Research Article

AN EFFICIENT IMAGE PROCESSING BASED IMAGE TO CARTOON GENERATION BASED ON DEEP LEARNING

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Abstract: This paper proposes an approach to convert real life images into cartoon images using image processing. The cartoon images have sharp edges, reduced colour quantity compared to the original image, and smooth colour regions. With the rapid advancement in artificial intelligence, recently deep learning methods have been developed for image to cartoon generation. Most of these methods perform extremely huge computations and require large datasets and are time consuming, unlike traditional image processing which involves direct manipulation on the input images. In this paper, we have developed an image processing based method for image to cartoon generation. Here, we perform parallel operations of enhancing the edges and quantizing the colour. The edges are extracted and dilated to highlight them in the output colour image. For colour quantization, the colours are assigned based on proposed formulation on separate colour channels. Later, these images are combined and the highlighted edges are added to generate the cartoon image. The generated images are compared with existing image processing approaches and deep learning based methods. From the experimental results, it is evident that the proposed approach generates high quality cartoon images which are visually appealing, have superior contrast and are able to preserve the contextual information at lower computational cost.

Key words: Canny Edge Detector, Median Filter, Dilation, Image To Cartoon, Colour Quantization

1.INTRODUCTION

As the digital world is achieving great heights, people are looking for different ways to represent themselves. One of the best ways is creating their cartoon images. People are using wonderful platforms like avatoon, photolab and many more. Even one of the popular platforms, snapchat, is providing the cartoon images. Some big and popular applications like photoshop, adobe illustrator, and many others help in achieving the goal of image conversion to cartoon. Working on thousands of images, it will be very difficult to implement the process individually on these platforms. Thus, it is required that we adopt an efficient algorithm that can skip the human involvement and within milliseconds can produce the cartoon image.

The task of converting an image into a cartoon can be achieved with image processing as well as machine learning. There are many existing algorithms reported in literature for this. The image processing based techniques use filtering and morphological operations for cartoon image generation. Machine learning approaches involve utilization of complex architectures such as gans for image to cartoon conversion. These machine learning algorithms are time consuming and require a huge dataset for training purposes. Sometimes, the model is not always the desired one and may lead to underfitting or overfitting. Therefore, with fundamental concepts of image processing, the time consumption, complex computations and model creation can be avoided.

2. LITARATURE SURVEY

In the early stage, non photorealistic rendering was primarily used as a supplement to photorealistic rendering [10]. Therefore, non photorealistic rendering technology for 3D models has many similarities with photorealistic rendering technology for 3D models in terms of implementation methods [11]. Non photorealistic rendering techniques for cartoon-style 3D object space are also rare. Non photorealistic rendering is generally defined as a technique that uses computers to simulate the rendering styles of various visual arts [12]. There are great differences between non photorealistic rendering and photorealistic rendering in the definition, purposes, and common methods. From the angle of specific rendering methods, photorealistic rendering mainly adopts the way of simulation, while nonphotorealistic rendering usually carries out the stylized process of the material. From the perspective of characteristics, realistic rendering results in the representation of the objective world, while nonrealistic rendering contains subjective expressions. From the point of the effect of the rendering works, realistic rendering will effectively reflect the real physical process, while works of nonrealistic rendering emphasize audiences' emotional cognition rather than visual correctness and usually attach some artistic processing closer to the art works in vision.

3. SYSTEM ANALYSIS

3.1 EXISTING SYSTEM

The existing system for image to cartoon generation predominantly relies on deep learning techniques. These methods require large datasets and substantial computational resources, making them time-consuming and resource intensive. Deep learning approaches involve complex neural network architectures and often result in high computational loads. The training of these models involves substantial time and hardware investments. Additionally, deep learning methods might struggle to retain contextual information and may require substantial fine-tuning to achieve desired results. The resource-intensive nature of these approaches has prompted the exploration of alternative, more efficient methods for image to cartoon conversion.

LIMITATION OF EXISTING SYSTEM

The limitations of the existing system for image to cartoon generation based on deep learning methods are as follows:

High Computational Demands: Deep learning models require significant computational resources and often rely on powerful hardware for training and inference, making them inaccessible for many users.

Lack of Transparency: Deep learning models are often considered "black boxes," making it difficult to interpret their decision-making processes.

Potential Over fitting: Deep learning models can be prone to over fitting, leading to less robust performance on real-world data.

3.2 PROPOSED SYSTEM

The proposed system for image to cartoon generation in this research offers an innovative approach to address the limitations of existing deep learning-based methods. Instead of relying on resource-intensive neural networks, this system leverages the power of image processing. It conducts parallel operations involving edge enhancement and color quantization on the input images. Edges are extracted and emphasized, creating sharp, defining lines reminiscent of traditional cartoons. Colour quantization is performed using a novel formulation on separate colour channels, resulting in a reduction in colour quantity compared to the original image. The magic happens when these enhanced edges are seamlessly integrated with the colour-quantized image to produce cartoon images of exceptional quality. This system distinguishes itself by generating visually appealing cartoons with superior contrast and the preservation of contextual information, all while significantly reducing the computational cost.

It also includes a thorough comparative analysis with existing image processing and deep learning-based methods, highlighting its efficiency and effectiveness in image to cartoon conversion. With this proposed system, the goal is to provide a more accessible and resource-efficient alternative, making cartoon generation accessible to a broader range of applications while simultaneously mitigating the demands on computational resources and training data.

4.SYSTEM ARCHITECTURE

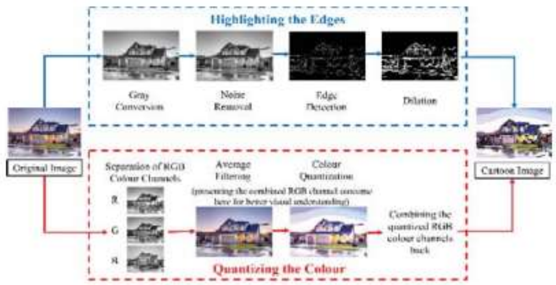


Fig.1: System Architecture

5. METHODOLOGY

The image contains a lot of information along with noise. Thus, the noise present in the image must be eliminated such that the information should not change. Therefore, initially, to eliminate the noise, the Median filter is applied. Fig. 1 shows the block diagram of the proposed method. The image to cartoon conversion requires extracting edges and reducing the colour quantity. The edge extraction and reducing the colour quantity procedure are different and independent from each other. Either they can be simultaneously performed, or can be implemented one after another. For extracting the edges from the image, it is converted to grayscale image and edge detection and morphological operations are applied. For reducing the colour quantity, a group of pixel values will be mapped to a particular pixel value. This process will be a point processing method. Once both are implemented, they are combined logically. Wherever, there will be an edge, black pixel value will be assigned to the image obtained by colour quantity reducing process.

6. MODULES

Data Collection:

Collect a dataset of real images and their corresponding cartoon versions. You can find existing datasets online or create your own.

Data Preprocessing:

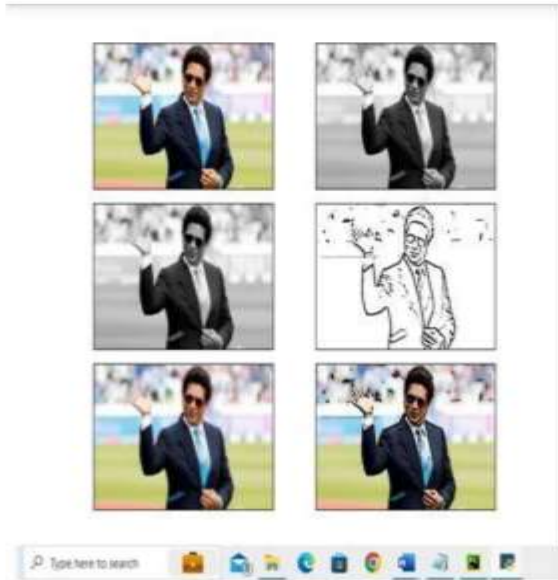
Resize and standardize the dataset images to a common size.Normalize pixel values to a specific range (e.g., [0, 1] or [-1, 1]).Split the dataset into training and testing sets.

Edge Extraction: Grayscale conversion precedes edge detection andmorphological operations, enhancing edges crucial for defining cartoon features accurately.

Colour Quantization: By mapping pixel groups to specific values, this module effectively reducescolour complexity, enabling smoother colour transitions in the resulting cartoon images.

Integration: Combining edge-detected grayscale and colour-quantized images, this module effectively merges enhanced edges with reduced colors to produce visually appealing cartoon images

7. RESULT



8.CONCLUSION

The image to cartoon generation method presented in this paper generates cartoon images using image processing operations. The goal is achieved by proposing a colour quantization method, which not only equalizes the histogram, but also enhances the dynamic range of the image. The output image is combined with thick and clear edges generated by performing edge detection and dilation after removal of the noise. The experimental results show that this algorithm is capable of producing high quality, visually superior cartoon images from real-life images. The generated images exhibit better contrast and colour quantization in comparison to existing image processing-based methods. It also performs better in comparison to deep learning-based approaches, at lesser computations and processing time, eliminating the need for model training.

FUTURE SCOPE: It also performs better in comparison to deep learning-based approaches, at lesser computations and processing time, eliminating the need for model training. This work can be further applied on video sequences for cartoon video generation.

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