Pattern Discrimination

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Abstract: This paper makes use of the preliminary analysis of the image, through its basic image features, to find the suitable model and algorithm. Using Matlab to process the image, and then using fuzzy clustering analysis, boundary matching model and other analysis, to achieve the purpose of solving the problem. In view of the first problem, the image is prepared for processing first, and the image is segmented in batches. Since the image given by the attachment is BMP form, we first use MATLAB to process the image given by the attachment, so that it is stored in the standard data storage format of Matlab. In view of problem two, we first define the submatrix by defining the search neutralization domain and the coverage domain, and then establish the boundary matching method model, and for the first time the left and right boundary of the matrix to be obtained and the left and right boundary of the obtained submatrix are matched.

Keywords: Image Batch Cropping; Transitive Closure Method; Boundary Matching Model

1. Problem restatement

1.1 Background of the question

In one episode of the show "The Strongest Brain", contestants observe nearly 100 pictures of sand paintings, and then the examiner randomly selects a pair of 4cmX4cm and 2cmX2cm screen shots from the pictures. The contestants were asked to observe the screenshots and determine which one was taken from the sand painting. After the show is over, if people feel that the examiner's choice was not good enough, they should have chosen the most similar part of the picture, rather than the characteristic target, then the difficulty of the question will be greatly increased. Based on this, the following questions were posed:

Question 1: How do I choose screenshots with high similarity? Build a model Select the attached 40 X 40 pixel and 20 X 20 pixel images that are most similar.

Problem 2: For a given screenshot, build a model to find the exact position of the image from which the screenshot came.

2. Problem analysis

2.1 Analysis of problem 1

The main objective task of problem 1 is to search for and select the most similar screenshots. Firstly, the image is preprocessed, and then the image is sorted and classified. It is easy to know that the texture feature is a kind of surface feature, which can not fully display its essential properties. However, due to the excessive number of images given, the amount of information in the image is too large, so only the texture features are far from enough. So in processing, we use matrix comparison model to find out the most similar screenshots.

2.2 Analysis of question 2

The main goal of question 2 is to find out the position of the given screenshot in the attached picture. Solving this problem is equivalent to matching two screenshots with all screenshots of the same pixel in the attachment. In addition to removing the blank area outside the coordinate axis that affects the matching accuracy of the matrix, the image is transformed into a grayscale image. We also improve the speed and accuracy of matrix matching by simplifying the 0 -1 matrix. Not only that, we use the boundary matching model, carry out the boundary matching comparison between the left

and right two times, and add a layer of feature matching constraints to make the model accuracy of problem 2 more accurate.

3. The model hypothesis

1. Assume that the images in the attachment can be discriminated, sorted and classified to get the basic change law;

2. Assume that when imported to Matlab, the image will not be affected by external forces that are easy to produce errors, such as image quality reduction;

3. It is assumed that the gray matrix obtained after processing the black-and-white linear screenshots in the attachment can be interval binarized.

4. Assume that the screenshot to be solved is the direct graphic cutting of the attached screenshot, so regardless of rotation, scaling and translation.

4. The establishment and solution of the model

4.1 Problem one mathematical model establishment

4.1.1 Image preprocessing

The 60 pictures given in the attachment all have large white space. In order to eliminate the influence of these blank areas on the calculation results, we use matlab to batch crop the pictures. Most of the blank parts and coordinates that are not considered except the black border of the picture are cut out, and the processed screenshots are taken as the object of this analysis.

4.1.2 Image data processing

First, import the attached image data in bmp format into matlab, use the import image_Datas function to read the image data, and finally save each data in the form of variables to the specified mat file. Using matlab, 60 images are converted into 60 pixel matrix a(1)343*435,,, a(60)343*435. At this time, the subsequent work is carried out with 45 images as the object.

4.1.3 Optimization with simulated annealing method

Simulated annealing method is a general probabilistic algorithm, but also a greedy method, is to find the maximum value of the function in a large search space, with the characteristics of effectively solving NP-hard problems, avoiding falling into the local optimal, no strong dependence on the initial value, etc., has been widely used in various fields.

The use of simulated annealing method to solve the probability problem, a sequence as a solution, each solution corresponds to an objective function value, because the actual problem of the model is to solve the TSP problem, it can not be through the second exchange, the third exchange and other perturbation methods continue to produce new solutions, here we use a random function to produce new screenshots of the starting row number, so as to search the solution space, to find the optimal scheduling sequence.

4.2 Establishment of mathematical model in Problem 2

4.2.1 Establishment of 0-1 data matrix

For problem 2, first of all, we capture the actual part of the original image, that is, the image within the coordinate axis, and then use PS software to locate the actual screenshot position of the image as (74, 33), and then apply mat lab to convert 60 pictures except two screenshots into 434X342 images. Using matlab, the 60 images in the attachment are transformed into color -independent grayscale, and 60 pixel matrix is obtained. Here, we use matlab software to find a suitable threshold for each pixel matrix, and then achieve image binarization. And then we get the 0-1 matrix we need.

4.2.2 Establishment of boundary matching model

In order to find out the position of the given screenshot in the attached picture, the boundary matching method is adopted. It is based on the characteristics of the screenshot: the cut picture is exactly the same as the picture at the original location of the cut, then the boundary must be the same, that is, the boundary difference between the two screenshots is small.

(1) Construction of boundary matching model

Left boundary:

First we define a screenshot matrix (the screenshot matrix is A(i,j, m)determined by the matrix position (i, j) of the

graph on the top left of the screenshot matrix and the image serial number m)

Match the left boundary of the given screenshot with the M-th picture of the same size and the left boundary, find the difference between the first column of the given screenshot matrix and the first column of the M-th picture of the same size picture matrix, and then use the difference method to get the absolute value:A(i,j, m)p (m)

P (m) = |a − a) |

The left edge of the screen i any picture in turn, and k values are obtained: as the matching value of the left edge, by comparing with 0, equal to 0 is recorded P(1) , P (2) , ··· P(k)A(i,j,m) if: P(m) = 0 cout: A(i ,j ,m)

(2) Establishment of the optimal screenshot matching model

After the above two rounds A(i,j, m) of screening, the remaining screenshots are very limited. We respectively compare the l screenshots after screening with the screenshot matrix by using the screenshot similarity evaluation model. The maximum between the obtained results A(i,j, m) Q(1), Q(2), ··· , Q(l)Qmax , Qmax should be close to 1, and the output is used to find the attached image matching the image to be sought, and the specific position of which picture is reflected through A(i,j, m) i, j and m.

Qmax = max{Q(1) , Q(2) , ··· , Q(l)}

5. Evaluation and promotion of the model

5.1 Advantages of the model

The similarity comparison model established in this paper is simple and easy to understand, and has strong universality, and is easy to be used in daily life. It can reasonably solve the similarity comparison problem of various picture situations. This problem makes the similarity comparison model have multiple constraints by constructing a matrix to form multiple similarity indexes. These constraints are not only limited to solving one problem, but also reduce the difficulty of solving subsequent problems, achieve maximum efficiency, and make the model more practical.

5.2 Disadvantages of the model

Since this model is mainly based on the processing of gray value of gray matrix, and there is no rating index of image shape for the actual picture, it is difficult to distinguish the same physical meaning or shape. At the same time, in the actual image processing, due to the large background difference, the similarity between the two images will also be considered as a big difference under the processing of this model, and the result obtained is not very ideal. In addition, the algorithm of this model is slow to solve, and the algorithm needs to be optimized. Additional image processing is required to solve these types of problems before you can use this template. At the same time, the simulated annealing algorithm cannot jump out of the local maximum point. Therefore, whether such a method can find the global optimal solution requires accurate initial values.

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