International Journal of Advances in Engineering and Management (IJAEM)
Volume 5, Issue 7 July 2023, pp: 485-489 www.ijaem.net ISSN: 2395-5252

Cartoonizing Images and Videos Using Image Processing

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Date of Submission: 10-07-2023 Date of Acceptance: 20-07-2023

ABSTRACT: Cartoonization is the process of converting real-life high-quality images and movies into realistic cartoon images and videos. We propose to separately identify three white-box representations from images by observing the cartoon painting behaviour and consulting artists: the surface representation, which refers to the smooth surface of cartoon images, the structure representation, which refers to the sparse color-blocks and flatten global content in the celluloid style workflow, and the texture representation, which reflects high frequency texture, contours, and details in cartoon images. The retrieved representations are learned and the cartoonized images are generated using a Generative Adversarial Network (GAN) architecture. Our framework is controllable and adaptable since the learning objectives of our methodology are based on each extracted representation separately. Due of this, our method can satisfy artists' requirements in different styles and diverse use cases. Qualitative comparisons and quantitative analyses, as well as user studies, have been conducted to validate the effectiveness of this approach, and our method outperforms previous methods in all comparisons. Finally, the ablation study demonstrates the influence of each component in our framework.

Keywords: Image processing, Video processing, Whitebox cartooonizing, Generative Adversarial Network (GAN),

I. INTRODUCTION

In the present day a lot of rising content creators fade away due of not being able to voice their opinions confidently. Girls are hesitant to post photos or videos online because they are worried about what might be done to their images inadvertently. A large portion of the population may benefit if the photos or videos may be submitted anonymously.

Therefore, we suggest developing a programme called white box cartoonization that uses GAN to turn both still photos and moving pictures into animated versions via a process known as cartoonization.

By introducing a novel framework for estimating generative models via an adversarial process, we propose to construct a white-box controllable image cartoonization that can generate high-quality cartooned images and movies from real-world photos and videos and expand an existing GAN framework. The learning goals of our system are built upon three separate representations: surface representation, structure representation, and texture representation. The surface representation is the term used to describe the images' smooth surface. The structure representation refers to the few color blocks and condenses general content. The texture representation in cartoon graphics shows the texture, curves, and features. Using the Generative Adversarial Network (GAN) architecture, which divides the images into many representations and learns from them, cartoon images are produced. When converting a real image to a cartoon image, the Generative Adversarial Network (GAN) takes less time. Not only the photographs may be changed, we can also transform the genuine videos into cartoon one. As a result, time is saved while producing high-quality cartoons.

II. LITERATURE REVIEW

[1] Based on its observations of cartoon painting behaviour and consultation with artists, it proposes to separate three white-box representations from images: the surface representation, which refers to the smooth

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surface of cartoon images, the structure representation, which refers to the sparse color-blocks and raze global content in the celluloid style workflow, and the texture representation, which reflects the high frequency texture, contours, and details in the image. The retrieved representations and cartoon images are learned using a Generative Adversarial Network (GAN) framework. Based on each of the retrieved representations, the method's learning objectives are established separately. This makes it possible for the technique to satisfy artists' needs across a range of genres and application situations. The has been validated using qualitative contrasts, quantitative analysis, and user studies research to confirm the usefulness of this technique. Finally, the ablation research reveals the impact of each component of the system.

[2] In this study, a valuable and difficult problem in computer vision and graphics— converting pictures of real-world scenes into cartoon-style images—is solved. Cartoon GAN, a generative adversarial network (GAN) framework for cartoonization, is proposed in this study. The model uses mismatched pictures and cartoon images for training, making it simple to use. Two novel losses suitable for cartoonization are proposed as a semantic content loss that is evaluated as a sparse regularisation in the high-level feature maps to deal with the significant style variation between photos and cartoons and uses an edge-promoting adversarial loss to maintain clear edges.

[3] Auto-painter: Conditional generative adversarial networks are used to create cartoon images from sketches (GAN). Deep neural network-based real-world image production has recently gained popularity in the fields of computer vision and machine learning. Pixel-level images can be produced by learning from a huge cluster of photographs. In addition to being an intriguing scientific question, learning to create colourful cartoon graphics from black-and-white sketches could also have potential uses in digital applications. The sketch-to-image synthesis problem is discussed in this research utilising white box generative adversarial networks (cGAN). It suggests using the auto-painter model, which can provide complementary colours for a sketch automatically. The new model allows customers to specify their desired colours in addition to producing hand-drawn sketches in the right colours. Experimental results on two sketch datasets show that the auto-painter performs better that existing image- to-image methods.

[4] Utilising a convolutional neural network to automatically colourize cartoons: In this study, automatic cartoon colorization is proposed. This is a challenging challenge since it is poorly articulated and typically requires user intervention to obtain better quality. Due to recent advancements in deep learning-based natural picture colorization, they used convolutional neural networks to investigate the colorization issue in the context of cartoons. As far as we can tell, deep learning methods are not used in any studies or research papers that already exist to address this issue. A deep Convolutional Neural Network-based automated colour filling approach for cartoons was requested here.

III. PROPOSED METHOD

Cartoonization is accomplished by the use of an algorithm known as Generative Adversarial Networks (GAN). GAN's two phases are a generating model and a discriminative model. The training data is utilized to produce new instances of data using the generative model. The discriminator is the model that is applied to verify the featured data and contrast it with the produced picture. The discriminator determines whether or not the produced image is authentic. This generator and discriminator both are neural networks and they run in conflict with each other in the training phase. In order to improve the output of both the generator and discriminator, the procedures are repeated several times. Now coming to the project, images Previous models that advocated the similar method employed black-box models, the earlier model obtains significant accuracies but downturns the stylization quality creating certain undesirable situations. For example, each cartoon process analyses distinct aspects, and these variances have an impact on black-box models. To address the shortcomings of the previous model, greater focus was placed on human painting behaviours and cartoon drawings of various types, and a white-box model was created.

The model decomposes images into three distinct cartoon representations, advising the network optimization to generate cartoonized images.

[1.] **Surface Representation:** This technique aids in extracting smooth surfaces from images with weighted low-frequency components while preserving the colour scheme, surface roughness, and other characteristics like edges and textures.

[2.] **Structure Representation**: It aids in generating sparse visual effects for celluloid-styled cartoon processes by assisting in the development of global

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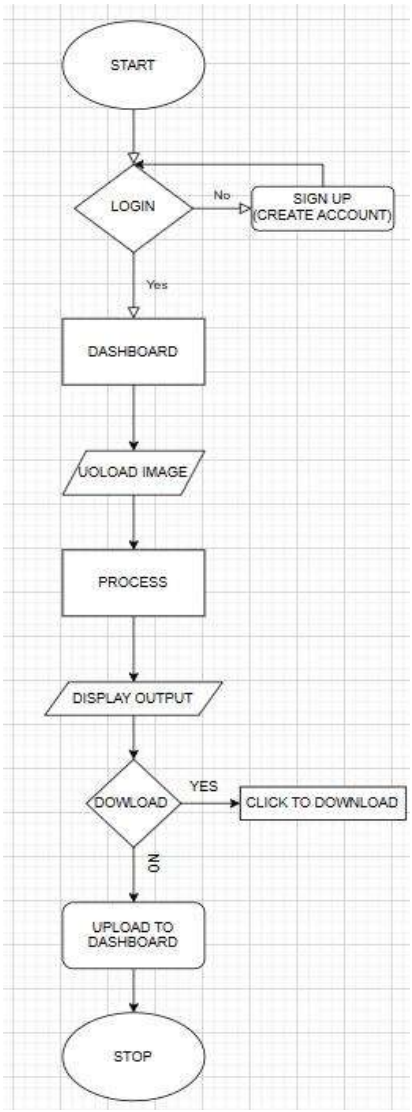
structural information and sparse colour blocks. Once completed, we apply adaptive colouring algorithms like the Felzenswalb algorithm to develop structural representation.



[3.] **Textured Representation**: This technique aids in maintaining painted edges and details. A single-channel intensity map is created from the three-dimensional image, which helps to preserve pixel intensity without sacrificing colour or brightness.it follows the approach of manual artist that first draw a line sketch with contours and then apply colors to it.

The extracted outputs are fed to a Generative Neural Networks (GAN) framework, which helps to optimize our problem making the solution more flexible and diversified.

IV. IMPLEMENTATION

Flowchart for the cartoonizer web app is shown in Fig. 1. The user begins by clicking the button to choose the image or video. The system will then provide a window for local storage. The system verifies the permitted image/video formats. The chosen photo or video will then be uploaded for cartoon conversion. After an image or video is successfully uploaded, the system processes the data and generates the output. The user may download the image or video by clicking the download button once the cartoonized output has been displayed on the screen. The video being uploaded must be less

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than or equal to 30mb in size. If the video exceeds 15 seconds, it is trimmed to 15 seconds and converted to cartoon-style video. The cartoonized video will have audio. The first 15 seconds of the video will be taken into account.

V. PROPOSED APPROACH PREPROCESSING

Preprocessing, along with the suggested three-step procedure, is crucial to our model. The image can be made more fluid, the features can be filtered, it can be turned into sketches, and the output can be translated from one domain to another. We can be confident that after executing these connected works, the output produced by our model will provide the best result and keep the highest quality features.

[1.] **Super-pixel and Structure Extraction:** This technique divides the image into regions and establishes a standard for determining when two areas are adjacent. An algorithm is created based on the predicate segmentation that uses a greedy decision-making process while still contributing to the satisfaction of global properties. We use Gradient Ascent to begin the image with rough clusters after contour identification, then we iteratively adjust the clusters till convergence. In order to advance our approach, we apply the Felzenszwalb algorithm, which enables us to capture global content information and generate outputs that are practically suitable for celluloid-style cartoon procedures.

[2.] **Image Smoothening:** Guided filters are used to extract from photos smooth, cartoon-like surfaces. A guided filter is a more sophisticated form of a bilateral filter with improved behaviour close to the edge. The noise must simply be eliminated or greatly reduced in order to produce useful image structures. The guided filter's output is an idealdownloaded outcome will be saved to local storage. The user can then exit the system at this point.
Linear transformation of the input image. It adheres to the methodology of bilateral filters and maintains its smoothing properties while being devoid of gradient reversal artefacts

[3.] **Non-photorealistic** RenderingImages can be transformed into artistic mediums including watercolour, painting, and sketching. We combine it with neural style transfer methods, which make it easier to compare the aesthetics of two images, to increase its functionality. The combined piece of code assists in separating image details from semantic edges. The "White box cartoonization" method, however, uses a single image and trains a model to produce high-quality output on a variety of cases by learning cartoonist qualities from a set of animated visuals.

[4.] **Generative Adversarial Network:** It is an image synthesiser that uses joint probability to produce fresh data. It makes use of the Generator and Discriminator to produce fresh images. The generator creates images, and the discriminator determines whether they are real or phoney before sending feedback and requesting that the generator provide better data. The quality of the photos increases when both networks are taught more.

[5.] **Image-to-Image Translation:** GAN has the limitation that it can only be used with training data that is already available, and paired training data isn't always available. We use cycleGAN, which aims to translate an image from a source domain X to a target domain Y even in the absence of paired training data, to get around this problem. With Surface Representation, Structural Representation, and Texture Representation, the input image is divided into three components. We describe a GAN model that consists of a generator G and two discriminators, Ds and Dt. While Dt is in charge of extracting textural information from model outputs and cartoons, Ds's objective is to characterise surface features from these
sources. We employ a pre-trained
VGGNetwork to extract high-level characteristics and impose a spatial limit on global content between outputs and the provided matched cartoons.

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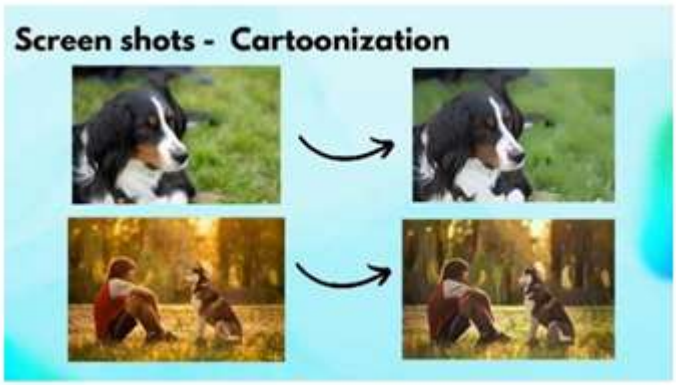

VI. CONCLUSION

We suggested in this research a white-box controlled image cartoonization framework using GAN that can create high-quality cartoonized pictures and movies from real-world photos and films. Pictures are deconstructed into three cartoon representations surface, structure and texture representation. Image processing modules such as openCV, tensorflow, matplotlib, PIL,etc are used to extract three representations for network training, and result styles could be controlled by adjusting the weight of each representation. Numerous qualitative and quantitative trials, as well as user studies, have been done to validate the performance of the technique.

VII. FUTURE WORK

In the future, we would like to concentrate on

- Process video faster
- Improve the UI
- Build a Social Media for cartoonized media
- provide more filters
- Animate larger and longer videos

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