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Canny Edge Based Image and Video Cartoonization

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Abstract: *Canny edge-based image and video cartoonization is a technique that transforms real-life images and videos into their cartoonified versions. This process emphasizes clear edges, smooth colors, and simplified textures, making it an excellent tool for creating artistic and creative content. To enhance the cartoonifying effect, we use image processing techniques that involve four main steps: noise reduction, edge detection, clustering, and erosion. By applying algorithms such as Canny edge detection and k-means clustering, we can achieve sharp edges and reduce the number of colors used in the image. To transform a video into its cartoonified version, we first convert it into frames of images, then process each frame using the same techniques, and finally combine the processed frames to create a cartoonified video. Overall, this approach provides a unique and artistic perspective on the original image and video content.*

Keywords: Canny Edge Detection, Image Processing, Noise reduction, Detecting edges, Clustering, Eroding, K Means Clustering, Smooth colors.

I. INTRODUCTION

The objective of this project is to detect objects in real-life images and videos and transform them into cartoonized versions. This process involves the use of various tools and software and is commonly referred to as image cartooning. Cartoons can be created in either 2D or 3D formats, but for the purpose of this project, all images are converted into a 2D format. Another approach used in this project is the use of convolutional neural networks (CNNs). This algorithm involves training the model using a set of photos and images to convert RGB images accurately into cartoonized versions. The algorithm applies several filters and Canny edge detection to achieve this transformation.

II. LITERATURE SURVEY

[1] CGANs for Cartoon to Real-life Images

Image-to-image translation is a learning objective that involves establishing a visual correspondence between an input and output image. The task can be differentiated based on its purpose, such as transforming synthetic images into real ones or converting photos into caricatures, among others. Various approaches have been used to address the problem, ranging from traditional computer vision methods to recent deep learning techniques. Among the popular and effective approaches is the use of conditional generative adversarial network (cGAN), which employs a generator and a discriminator network to produce cartoonized images for image-to-image translation

Disadvantages: It works on only specific data set.

[2] Cartooning an Image Using Opencv and Python

The aim of this project is to convert real-world images and videos into cartoon-style images or videos using the Cartoon GAN, a type of Generative Adversarial Network, which employs both a glad loss and an inimical loss to produce sharp and clear images. Python, with its numerous libraries for real-world operations, including OpenCV, will be used to develop the project, which is based on established theories regarding the color and positioning of objects in cartoon art.

Disadvantages: It is not suitable for all types of images.

[3] Cartooning of an Image

The focus of the animation picture recovery system is to retrieve relevant pictures from a database that contain the same object as the query picture. To achieve this, object extraction from animation pictures is a critical step, which is based on assumptions related to the color and location of objects in animation pictures. Typically, objects are positioned near

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the center of the picture, the background colors are commonly found near the edges, and object colors are less pronounced towards the edges. The proposed method uses color quantization, seed filling, and object contour detection to efficiently extract objects from animation pictures.
Disadvantages: Accuracy is less than 75%.

[4] Cartoon GAN: Generative Adversarial Networks for Photo Cartoonization
This paper proposes a learning-based solution for transforming real-world photos into cartoon-style images, which poses a significant challenge due to the unique characteristics and simplification of cartoon styles, and the clear edges, smooth color shading, and simple textures in cartoon images. The proposed CartoonGAN is a generative adversarial network framework that utilizes two novel losses, including a sparse regularization semantic content loss to deal with style variation between photos and cartoons, and an edge-promoting adversarial loss. The method is easy to use and takes unpaired photos and cartoon images for training.
Disadvantages: It needed high resource to implement, Cost also more.

III. EXISISTING SYSTEM

The proposed MS-Cartoon GAN model aims to address the multi-style photo cartoonization task, which involves generating multiple cartoon styles from real-world photos. This model follows the standard GAN architecture with two CNNs, a generator (G) and a discriminator (D). However, to learn multiple cartoon styles, the G is decoupled into one encoder for real-world photos and multiple decoders for different cartoon styles. Additionally, multiple discriminators corresponding to each cartoon style are used, along with an auxiliary classifier and a style loss, to ensure significant differences between the output styles.

Disadvantages

- Less Accuracy in cartoon generation
- It takes more time and resources to train machine.
- It is not suitable for all types of images

IV. PROPOSED SYSTEM

The proposed approach for image processing and cartoonization involves using the K-Means clustering algorithm. The input images are first blurred using a Bilateral filter and edges are detected using canny. The images are then converted to HSV format and K-Means clustering is applied to them. The resulting images are then converted back to RGB format and contours are drawn on them. To thicken the boundaries, erosion is used, and the output image is displayed. This approach can also be used to convert images into videos.

Advantages

- Accuracy is higher than 96%.
- It is supports for all types of images
- Faster than existing system

Design

The proposed approach for cartoonizing images or videos involves using image processing techniques to read the input and pre-process it using bilateral filters. Canny edge detection is then applied to identify the edges in the image, followed by the application of K-means clustering to the detected edges for the purpose of cartoonization. This approach effectively converts the image into a cartoon style.

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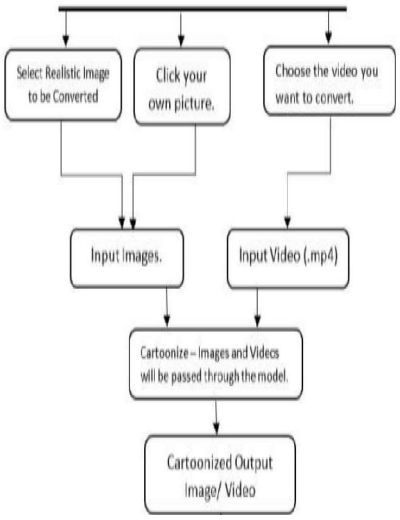

Fig1: System Architecture

Data Flow Diagram

The data flow diagram (DFD) is a modeling tool used to represent a system's components and the flow of information within it. It includes the system process, data used by the process, external entities, and transformations applied to the data. DFD is a graphical technique that shows how information moves through the system, and it can be partitioned into levels that represent increasing information flow and functional detail. The diagram, also known as a bubble chart, is a simple way to depict information flow and transformations that occur as data moves from input to output.

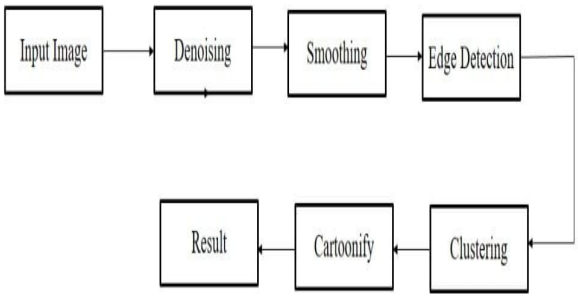

Fig 2: Data Flow Diagram

V. IMPLEMENTATION

We have split this paper into following parts

- Image Preprocess
- Edge Detection
- Clustering
- Cartoon generation

Image Preprocess

Blurring is an important step in image preprocessing as it helps to remove noise and make the image smoother. However, traditional blurring techniques such as Gaussian and Median Blur can also blur the edges, resulting in loss of important details. To overcome this, we can use a Bilateral Filter which smooths the image while preserving the edges. The Bilateral Filter works by considering both the spatial distance and color similarity between adjacent pixels, ensuring that only similar pixels are blurred together.

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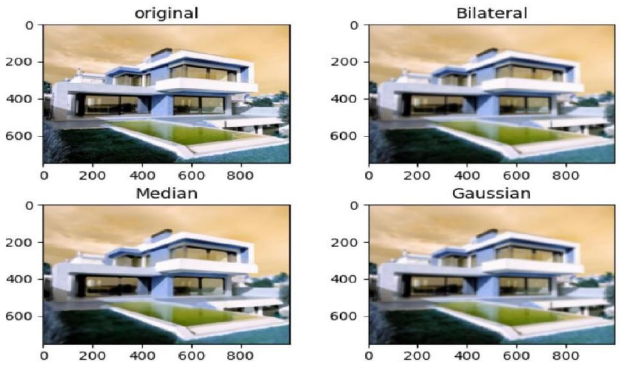

Fig 3: Bilateral Filter

Edge Detection

In the current image preprocessing module, we utilize the Canny Edge detection algorithm to identify the edges in the image. The Canny algorithm is a widely used technique for edge detection due to its accuracy and efficiency. However, as with any edge detection technique, noise in the image can lead to false detections or inaccuracies. To mitigate this, we apply a bilateral filter to the image prior to edge detection to remove noise while preserving the edges, thereby improving the accuracy of the Canny Edge detection algorithm..

Fig4: Edge Detection

Clustering

K-Means clustering algorithm partitions n observations into k clusters and is useful in reducing the number of shades in an image. For instance, in an image with each pixel represented by 8 bits, the algorithm can cluster the 8 bits into 5 bits, resulting in a reduction of the number of shades, which can lead to a more compressed output image.

Fig 5: Clustering Image

Cartoon generation

After generating the clusters using K-Means clustering algorithm, the system performs dilation of the clustered shades and uses the cv2.erode function to create a cartoonized image. Dilation is a morphological operation that expands or

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thickens regions of an image, while erosion shrinks or thins regions of an image. These operations can help to enhance or remove certain features in an image, which is useful in generating a cartoonized version of the original image.

Fig 6: Image Erosion

Algorithms used for each modules

Image Preprocess: To remove the noise and blur the input image bilateralFilter algorithm is used.
Edge Detection: To detect edges in the input image canny edge detection is used.
Clustering: To detect the similar shades we apply the k-means clustering.
Cartoon generation: To generate the catoonized image we use the Erosion techniques

Demonstration of working modules

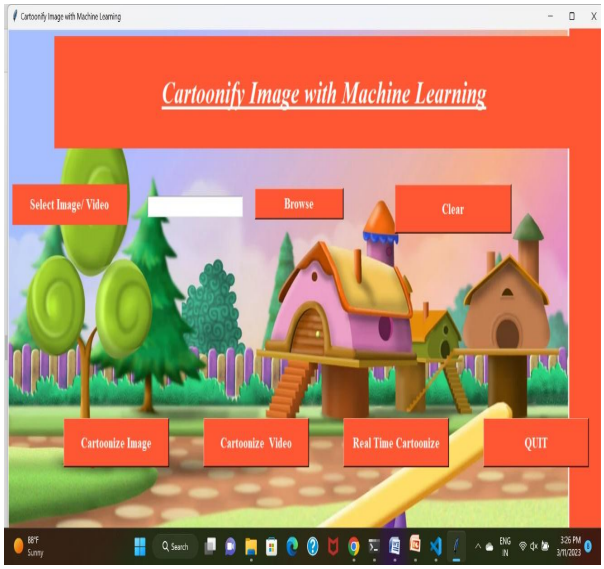

Fig 7: Home Page

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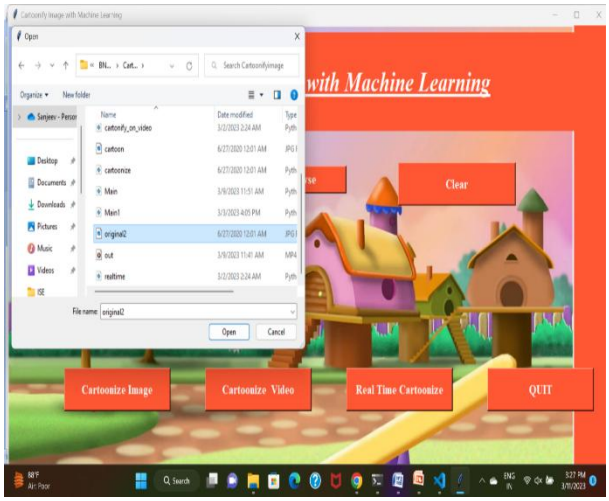

Fig8: Selecting image or video

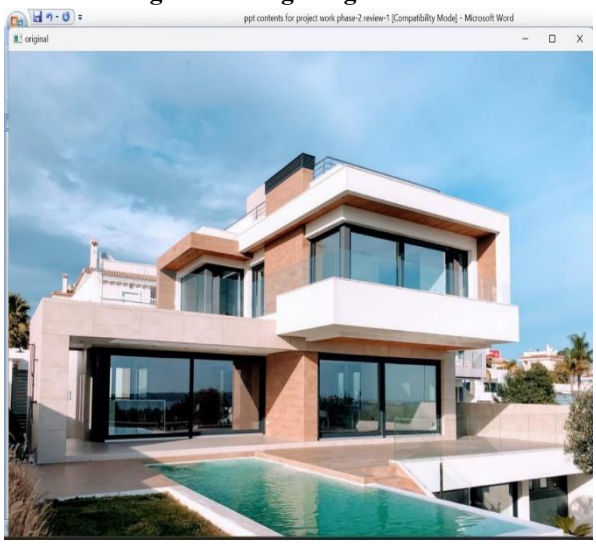

Fig9: Input image

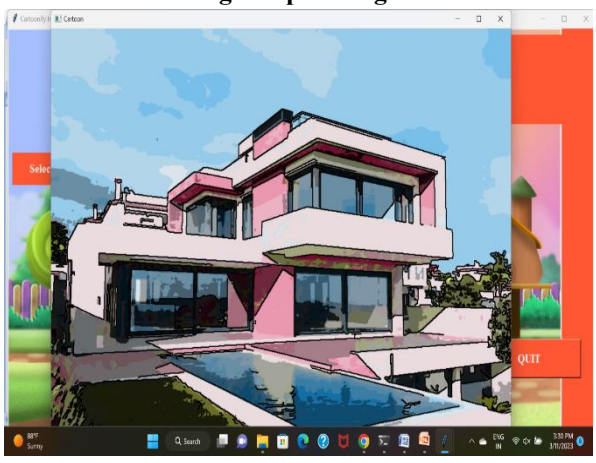

Fig10: Output image

VI. CONCLUSION

The study presents a novel method for cartoon generation in images and videos, which is useful for animators as it automatically recognizes objects in the image. Compared to existing methods, this approach requires less time to derive

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the cartoon and produces a high-quality output with sharp edges, a smooth image, limited colors, and an extra border to enhance the cartoon effect. This makes it suitable not only for animators but also for educational purposes, especially for training children. Additionally, thisapproach requires less memory, resources, and time, which is an advantage for efficient processing

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