Research on Colour Modelling and Detecting System Based on Computer Big Data

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Abstract. Through the statistics and analysis of the three colour components of dynamic background pixels in RGB space, the paper found that the difference between the three components fluctuates in a narrow area. Based on this fact, it proposes RGB colour based on computer big data Background modelling method of component statistics. This method fully considers the correlation of the three colour components of RGB, and the foreground detection process is faster. Experimental results show that compared with other colour invariant methods, this algorithm can more accurately reduce the computational complexity, time consumption and memory consumption of foreground detection.

Keywords: Computer, big data, colour modelling, colour detection, gaussian distribution.

1. Introduction

Because the shadow and the target have similar motion characteristics, the video target detection algorithm often misjudges the shadow as the target. Motion shadows will form falsely enlarged target areas, and easily lead to adhesion between the target foreground, affecting target segmentation and positioning, and causing obstacles to high-level computer vision processing such as target recognition. The moving shadow detection algorithm extracts video image features according to the shadow formation principle and its physical properties, and distinguishes between shadows and real moving targets [1].

In this paper, the color algorithm is converted to the Lab color space for foreground image extraction, and finally morphological processing is performed to obtain an effective foreground target. The improved algorithm is more accurate for image target detection, and can accurately detect and mark shadow parts.
2. Colour space

2.1. RGB colour space
The RGB color space consists of three primary colors: red, green, and blue. The spectra of these three colors are superimposed to produce a composite color [2]. The RGB color space is represented by a three-dimensional cube, with red, green, and blue distributed on three coordinate axes (Figure 1). The black is at the origin and the white is at the vertex on the other side of the cube. Gray is distributed on a line from black to white. In a graphics system where each color component occupies 8 bits, red is (255, 0, 0), green is (0, 255, 0), and blue is (0, 0, 255). The RGB color space is shown in Figure 1:

![Figure 1. RGB color space](image)

2.2. HSV colour space
The HSV colour space scheme consists of hue, saturation and brightness. In the HSV colour scheme, H represents hue, H ranges from 0 to 360, and the colour ranges from red, yellow, green, cyan, blue, purple, and then to red; S changes from 0-1, and the colour saturation gradually changes from unsaturated to saturation; V changes from 0 to 1, and the brightness gradually increases. The conversion formula from RGB colour space to HSV colour space is as follows [3]:

\[
H = \text{arccos} \left( \frac{\sqrt{(R-G)^2 + (R-B)^2}}{2} \right) \\
S = 1 - \left( \frac{\text{min}(R,G,B)}{R+G+B} \right) \\
V = \frac{1}{3} (R+G+B)
\]

Figure 1. RGB color space

HSV is modelled as a hexagonal pyramid, and the hue (H) is expressed as an angle, varying from 0 degrees to 360 degrees. The saturation (S) corresponds to the radius and varies from 0 to 1. The brightness (V) changes along the z-axis, with 0 representing black and 1 representing white.
3. Image colour detection algorithm

An intuitive way to express the content of an image is to count the frequency of each color in the image, that is, a color histogram. The color histogram reflects the composition distribution of colors in the image, that is, which colors appear and the probability of each color [4]. The histogram is a histogram drawn with the color value as the abscissa and the frequency of the pixel of that color as the ordinate. The color histogram can be extracted by formula (10).

\[ H = \{h[c_1], h[c_2], ..., h[c_n]\}, \sum_{i=1}^{n} h[c_i] = 1, 0 \leq h[c_i] \leq 1 \]  

(2)

Where \( h[c_i] \) represents the frequency of the k-th color pixel:

\[ h[c_i] = \frac{\sum_{j=0}^{N_1} \sum_{k=0}^{N_2} [1 \text{ if } I[i, j] = c_k] \times N_1 \times N_2}{N_1 \times N_2} \]

(3)

Among them, \( N_1, N_2 \) represents the total number of pixels in the vertical and horizontal directions of the image, and \( I[i, j] \) represents the colour of the pixel whose abscissa is i and the ordinate is j. Since the value range of R, G, and B is 0 to 255, the color histogram can be represented by an array containing 255 255 255 elements. In practice, quantization methods are often used to reduce the number of elements in the array. Thereby improving retrieval efficiency. The color histogram represents a global characteristic of the image. Each image has a unique color histogram, but different images may have the same color histogram [5]. The color histogram is insensitive to geometric transformations such as the rotation of the image with the observation axis as the axis, and small amplitude translation and scaling, and the color histogram is also insensitive to changes in image quality (such as blur). This characteristic of the color histogram makes it more suitable for the occasion of retrieving the global color similarity of the image, that is, to measure the difference in the global color distribution of two images by comparing the difference of the color histogram.
\begin{equation}
\sum_{j=1}^{n} \min(I_j, M_j)
\end{equation}

Among them, \( j \) takes each color in the histogram, and \( I_j \) and \( M_j \) represent the frequency of the \( j \) color in the histogram \( I \) and \( M \), respectively. Through the following formula, the normalized result can be further obtained:

\begin{equation}
H(I, M) = \frac{\sum_{j=1}^{n} \min(I_j, M_j)}{\sum_{j=1}^{n} M_j}
\end{equation}

Of course, there are still some problems with the method of intersecting histograms. When the features in the image cannot be all available values, there will be some zero values in the statistical histogram [6]. The appearance of these zero values will affect the similarity measurement, so that the similarity measurement cannot correctly reflect the color difference between images.

4. Colour modelling algorithm detection

In order to verify the effectiveness of the color grading method, this article uses colorful tile images as the experimental object, and uses a CCD (Charge Coupled Device) camera to obtain the image. The image size is 512×512 pixels. The experiment uses two different patterns of tiles as shown in Figure 3 ~ Figure 4, 6 tiles of each pattern are used as samples. In the experiment, the template used in manual inspection is used as the learning template to measure the similarity between each sample and the corresponding learning template image. In the image quantization process, the quantized color numbers of various patterned tile images and the initially designated cluster color numbers are shown in Figure 5 and Figure 6 [7].

![Glazed pattern tiles](image)

**Figure 3.** Glazed pattern tiles
Figure 4. Marble tiles

Figure 5. Color difference curve of glazed pattern tiles

Figure 6. Color difference curve of marble tiles

From Figure 5 and Figure 6, it can be seen from Figure 2 that the color difference between each sample and the corresponding color number template is less than the color difference between each sample and the original color number template. The color difference between the color difference is generally less than 0.05, and the color difference between different color number templates is generally
greater than 0.1. You can compare the color difference value as the basis for color grading; in addition, you should choose the color number to be quantified according to different types of tiles, and specify the quantization [8] The initial color number and clustering center reduce the calculation complexity of the color grading system. The program is completed on a Pentium 4.2.8 GHz PC with MATLAB 7.6. The time for a classification calculation is between 500 ms and 700 ms, which satisfies the visual inspection. Real-time requirements. Explanation of the experimental process and experimental results: (1) The conversion matrix from input RGB data to XYZ space and the conversion matrix from XYZ space to opposite space should be determined according to the colorimetric characteristics of the actual imaging hardware system; (2) Quantification during dynamic clustering The determination of the color number and the determination of the initial key color have a greater impact on the complexity and processing effect of the system computer. The number of quantified color numbers should be determined according to the product design plan; (3) The size of the color grading threshold can be based on the actual needs of the enterprise determine. Each algorithm repeats 20 times to calculate its average time, which is shown in Table 1 and Table 2.

### Table 1. The time required for foreground detection by different algorithms (ms/frame)

| Algorithm | 160px×120px | 320px×240px | 800px×600px |
|-----------|-------------|-------------|-------------|
| MOG       | 22.6        | 87.3        | 367.9       |
| Histogram | 32.4        | 115.2       | 579.3       |
| Cookbook  | 6.4         | 21.5        | 84.5        |

### Table 2. Time required for background modelling by different algorithms (s/200 frames).

| Algorithm | 160px×120px | 320px×240px | 800px×600px |
|-----------|-------------|-------------|-------------|
| MOG       | 17.5        | 43.5        | 332.4       |
| Histogram | 34.8        | 120.8       | 814.6       |
| Cookbook  | 10.2        | 38.7        | 212.2       |

From the statistical data in Table 1 and Table 2, it can be seen that the method in this paper is better than the other two methods in terms of minimum colour difference, average colour difference and maximum colour difference; for tile b, because the colour is single, the histogram clustering method is based on the colour difference of the whole picture. The calculated colour difference will be more accurate, so MOG is smaller than the minimum colour difference of the histogram, but overall, the average colour difference of the Cookbook is smaller than the histogram method.

### 5. Conclusion

This paper proposes a method for moving shadow detection in the framework of colour logarithmic image processing. The histogram algorithm is used to convert the colour image into achromatic and opposite tone signals that are in line with the human visual perception. On this basis, the shadow area is combined with the characteristics of reduced brightness and colour closeness to distinguish the shadow and the moving foreground. Compared with the current popular background modelling methods, the algorithm proposed in this paper is simpler and faster, and has good robustness. Therefore, the algorithm will have greater application prospects in processing high-definition video images and smart cameras.

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