Image quality enhancement algorithm based on game theory model

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ABSTRACT

Image quality enhancement algorithm based on game theory model is designed in this research. The core idea of the algorithm is to enumerate the sequence of sub-pictures obtained from different free parameters, and then perform image fusion according to the image details, saturation, and brightness, and then fuse a higher quality enhanced image. At present, with the development of image processing technology, feature extraction and matching algorithm will be an important research direction in the field of intelligent data. This research work integrates the game theory model to construct the efficient image analytics model. The experiment results are compared with the latest methods to evaluate the proposed framework from the robustness and accuracy perspective.

1. INTRODUCTION

Digital images are easily affected by imaging equipment, dynamic range, lighting conditions and other factors during the acquisition process, which reduces the image quality and even affects the subsequent human-machine image analysis and recognition process. Therefore, in practice, image contrast enhancement is often used to adjust the quality to obtain better human visual perception. Image enhancement has become a very important preprocessing step in image processing, video processing, and face recognition [1-3]. The current image enhancement algorithms based on the spatial domain technology can be divided into global methods and local methods. In order to implement adaptive spatial image enhancement algorithms, the current mainstream spatial image enhancement algorithms can be divided into the two categories, namely histogram methods and the non-histogram methods. Typical representatives of the histogram method include: Literature [2] proposed to use the gray values of the adjacent troughs in the histogram as the endpoints of the piecewise linear transformation, and calculate the slope of the linear transformation within the two ends according to the probability of the general two ends; Literature [3] adaptively calculates the Gamma correction coefficient corresponding to each gray scale value by analyzing the cumulative distribution law of the histogram; Literature [8] divides the histogram through the basic Gaussian mixture model, and divides the intersection of adjacent Gaussian distributions as a segment point, the slope of the linear transformation is then determined according to the mean value and variance of the gray level Image restoration is the process of using the available information in the degraded image to then establish an image degradation model, restoring and reconstructing to obtain the original clear image estimate. Low-light image enhancement is a very important research content in the field of the image restoration. In the next parts, details will be presented.

Image enhancement is an important technique in the image pre-processing field. In previous research, many enhancement algorithms have been used in various image processing applications. Regrettably, these traditional algorithms tend to only have the ability to solve a single specific problem of degraded images. For instance, histogram equalization can improve an image's contrast by extending the dynamic range of its grey variation, and sharpening can elevate an image's sharpness via compensating contours and emphasizing edges. When a degraded image has more than one problem, traditional algorithms cannot provide a satisfactory resultant image to meet the enhancement demand of applications, even after several of these algorithms have been applied successively. Fortunately, image fusion can help to provide a solution to the aforementioned enhancement difficulty. The objective of image fusion exists in combining multiple source images into a fused image that exhibits

more useful information than the individual source image. For about two decades, image fusion has emerged as a promising

image processing technique in many fields, like remote sensing and medicine. Out of various image fusion techniques, the fusion based on wavelet transform has been proven to be an active research focus in recent years because of its excellent performance [1][2] [3].

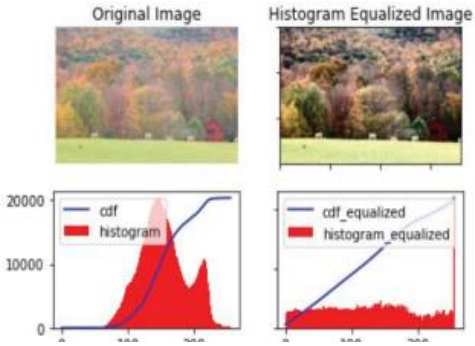

Fig 1.1 Histogram Equalization

2. LITERATURE SURVREY

The Image Quality Enhancement Algorithm Linear contrast stretching stretches the low-gray-level part and compresses the high-gray-level part, so that the image is effectively compensated, but it is easy to then lose details. The above algorithm is suitable for processing images with low overall contrast, but it has poor effect on images with low local contrast, and it is easy to lose detailed information. Local enhancement methods are better than global methods when dealing with images with low local contrast [20-21]. However, it is difficult to the construct local enhancement operators. At the same time, local enhancement operators are usually not universal and easy to add noise. In the formula 7, we denote the estimation standard.

$$\mathrm{SNR}_{\mathrm{RMS}} = \sqrt{\frac{\sum_{r=0}^{N-1}\sum_{c=0}^{N-1}[g(r,c)]^2}{\sum_{r=0}^{N-1}\sum_{c=0}^{N-1}[g(r,c)-I(r,c)]^2}}$$

The core problem of the image enhancement method is to propose a core global mapping function to directly map the grayscale value. Obviously, this type of the method does not consider the local features of the pixels such as details and textures, but only maps the grayscale value of the original image with the enhanced image one by one, and the quality of the enhanced image needs to be further improved. The Retinex model decomposes the image into illuminance components and reflection components, respectively depicting different aspects of the image. In order to then obtain a better visualization of the image, different functions are used to enhance the illuminance and also reflection components of the image, and then the enhanced illuminance and also reflection components are merged to obtain the final enhanced image. First, construct the saliency feature map of the infrared image, and on this basis, identify the infrared image and segment the area to be enhanced. At the same time, the image to be enhanced is inverted, and the transmission map of the inverted infrared image is estimated based on the dark channel prior. Then, based on the image segmentation result, the estimated transmission image is corrected to then eliminate the overestimated component in the image space. Furthermore, using the corrected transmission image, the enhanced infrared image is directly obtained based on the simplified atmospheric scattering model.The Retinex (retina + cortex) theory

was proposed by Land and McCann [7]. The Retinex is a simplified computational model of the human visual system that explains the color constancy phenomenon, and compensates illumination effects in images. The primary goal of Retinex-based algorithms is to decompose an image into a reflectance image and an illumination image to remove the illumination effect. Several Retinex-based image enhancement approaches have been developed. Literature [7] proposed the model of how the human vision system adjusts the object color and brightness apperceived - Retinex algorithm. It may achieves the balance in the gradation dynamic range compression, the edge enhancement and the color constancy, thus may be used to the automatic enhancement for different kind of images. But the algorithm is based on the experimental data, and has no unitive mathematical model. Many different improved Retinex algorithms appeared, such as SSR (Single Scale Retinex) algorithm [8-9], MSR (Multi scale Retinex) algorithm [10-12], McCannps Retinex algorithm [13-15] and so on, and obtained widespread application. In essence, all these classics Retinex algorithm is to smooth original image through Gauss model with certain parameters and to extract image's background as far as possible accurate through some suitable ways. In this article, considering the relevance of video's adjacent frame images, we propose an improved multiscale global Retinex algorithm.

GAMMA CORRECTION

In general, the enhancement techniques can be divided into two main categories: direct enhancement methods and indirect enhancement methods. In direct enhancement methods, the image contrast can be directly defined by a specific contrast term. Where in indirect enhancement methods attempt to enhance image contrast by redistributing the probability density. In other words, intensity of the image can be redistributed within the dynamic range without defining a specific contrast term. Histogram modification (HM) is the most widely used indirect enhancement techniques due to their easy and fast implementation.[17]

3. PROPOSED METHOD

The Image Feature Extraction Image feature extraction is performed by analyzing global pixels. Determining that some pixels can represent the same feature is the image preprocessing stage, and it is also the basis and prerequisite for image matching and recognition. At present, with the development of image processing technology, feature extraction and matching algorithm will be an important research direction in the field of intelligent data [7-9]. Because the general influence of the real environment is unavoidable, the actual digital image may be interfered by serious noise. Therefore, before the feature extraction, the digital image must be preprocessed by binarization, smoothing, and denoising, and then feature extraction. Moreover, when the digital image is shifted, it will cause the misalignment between corresponding grids, thereby reducing the recognition rate, so before general identifying one by one, normalization processing must be carried out, and their positions and sizes must be normalized to a standard size. The below formula says the process :

$$\sum_{i=1}^{n}\sum_{j=1}^{n} a_{i,j}(x)\xi_i\xi_j \geq \varepsilon\sum_{i=1}^{n}\xi_i^2$$

Digital image processing is a primary preparation stage for image feature extraction, in order to determine whether any pixel can replace an image feature [10-12]. The target image is calculated once. At the same time, several features with independent properties are extracted, so that the acquired features can reflect all the characteristics of the target image as much as possible. This method is also an important technical means for the classification recognition, image understanding and pattern recognition of image targets. In the figure 2, we denote the feature pattern is

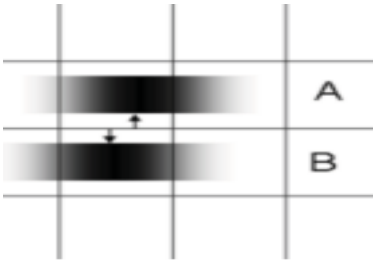

Fig. 1 The Feature Patterns

Incremental feature extraction methods can fuse the new samples or new types of the features, especially when large sample data emerges or new classificat ion targets enter, the incremental method has obvious adaptive advantages. The procedures are explained using below formulae

$$E(\xi^2)+E(\| \overline{D}^{M} \xi \|^2_{L_2([0,T])})<+\infty$$

$$k(w)=\left(1-\frac{i}{2Q(w)} \right)\frac{|w|}{c_r}\left|\frac{w}{w_h}\right|^{-\gamma}$$

When calculating the estimated vector of the high-order feature principal components, the same as PCA, it can ensure the orthogonality between the estimated feature vectors and avoid other complex orthogonalization processing. The PCA mainly aims at all the variables proposed before and saves the original information as much as possible. Principal component analysis is used to then enhance the analysis. After the feature extraction of the gait, the feature variables generated from the acquired data are enhanced to obtain effective data feature indicators, Calculationprocess is defined as

$$\mathbf{x}=IFFT\left\{\sum_{i=1}^{M} b_i \mathbf{X}_i\right\}=\sum_{i=1}^{M} b_i IFFT\left\{\mathbf{X}_i\right\}$$

The Gaussian filter does not consider the influence of the gray value of neighboring pixels in the filtering process, so it will also filter out some edge information. Obviously, the detail information of the image edge texture filtered by the Gaussian filter.

Because many experimental models at this stage are not completely solved by simple linear functions and because PcA cannot solve the related nonlinear problems. Therefore, based on the traditional PCA method, KPCA is adopted and studied to extract and reduce the dimensionality of the obtained gait energy map. In the image semantic description model based on the attention mechanism, it relies on the encoder and the decoder. At the moment, as based on the hidden state, the decoder will focus on the specific area of the image and the output of the convolutional neural network to calculate, which improves the image scene understanding performance.

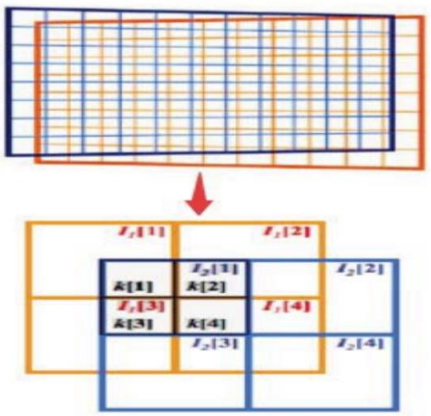

Fig.2 The Designed Image Feature Extraction Pipelines

4. RESULTS

The enhancement algorithm based on image gradient field is derived from high dynamic image processing technology. In this enhancement method, the gradient field function of the image is firstly calculated, then the enhancement function is constructed, and the gradient field is directly enhanced by the enhancement function. Finally, the general enhanced image is reconstructed from the gradient field. Figure 6 presents the data sets and the processed images.

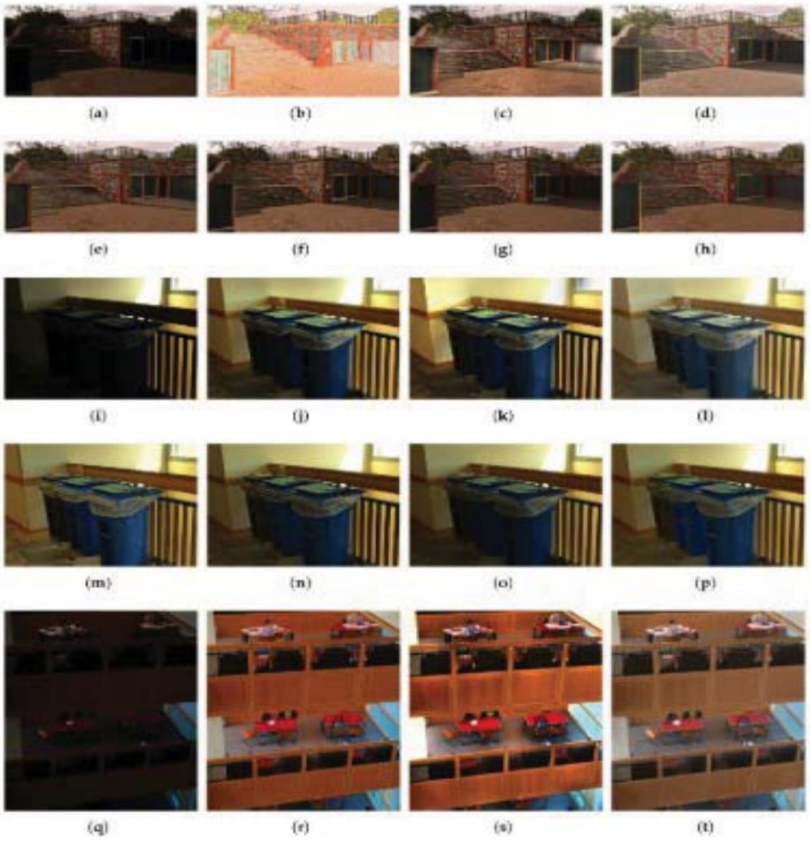

Fig. 3 Outputs using existing and proposed models

Better fitness values are obtained on the images. On the one hand, it shows that the convergence accuracy of the ITLBO algorithm is higher, and the enhanced image that is closer to the optimal solution can be obtained. On the other hand, it shows that the detailed information of the enhanced image obtained by ITLBO is better.

5. CONCLUSION

Image quality enhancement algorithm based on the game theory model is designed in this research. The results of the quantitative evaluation show that our proposed method can effectively use unsupervised learning methods to enhance artificially synthesized low-light images and natural and real low-light images, and restore more vivid, clear, intuitive, and natural high-quality image. In our future study, the robust test will be done to test the feasibility.

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