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High resolution Remote Sensing Image retrieval Based on

Multi-visual Feature and K-centroid Clustering

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Abstract: I At present , Resolution remote Sensing image retrieval based on single content has the problem of one-sided description and imprecise information. The color, shape and Texture features of remote sensing images were fully used and combined to form multi-vision remote sensing image retrieval in order to solve this problem. Through a series of iterative operations, the best proportionality coefficient for this three features to treat Types of remote sensing images can be obtained, which gets a better search result. Aiming at the problem of the retrieval speed are slow when searching the large image databasefor the color <b1 6>, shape andTexture features of the remote sensing image respectively , the improved k-centroid clustering algorithm which firstly clustered the images in the remote Sens ing image database is introduced to reduce the retrieval scope as as the improve the retrieval speed. The experimental results show that this method has the retrieval results.

Keywords: multi-vision features remote sensing image; image retrieval; iterative; clustering

In recent years , with the development of sensor technology , and the National letter The implementation of major plans such as the expressway , processing Remote sensing images and applications are increasingly applied in practice a . however , remote sense image differs from general image , It has multi-scale , high dimensions andunique features such as diversity 0 . face sensing technology with users need rapid development , How remote sensing contains rich information images for effective organization , admin , retrieval is particularly important .

In view of traditional text-based image retrieval , only uses keyword retrieving , Unable to meet user's search requirements . i century year the age of a new search technology , that is based on volume image Retrieval H. content-based Image Retrieval main benefits Use the underlying features of the image to match the image , nowmost commonly used image bottom features have color , shape and texture . then and , Use only _ The underlying features of a feature extraction are often compared to one-sided , cannot get sufficient information to differentiate , especially for remote sensing images This complex special class image , Use single _ underlying The feature does not achieve satisfactory search results . Therefore, in the process of image check Cable, the image content is generally considered by multiple image features for a full description M. When combining feature retrieval , Special the value of the levy takes a direct effect on remote sensing image retrieval results and ; . for different kinds of remote sensing images , various features The scaling factor for is bound to vary . , all feature weights selected directly affects the results of the search . initially someone

will3 a feature press with 1:1: 1 assigned to , effect is not ideal ; document [ten] use genetic algorithm to

automatically adjust weights , but genetic algorithm itself has a certain flaw , easy to occur prematurely , so The weight value optimized by genetic algorithm also has certain limitations . This article takes a series of iterations , Let the system automatically test the best feature combination for the same remote-sensing images without.

in the large image database , to retrieve the image and image gallery images in each match , slow down . in order to increase the like retrieve speed , often included in image retrieval one Some clustering algorithm . to first cluster images in an image library , shrink image Retrieve range , reduce access to image gallery , To improve retrievalspeed Q1 . K-xntroid Clustering algorithms are widely used , and Jane Simple implementation of, But it often terminates at a local minimum , Clustering results are not stable . for this , take the one Improved K~centroid Clustering algorithm .

1. Remote Sensing image retrieval

1.1 Remote Sensing image feature extraction

Select the color of remote sensing images , shape and texture features . its medium , The color model used is HSV color Model , HSV Color more in accordance with the subjective feelings of the human eye . First the RGB in remote sensing image Color conversion to HSV, and then quantifying colors . the shape feature uses the invariant moment expression method . invariant moment is A statistic feature of the in the image , Translation of the image , rotate and scale with has good invariance &2. also , using four pixel symbiosis matrix to analyze the texture primitives and arrangement information for remote sensing images . first First extract color image gradient information ,using four-pixel symbiosis Matrix description image . Because all texture information is considered , calculation volume will be large , So select the more commonly used energy , entropy , contrast , deficit torque and dependencies this 5 a eigenvalues ,, counting 5 features in 4 The average for a direction ((1, (2, (3, (4 + (5 / and then Compose eigenvector 0 1,2, 3,4, 5) as remote sensing image Rationale features .

The similarity between images is based on Euclidean distance metrics , that is

M

D (Q,C)) = X W i dI [@m] [] {Q,C). (1)

m = 1

which

D m IQ . C)= 榡 dmtheMC . (2)

type : Q represents the remote sensing image vector to query ; C represents a target remote sense image vector ; D (Q,C) indicates the distance between Remote sensing images and the mesh Mark Remote sensing images ;dm (Q , C) for Remote sensing images distance under each feature component ; m = 1, 2, 3 represents remote sensing diagram image Colors , shape and texture features ; D Mr (Q, / C) is a remote-sensing map like on feature m R the distance on the component ; and on behalf of remote sensingThe different features of the image have several components :; W m Remote sensing image Color the proportional weight of the ,, and the shape and texture features .

1.2 Evaluation Guidelines for remote sensing Image retrieval Systems

in content-based image retrieval Systems , retrieves the of the algorithm The difference in causes the retrieval system to be different. , so it usually makes To, _ Some evaluation criteria to evaluate the quality of the retrieval system _ . precision and recall is the most widely used retrieval in image retrieval to evaluate indicators M. Precision describes the results of the search the correct results as% of the total search results ; recall description is the correct result in the retrieved result that accounts for the correct knot in the entire image Library number of results .

This article takes the previous Ten Precision for retrieving results , always check rate and recall as the evaluation criteria for this system . The definition is as follows :

/10 (3)

RP= : N C _ CT / nTata ; (4)

RT U (5)

= : We were 0 ^2+ Sepia • (6)

type : and # represents the previous Ten Precision for retrieving results ; The represents the 1 page show Ten picture ;' represents the total precision ;^ represents a recall ;represents the previous Ten related in a search result number of images ; ncorrect represents the number of images associated with the retrieved results ; Ntotol represents the total number of images retrieved On behalf of the remote image gallery Each type of remote sensing image has a page Zhang ; Cpt is the total precision and check Full rate _Group , The is used as a factor when the program is iterated Bad decision conditions ; a is Cpt The proportion of precision in, ; 0 is The share of the recall . This article sets a = 0.7, = 0.3.

1.3 Iteration Algorithm

color for remote sensing images , shapes and textures 3 kinds of content feature , set two-layer iteration , to find the combination of factors when the maximum is so far , The indicates that this set of weights is best for this class diagram like . The steps are as follows .

1) colors for remote sensing images , shapes and textures 3 type feature assignment Wm . and assign initial values , order % = 0, W2 = 0, W 3 = 1- W W 2 .

2) by formula (1) get distance D (Q, ().

3) through D(Q , C) get image sort , then get

C ¡î

4) assumption C mai is the current largest C PT value , and C mai =0.

5) from formula (6) calculation C¡î if ^ 彡 Cm"", order = and leave this factor ,W2 self-increasing 0.1; if Cp ¡î

Cmax , W 2 self-add 0.1.

6) if W2 then 1, To 5) , to continue iterating ; otherwise Wi Auto-add 0.1, W 2 is 0.

7) if R no 1 , To 6) , to continue iterating ; otherwise , lose The current best factor .

2. Clustering Algorithm

Use iterative operations to find the best for remote sensing images feature combination , but large operations . to make up for this _ defect , to shrink the system's retrieval scope , Improve system retrieval speed degree , introduction _ an improved k-xntroid Clustering Algorithm . K~cen- troid algorithm is a classical clustering algorithm based on distance , Mining use distance to size as similarity indicator , View ' two distance Closer Object , similarity Greater "" M . This algorithm is widely applied in the large number according to processing , But its disadvantage is to randomly select the initial class heart , and the result of clustering is often the same for the initial class. _dependent sex , So the selection of the initial class heart is in a To a degree affect the poly class Results .

2.1 The determination of the initial class heart

The selection of the traditional initial class heart is randomly generated . This article makes sure the class heart over distance to determine the type of Mind selected class heart more accurate , specific The algorithm is as follows .

Sets the cluster center vector collection to L ,- selects altogether K Poly class Center , with L ={l1,2,.... Remote Sensing Image feature Gallery the number of feature vectors is N The feature dimension is M , Remote sensing diagram like feature vector set to C= Bismuth 1,2,..., cw }. Two initial classes heart through the Euclidean distance between any two eigenvectors to be sure set ,,

and Cj is the initial two cluster center , has One-by-one = Cl , b = C J. the first two classes are OK. , continue to determine remaining (K -2) class Heart . assumes that you have selected K a class heart , calculation remaining Eigenvector and the previous selection of the K "" class Heart vector "cumulative and , the cumulative and maximum vectors are the first (K + 1) class Heart to amount ^+1,

K

H I Ci - 1 I. (8)

J = 1

to find the largest \ = Max then feature vector Ci Yes

(K+ 1) class Heart vector . and so on , until found all The class heart vector for .

2.2 Iteration Optimization

the Iterative optimization section and the traditional k~centroid The algorithm's iteration optimization is the same, Specific steps are as follows .

1) remaining vector in remote sensing image database q Sub do not calculate the distance to each class heart vector , that

DJ = | 0 , - LJ I . (9)

when ^ = min d. , the eigenvector Q to the 1. for Class-heart classes . and so on, all eigenvectors is grouped under the owning class .

2) for each class , re-determine the class heart . within each class, To find Representative points , is the other vector in the class to the vector the Euclidean distance of the is the least square and the minimum . after the first cluster is set , The first class has a X a feature vector , and

dis ij = z (ci - cJ"2 • (ten)

when di = min dis. , Ci is the new class heart . The is left with its and it does so in each class .

3) When you re ok K after the Heart and then follow the formula (9) Way, the feature vectors in the remote sensing Image Library are grouped in the classes .

4) Repeat steps 2), until found adjacent two class heart to the quantity is not changed , iteration termination .

3. Retrieve process

The remote Sensing image retrieval system presented in this paper uses a comprehensive view to describe remote sensing images ; and pass a series of iterations On -Behalf tests assign the appropriate coefficients to each feature ; by using the remote sensing diagram Gallery for clustering , then query image with various classes of heartfor similarity matching , Find the most similar kind of heart , on This class query ; then sort by similarity distance from small to large , Press requires a certain number of images to be intercepted . The overall flow of this algorithm as shown in the diagram 1 is shown in .

4. Experimental Analysis

This article retrieves the operating platform of the system as Microsoft Visual Studio , The programming language used is C + + Language . The remote sensing Image Library for the meter with is included farmland, aircraft , building , baseball field , fill Wood Bundle , Beach , Golf Course and forest class altogether 2 Towel UC Remote sensing imageMerced Land use Dataset gallery ^5. in the same hardware and software environment The algorithm is the same algorithm as the specific gravity , document [ten] algorithm Precision and recall made a comparison , The comparison with the run time without clustering .

This experiment carries out a variety of remote sensing images in the remote sensing Image Library Search test , previous 10 The precision of the search results ' 1, Total Precision ' and the recall as an evaluation standard . Chart 2 and Figure 3 lists the use of this algorithm , Literature [ten] algorithm and the same algorithm for each feature in remote sensing image gallery Comparison results retrieved by the row . where data is randomly selected from each type of image A remote sensing image is retrieved and its flat is computed The is given .

to see , in various remote sensing images , The best effect is Bushes , Worst is construction class .

will use the clustering algorithm with the When the clustering algorithm is not used The time for is compared to . where clustering is not used 29.3 s, This article uses clustering when 16.4 s. description Add Clustering algorithm dramatically Shorten program run time .

Documentation [ten] algorithm equals Weight ' I article algorithm ' document "101 Grate Method ' all equal weight A effect General , Building class retrieves the worst effect . usually , fill The color distribution of the wood bundle is very characteristic . for Bushes , when the ratio of color features is slightly larger , is very easy to get. The search effect . and for construction classes , from Diagram 4 and diagram 5 can look at the shape features , different building shapes , Even if you belong to the Building class , Their texture parameters are also very different . because this , Even if color ,shapes and textures 3 features , for The search effect for building classes is also not ideal .

diagram 4 Building 1 Feature Extraction results

diagram 5 Building 2 Feature Extraction results

5. Conclusion

synthesizes The colors of remote sensing images , shapes and textures 3 species Special sign , and by iterating the best for different class of images parameter combination , Improving system's precision ; introduces an improved K -xntroid Clustering Algorithm , improves system retrieval speed . but is for _ Some colors , shapes and textures 3 features are not very Clear Remote sensing class images , The retrieval effect is not ideal . for remote sense class images , Spectral characteristics play a significant role , for this next _ The work of the step is to enlist the spectral characteristics of remote sensing images to join its in , hoping for better results .

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