval is extremely important.

3.3. Coarseness

There are two different textures. And the greater the value is, the more the coarseness is. According to coarseness formula proposed by Wordnet, concrete steps are as follow:

Step1.I(x, y) is I x j of image. Take the pixel size 2^k radius in the range.$A_{k(x,y)}$is the averages gray of (x, y) over neighborhood.in the study, k=1,2,3,4,5. the average over the neighborhood of size $2^k \times 2^k$ at the point(x, y).

$$A_k(x,y) = \frac{1}{2^{2k}} \times \sum_{i=x-2^{k-1}}^{x+2^k-1} \sum_{j=y-2^{k-1}}^{y+2^k-1} T(i.j) \quad (1)$$

Step2. For the point(x,y) is the center. Take difference between two points corresponding to $A_{k(x,y)}$ and calculate the different value mean difference in both vertical and horizontal orientation:

$$E_{k\ vertital}(x,y) = \left|A_k\left(x+2^{k-1},y\right) - A_k\left(x-2^{k-1},y\right)\right| \quad (2)$$

$$E_{k\ vertital}(x,y) = \left|A_k\left(x,y+2^{k-1}\right) - A_k\left(x,y-2^{k-1}\right)\right| \quad (3)$$

Step3. The best to calculate for each pixel convolution to find the maximum value of E_k .Select the best size that give the highest value:

$$E_k = \max(E_{k\ horizontal}, E_{k\ vertital}) \quad (4)$$

$$\text{Coarseness} = \frac{1}{m \times n} \sum_{i=1}^{n} \sum_{j=1}^{m} S_{best}(i,j) \quad (5)$$

3.4. Directionality

Between specific direction of associated can be statist calculation.

Step1. For i(x, y), implementing horizontal and vertical differences measured, respectively. Sobel edge detects to obtain strength and direction of the edge.

Step2. Statistics of direction histogram, we can use the histogram of curvature distribution.

Step3. Calculated $H_D(\emptyset)$ has between peaks and valleys rolling speed.

$$\boldsymbol{F_{directionality}} = \sum_{\boldsymbol{p}}^{\boldsymbol{n_p}} \sum_{\emptyset \in \boldsymbol{W_p}} \left(\emptyset - \emptyset_{\boldsymbol{p}}\right)^2 \boldsymbol{H_{D(\emptyset)}} \quad (6)$$

In formula, p is the representative histogram of the peak.$n_P$is the histogram of all the peaks.$w_P$is the range of pth peak between valleys. $\emptyset_P$is pth peak peak position of.$H_D(\emptyset_P)$.

3.5. Line-likeness

It seems necessary to give a more detailed description of line-likeness.

The line-likeness of the formula is:

$$\boldsymbol{F_{lin}} = \frac{\sum_i^n \sum_j^n \boldsymbol{P_{Dd}(i,j)} \cos\left[(i-j)\frac{2\pi}{n}\right]}{\sum_i^n \sum_j^n \boldsymbol{P_{Dd}(i,j)}} \quad (7)$$

$\boldsymbol{P_{Dd}}$is define co-occurrence for the nxn image block. Entry (i, j) is direction co-occurrence matrix $\boldsymbol{P_{Dd}}$.

3.6. 2D Autocorrelation

Autocorrelation [6,7] is a cross correlation. The information for the image itself matches and search relationship. Find out the repeat pattern or the signal buried in noise.

For the pixel of image corresponds to a rectangle. The Rectangular Region calls Plaquette. For example, Plaquette have 3x3 the rectangular region. On a 6x6 image find the auto-correlation. When Plaquette is the

first pixel point A_{11} of image start, there will be product around with A_{11}pixel recorded. If the neighbor pixels do not exist, it will not be taken into account. Then plaquette shift right the second pointA_{12}, product around and recorded in plaquette. Applied the palquette operate for each point of image. After each point operating, use each point‘s palquette 3x3 to make a sum of the respective position. Then respective position divided the palquette’s average of nine positions into the respective position. That produced palquette; each pixel and neighbors have relevance.

The following is the formula:

$$A[i,j] = \sum_{j=\frac{Nj}{2}}^{j<\frac{Nj}{2}} \sum_{i=\frac{Ni}{2}}^{i<\frac{Ni}{2}} \left(Mask\left[i+\frac{Ni}{2}, j+\frac{Nj}{2}\right] - \overline{mask}\right)\left(image\left[i+\frac{Ni}{2}, j+\frac{Nj}{2}\right] - \overline{mask}\right) \quad (8)$$

The position (i, j) operate autocorrelation $A[i, j]$. $\overline{mask}$is the mean of the masks pixels

4. Experimental Result

The experimental using the ornamental fish have 44 different kinds of 410database. Each kind have ten different angles same kind fish image.

Experimental result correct rate of 85.7%, Accuracy rate is calculated as hit five images. Determine whether the query image for the same species. The query image with one image hit the same species, was hit, if the query image with the top five images are all different species, was not hit, statistical results system can achieve an average accuracy rate of 85.7%

In order, the system through various feature weighting, sort of ranking can be increased, for example the following table for Tamura, Auto-correlation, the color characteristics of individual sorting, the image of the same species in accordance with the characteristics listed in the order The following table, the Tamura sort, the sort the results by ranking system is greatly enhanced.

It was found as show in Fig. 2(a)and Fig. 2(b) are different kind of fishes. But their texture feature is similar. Texture analysis led to the identification error.so texture accuracy is lower than color and autocorrelation.

(a) Nannostomusbeckfordi (b) Emperor tetra

Fig. 2: Similar the texture of the fish.

Table. 1: Rank result

Database No.	Color rank	Tamura rank	Auto-correlation rank	All rank
#1202#	15	16	21	1
#1201#	2	126	9	2
#1204#	1	145	4	3
#1208#	8	98	37	4
#1207#	6	123	30	5

5. Discussed and Future Work

Ornamental fish have bright color, variety of textures and shape features. The proposed method uses color and texture features to identify the different image of search methods to create the image retrieval system. The ornamental fish of image retrieval can use to education, ecological research and collections applications. The system provides a fast and convenient query system. People who don.t have the professional of the fish can use the system. According to the color and texture feature, we get the most similar to the ornamental fish information. In the future, we will add shape features condition to improve the accuracy. Let the user select a specific location. It will add intuition feature for addressing the particular problem. Maybe it can solve similar the problem of Fig How to combine different features is an important problem that we plan to study further.

6. References

[1] J.R. Smith and S.F. Chang, “VisualSEEk: A Fully Automated Content-Based Image Query System,” Proceedings of the 4th ACM International Conference on Multimedia, pp. 87-98, 1997.

[2] HanifeKebapci, Berrin A. Yanikoglu, Gozde B. Unal”Plant image retrieval using color and texture features.” ISCIS 2009: 82-87

[3] RishavChakravarti, XiannongMeng” A Study of Color Histogram Based Image Retrieval.” ITNG 2009: 1323-1328

[4] Th. Hermes, A. Miene und O. Moehrke” Automatic Texture Classification by Visual Properties.” In R. Decker and W. Gaul (eds.), Classification and Information Processing at the Turn of the Millenium, pp. 219-226, Bielefeld, Germany, 10 - 12 March 2000. (Proc. 23rd Annual Conference Gesellschaft fur Klassifikatione.V. 1999)

[5] Tamura, H., S. Mopi, and T. Yamawaki, Textural features corresponding to visual perception. IEEE Transactions on Systems, Man, and Cybernetics, 1978. SMC-8(6): p. 460-473.

[6] Paul Bourke. Cross Correlation: AutoCorrelation – 2D Pattern Identification.url:http://astronomy.swin.edu.au/pbourke/other/correlate/index.html, 1996.

[7] F. Mahmoudi, J. Shanbehzadeh, A. Eftekhari-Moghadam, and H. Soltanian-Zadeh, "Image retrieval based on shape similarity by edge orientation autocorrelogram", presented at Pattern Recognition, 2003, pp.1725-1736.