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Application of MATLAB in Image Similarity Analysis

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Abstract: Recently, Web's hot topic "being baked and conquered to find the biological parents" has aroused widespread concern. In the end, the protagonist succeeded in finding his family through image recognition technology. Actually, artificial intelligence such as image recognition is widely used in online payment, access control security, and criminal investigation. Cases and other areas. MATLAB has a wide range of applications, including signal and image processing, communications, control system design, testing, and measurement. This article focuses on a method for similarity analysis of pictures by Mat lab software, so that everyone understands the application of Mat lab in picture processing.
Keywords: Mat lab; Grayscale Matrix; Image Processing; Cosine Theorem.

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1. INTRODUCTION

In recent years, old people have lost their lives and children have been lost. Therefore, the relevant departments need to collect the pictures of people appearing on the monitor and compare them with the pictures in the database. This makes the similarity analysis requirements for pictures. Higher and higher. In this paper, Mat lab is used to process related pictures, and the resulting picture information is compared with the pictures in the database, and the identity of the person in the target picture is inferred. This article is the study of the similarity analysis method of the cosine vector for the image grayscale matrix transformation and the corresponding vector generated in Mat lab. It is the application of Mat lab in image similarity analysis.

2. MATLAB'S ADVANTAGES IN IMAGE

Most of the operations in MATLAB are done through the form of a matrix. This feature also determines the unique advantages of MATLAB in processing digital images. In theory, an image is a two-dimensional continuous function. Digital image processing is an emerging technology. With the development of computer hardware, real-time processing of digital images has become possible. Due to the appearance of various algorithms for digital image processing, the processing speed is faster and faster. People serve. Digital image processing is a technique that uses a computer to process graphic images using certain algorithms. Digital

image processing technology has been widely used in various fields. The amount of information processed by the image processing is large, and the requirement for the processing speed is also high. MATLAB's powerful calculations and graphic display capabilities make image processing easier and more intuitive. However, when digitally processing an image on a computer, it must first be digitized in space and brightness. This is the process of image sampling and quantization. Uniform sampling of a two-dimensional image yields a digital image that is discretized into M×N samples. The digital image is an integer array. Therefore, using a matrix to describe the digital image is the most intuitive and simple. The strengths of MATLAB are the processing of matrix operations, so it is very convenient to use MATLAB to process digital images.

Mat lab integrates computing, visualization, and programming in an easy-to-use environment. Its image processing toolbox covers almost all aspects of image processing. It also includes typical applications such as mathematics and calculations, modeling, simulation and prototyping, and data acquisition [1]. The digital images in Mat lab are represented in a matrix, which means that Mat lab's powerful matrix computing capabilities are very beneficial for image processing. The syntax of matrix operations is also applicable to digital images in Mat lab.

3. IMAGE PROCESSING METHODS

The principle of image processing in this method is to use a Mat lab software and a grayscale conversion formula to convert grayscale images after reading an image file. After the grayscale image is obtained, the human face is extracted from the image and the extracted facial grayscale image is extracted. Normalize the face size with the database and generate a grayscale matrix, then generate a corresponding vector from the normalized face image grayscale matrix. Finally, use the cosine similarity to convert the similarity of the photo to the cosine of the picture vector. Judging from the proximity to 1. The grayscale matrix of a picture can reflect the comprehensive information of the grayscale of the picture about direction, adjacent interval, and amplitude of change. It is the basis for analyzing the local patterns of the pictures and their arrangement rules.

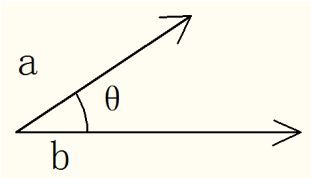
Take any point in the picture and set its coordinates to (x, y). Set the gray value corresponding to this point to (g1, g2). If you move the point (x, y) over the entire image coordinate, you will get the gray value corresponding to each coordinate. For the entire picture, count the number of occurrences of each (g1, g2) value, and then arrange them into a square matrix, normalizing them to the probability of occurrence P(g1, g2) with the total number of appearances (g1, g2). Such a square matrix is called a gray level co-occurrence matrix. Let f(x, y) be a two-dimensional digital image whose size is M*N and the gray level is Ng. The gray matrix that satisfies a certain spatial relationship sip(imp)=#{(x1,y1),(x2,y2) ∈ M×N | f(x1,y1)=if(x2,y2)=j}, where #(x) represents the number of elements in the set x.

To facilitate the calculation of the similarity of the grayscale matrix of the two images, we convert the human face gray matrix A1 generated by the target image and the database image

gray matrix A2 into a one-dimensional vector a1k= {a1k11, a1k12, ⋯, a1k1n}. Similarly, we can see b1k= {a2k11, a2k12, ⋯, a2k1n}, where kid represents the (imp) value in the matrix.
According to the principle proposed above, using Mat lab misread function to read the picture to be compared, and then use the rgb2gray function to generate grayscale image and facial extraction of grayscale image, then use graycomatrix function to make facial grayscale image Generate a gray matrix, and finally write a related program according to the cosine function to determine similarity.

4. COSINE SIMILARITY CONCEPT AND USAGE

Cosine similarity uses the cosine of the angle between two vectors in vector space as the measure of the difference between two individuals. Compared to distance metrics, the cosine similarity focuses more on the difference in direction of the two vectors than the distance or length. Similar to the Euclidean distance, the calculation method based on the cosine similarity also considers the user's preference as a point in the n-dimensional coordinate system. By connecting this point with the origin of the coordinate system, a straight line (vector) is formed. Two users the similarity value between them is the cosine of the angle between two straight lines (vectors). Because the straight line connecting the point representing the user rating and the origin will intersect at the origin, the smaller the angle, the more similar the two users are, and the larger the angle, the smaller the similarity between the two users. At the same time, in the trigonometric coefficient, the cosine of the angle is between [-1, 1], and the cosine of the 0 degree angle is 1,180 the cosine of the angle is -1.
For two vectors, we can similarly think of two directional segments that exist in space, starting from the origin ([0, 0,]) and pointing in different directions. Two lines will form an angle. If the angle is 0 degrees, it means that the two lines are in the same direction and overlap. If the angle is 90 degrees, it means that the direction is different. If the angle is 180 degrees, the direction in contrast. Therefore, you can judge the similarity of vectors by judging the angle between two vectors. The smaller the angle, the more similar it represents.



The above figures a and b are two vectors in space, and we want to calculate the angle θ between them. According to the cosine theorem, we know that we can use the following formula:

$$\cos\theta = \frac{a^2 + b^2 - c^2}{2ab}$$

Assuming that the vector is [x1, y1] and the b vector is [x2, y2], we can rewrite the cosine theorem into the following form:

$$\cos\theta = \frac{x1x2+y1y2}{\sqrt{x1^2+y1^2}+\sqrt{x2^2+y2^2}},$$

This calculation method also holds for n-dimensional vectors. If A and B are two n-dimensional vectors, A is [A1, A2, An] and B is [B1, B2, and Ban], then the cosine of the angle θ between A and B is equal to:

$$\cos\theta = \frac{\sum_{i=1}^{n}(\mathrm{Ai} \times \mathrm{Bi})}{\sqrt{\sum_{i=1}^{n}(\mathrm{Ai})^2} + \sqrt{\sum_{i=1}^{n}(\mathrm{Bi})^2}} = \frac{\mathrm{A} \bullet \mathrm{B}}{|A||B|}$$

According to the respective calculation methods and measurement characteristics of Euclidean distance and cosine similarity, they can be applied to different data analysis models respectively: Euclidean distance can reflect the absolute difference of individual numerical characteristics, so it is more used in the numerical values that need to be dimensioned. The analysis that reflects the difference, such as the use of user behavior indicators to analyze the user's value similarity or difference; and the cosine similarity is more to distinguish the difference from the direction, and is not sensitive to the absolute value, more for the use of the user to the content Scoring to distinguish similarities and differences in user interests, and at the same time correcting the possible inconsistent metrics among users

5. CONCLUSION

After Mat lab analysis, we can clearly see the results based on the data. The closer the cosine value is to 1, the closer the spatial distances between the two vectors are, ie, the more similar the faces of the two images are, the more the characters in the image and the data are the same person. MATLAB software provides an accurate and efficient toolbox with multiple functions for almost all areas of engineering computing, and has unparalleled advantages in signal and image processing. It has developed modules for many areas: signal processing, database interfaces, neural networks, wavelet analysis, image processing, and so on. MATLAB has become a de facto standard for mathematical calculation tools with its powerful scientific computing functions, a large number of stable and reliable algorithm libraries, and high programming efficiency.

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