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Multi-functional image Stylization and portrait dispose based on traditional image dispose and deep learning

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Abstract: This paper studies the multi-function image based on traditional image processing and deep learning stylized processing method with the portrait, aims to develop the most efficient and convenient image processing system. The content of the research includes two core modules: image stylization and portrait dispose, which combines traditional image dispose techniques with deep learning method. Image stylization module adopts VGG19 network to realize image style transfer, and combines OpenCV technology to realize image cartoonization dispose. Portrait processing module through deep learning algorithms for detecting like cutting and exposed skin. System USES Qt GUI interface technology integration, and through the multithreaded processing efficiency. Results show that a system in the processing efficiency and quality of output achieves the expected effect, provides users with efficient and diversified image processing solutions.

Keywords: InserImage dispose; Deep learning; Image stylization; Portrait dispose

1. Introduction

With the rapid development of computer, multimedia and data communication technology, people's demand for image dispose is increasing day by day. From the needs of enterprises for website posters and publicity maps to the needs of individuals in the circle of friends and avatars, image dispose has penetrated into all aspects of life. However, manual retouching operation is complex, the effect is difficult to guarantee, and often makes users feel troubled.

Based on the rapid development of machine learning technology in recent years, the team for a variety of machine learning applications in the field of image processing were studied, and try to combine against the thought of generating network (GAN), realizes the image style of migration and transformation, and other functions. This project aims to let the computer "learn" automatic processing image, to provide users with efficient, convenient and innovative image processing experience.

pass the purpose research and application of this project, it can not only improve the efficiency and quality of image processing cell, but also expand the application prospect of image processing cell technology in various fields, providing enterprises and individuals with more diversified and personalized image processing cell solutions (). At the same time, the objective of the study are relevant for the future in the field of technology development provides new ideas and methods.

2.Research content

This project mainly around the stylized image processing with the portrait of two core modules, combined with the traditional method of image processing technology and deep learning, to develop a high efficient and multifunctional image processing system. The specific content is as follows:

2.1. Image stylization module

The module adopts two stylized image processing technical route:

2.2.1. the traditional image processing methods

using common machine learning method of image

processing, the transition of style. Including but not limited to these methods based on edge detection, filtering and color transformation technology, in order to realize the image output of different style.

2.1.2. Deep learning methods

based on VGG19 network architecture, the migration image style. The deep learning model is used to extract image features and recombine these features to achieve stylized image generation. At the same time, combined with the principle of machine vision, the portrait style transfer function is developed to make the image style transfer more natural and diverse.

2.2. Portrait dispose module

This module aims to provide efficient portrait processing capabilities, including like cutting with exposed skin detection:

2.2.1. like cutting function

through image segmentation algorithm, the character and the background of fast separation. Deep learning technology was adopted to realize accurate extraction of the portrait, and will be isolated as part of the stored in the designated position, so that subsequent processing.

2.2.2 Skin exposure detection

A skin detection algorithm is developed to identify and label skin regions in the target image. Test results will be marked on the image, and saved to the specified location, for users to view and analysis.

2.3. System design and implementation

Project provides a GUI interface contains all the functions of integration, the Qt technology implementation, control and easy to use. GUI interface design pays attention to user experience, simplifying the operation difficulty, improve the overhand speed. At the same time, the system introduces multi-thread parallel dispose to improve the stability and dispose efficiency. The specific implementation includes:

Parallel dispose: pass multithreading technology, to achieve multiple tasks at the same time dispose, significantly improve the dispose speed and system response.

Deep learning model optimization: The original VGG19 network is optimized, and GPU acceleration and parameter curing technologies are adopted to decreased model loading time and improve dispose speed.

Resource allocation: Under the premise of ensuring the output result quality, optimize the system resource allocation and improve the model running speed under low load conditions.

2.4. Performances optimization and testing

After optimization, the objective of the portrait processing module processing speed increased to 10 seconds/sheet, stylized image processing speed up to 1 minute/zhang, from early for a few minutes of processing time have significantly improved. pass a large number of testing verification, the system achieved the expected results in the efficiency and output quality of the processing cell.

3. Image stylization module

3.1. Deep learning method based on VGG19 network architecture

3.1.1. overview of the overall framework

In this module, we will conduct analyzed processing for three kinds of pictures: style pictures, content pictures and content pictures with noise. The main steps are as follows: Firstly, random Gaussian noise is added to content picture to obtain content picture with noise, and then the noise picture, content picture and style picture are input into vgg19 network. pass network, the parameters of the noise picture are gradually adjusted, so that the noise gradually approaches the expected style and does not deviate too much from the characteristics of content picture.

3.1.2. Principle of vgg19 network model

In this framework, we will use the vgg19 neural network model pre-trained on the imagenet image dataset, which is a platform for developers and data scientists to host machine learning competitions, host databases, and write and share code. Imagenet data sets on the trained model in theory, can be directly used to extract image features, this module will be mainly used in the data set training vgg19 network model for the extraction of image characteristics. The structures of Vgg19 is shown in Figure 2.

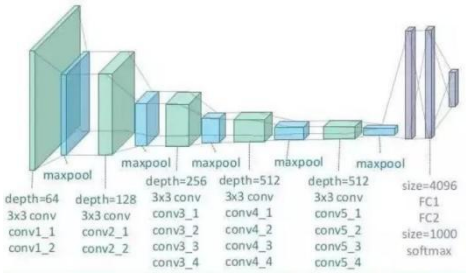

Figure 2 *Vgg19 structures*

Vgg19 model is mainly used for image feature extraction. In this module, we need to use the network to extract the feature data of style image and content image as the supervision Standard for noise adjustment, and input the style image and content image into the network respectively, and each layer of the network will get a corresponding feature data.

In order to simplify the volume as well as the network complexity, and ensure good supervision effect, this module will keep specified conv4_2, conv5_2 features for content image monitoring data of two layers of conv1_1, conv2_1, conv3_1, conv4_1 four layers of the supervision of the characteristic data for style picture data. Therefore, the content picture and style picture are input into the network, and the specified layer feature data is saved, and the preliminary construction of the training module is completed.

3.1.3. Loss Function and Backpropagation

Loss function is used to measure the noise characteristics and style of pictures and content of the gap between the

characteristics of the images, and in this module for noise image constantly tend to style images at the same time cannot too deviate from the original image content features, So we decided to use the loss function of noise image with the content and the number of loss function with style images weighted summation method to get the final loss function.

After get loss function, and to take advantage of the loss function and on the basis of noise image gradient calculation, and according to the gradient descent algorithm to adjust the parameters of the noise image step by step, make the content of the image with noise gradually formed with the content of the style picture. The gradient descent algorithm used in this module is more traditional. Its principle is to follow the direction of the decrease of the derivative of the loss function to find the extreme value of the loss function, because the parameter corresponding to the minimum value is often considered as the

The noise image is the parameter closest to the target, so the parameter is updated according to the parameter here, and this process is repeated to gradually obtain the target image with better effect.

3.1.4. Idea of adversarial generation

This module is not a typical network model was generated against, but the principle borrowed against the generated ideas, namely the computer through the neural network to style picture characteristics were extracted, and then on the basis of the feature as standard, will be randomly generated noise photo gradually adjust and close to the style characteristics. It is as if the computer "learned" how to draw style pictures, and gradually "draw" a noise picture into a style picture. This also is the foundation of this module implements style migration theory, by against generate ideas by computer on the basis of the original image by noise "painting" the expectation style new pictures, in order to realize the migration of style.

3.2. Traditional image dispose method based on OpenCV

3.2.1. Overall overview of the model

This module is mainly used in the traditional digital image processing technology OpenCV to create cartoon image effect. Comparing cartoon effects to real pictures, we notice two things: edges and color palettes. This is largely what makes a photo different from a cartoon. So in this module, we will use OpenCV to create the edge mask for the image and appropriate control palette, and then to make the mask edges combined with color images, according to the way of thinking to realize photos cartoonish.

Table is as follows: Use words rather than symbols or abbreviations when writing Figure axis labels to avoid confusing the reader. As an example, write the quantity “Magnetization”, or “Magnetization, M”, not just “M”.

3.2.2. Create a edges mask

We first convert the image to grayscale.Then, cv2.medianBlur function is used to de-noise the fuzzy gray image dispose. The larger the blur value is, the less the black noise appears in the image. Then, applied adaptiveThreshold function and defines the line size of the edges . A larger line Size means a wider edges , which will be shown in the image.

3.2.3. decreased color palette

As far as color is concerned, the main difference between a photograph and a painting is the quantity/Qty of different colors in each photograph, where the painted image has fewer colors than the photograph. Therefore, we use quantification to decreased the quantity/Qty in the photo.

3.2.4.K-Means algorithm

K - means clustering algorithm is an iterative algorithm of clustering analysis, its steps are randomly selected from K objects as the initial clustering centers, and then calculated for each object and the distance between every seed clustering center to allocate each object to its nearest cluster center distance. Cluster centers and the objects distribution to them represent a cluster. Distribution of each sample, the clustering of clustering center according to the clustering of the existing object is recalculated. This process is repeated until some termination criterion is met. The termination condition can be that no (or minimum) objects are reassigned to different clusters, etc.

In this module, the K-means algorithm is used to cluster the target images, and then the number of colors in the color palette is controlled by adjusting the k value. The team decides to use a k value of 9 for color blending, and the color blending result is shown in Figure 4:

Figure 4 *Color palette result diagram*

3.2.5 Combine the edge mask and color map

The final step is to the edge of the we created earlier mask with treated with color images. The final result of this module is shown in Figure 5:

FIG. 5 *Comparison of final results*

4. Portrait dispose module

4.1. Module flow chart

Figure 6 *illustrates the dispose module flow*

4.2. System flow and implementation

The image to be tested is imported from the file folder modles into the model 'deeplabv3p_xception65_humanseg' to extract the human body contour in the image. The output human body contour image will be placed in the specified directory according to the upper call, and the file name is the same as the name of the original image. But the file format is png.

The area of the human body contour area of the output image is calculated, and the pixel sum of the human body contour area is calculated by splitting the image channel and traversing all the pixels.

The skin area of the image after dispose is calculated, the image is converted into hsv, the specific area is extracted, the ([5,0,0],[20,255,255]) is converted into an array form, and the image value outside the threshold is set to 0, and the pixel sum of the image value position 0 is summed to obtain the pixel sum of the skin area.

Finally, the sum of the pixels in the skin area was divided by the sum of the pixels in the contour area of the human body to obtain the accurate (relative) proportion of the skin exposure degree.

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5. Summary and prospect

In this paper, we systematically study the methods of image style transfer and portrait dispose based on deep learning and traditional image dispose. By constructing and optimizing the VGG19 network and the adversarial generation network, we achieve efficient and diverse image style transfer. At the same time, the use of OpenCV technology to realize the image processing card tonghua, and combining the PaddlePaddle platform developed portrait processing module, makes like cutting and skin exposed to detect more accurately.

In practical applied, our system demonstrates good Performances and user experience, solves the problem of low efficiency of traditional image processing, and provides users with a convenient tool for applied. During the study, however, we also found some shortcomings, such as when dealing with complicated background or high resolution images, processing speed and precision of the system still has room to improve.

In the future, we plan to conduct further research and improvement in the following aspects:

Optimization algorithm Performances: further optimize the structures of VGG19 network and adversarial generation network, and combine the latest deep learning algorithm to improve the speed and accuracy of image Performances.

Enhance system stability: Improve the multi-threaded dispose capability of the system to ensure stable operation under high load conditions.

Expand applied scenarios: The image applied technology is applied to more practical scenarios, such as medical image analysis, image recognition in automatic driving, etc., to improve the practicability and value of the system.

User experience improvement: Based on user feedback, continuously optimize the design and interaction mode of the GUI interface, simplify the operation process, and make the system more easy to use and user-friendly.

In conclusion, the research in this paper provides a novel and efficient solution for the field of image dispose. Future work will continue to focus on algorithm optimization, system stability and the extension of application, etc., in order to provide users with a better image dispose experience.

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