



---

# Cartoonifying an Image Using Machine Learning

*Madugula Sai Joshitha*

Department of Information Technology, GMR Institute of Technology

---

## ABSTRACT

Machine learning is a branch of artificial intelligence (AI) which focuses on the use of data and algorithms to imitate the way that humans learn, gradually improving its accuracy. Machine learning allows the user to feed a computer algorithm an immense amount of data and have the computer analyze and make data-driven recommendations and decisions based on only the input data. In this study, the discussion is all about the Cartoonifying an Image. Cartoonify uses a neural network to turn your uploaded photo into a unique cartoon. There are several techniques for image to cartoon conversion such as using photoshop, adobe illustrator, windows MAC, paint.net and much more. Python is the pool of libraries. Rather than using web applications such as photoshop, use libraries in python which gives us better output. One such library is OpenCV. OpenCV is a cross-platform library used for Computer Vision. It includes applications like video and image capturing and processing. It is majorly used in image transformation, object detection, face recognition, and many other stunning applications. We will use some of the standard libraries such as numpy, matplotlib. You can use a photo of your own in a profile image, create an amusing avatar or turn your photo into a cartoon. Using Machine learning, we can design such projects. Thus, we will build a python application that will transform an image into its cartoon using OpenCV. Python programming is very much important in machine learning projects. The outcomes of the study is "how to cartoonify a image using machine learning".

---

**Keywords:** Cartoonifying, open cv, machine learning

---

## 1. INTRODUCTION

Cartoons are commonly used in various kinds of applications. As we know cartoons are made artistically it requires elegant and fine human artistic skills. While portraying Cartoons in humongous numbers for any animated movies it gets time-consuming for the artist as they need to define the sketch of the cartoon properly to get a good result. Cartoons are not only done in film industry but also done in different fields like people try to convert their own image into cartoons to know their appearance in Cartoon effect. But this is all time taking process and requires more resources which might be difficult to collect all resources and execute accordingly. This technique of cartoonifying image reduces the time consumption for Artists in Films. They can get the same output as before with this technique. But compared to sketching an image, cartoonifying an image is efficient and quick. Python programming language is used for writing a code to this technique. And different python libraries are used to get most accurate output. Mainly OpenCV, One of the library in python, is used in this method of cartoonifying.

### 1.1 Open CV:

OpenCV is an open-source library in python that is used mainly for computer vision tasks in the areas of machine learning and artificial intelligence. Nowadays, openCV is playing a major role in the field of technology. Using OpenCV we can process images and videos for some tasks like object detection, face detection, object tracking, and all.

OpenCV has c, c++, java, and python interfaces and it supports all kinds of systems such as Windows, Linux, Android, Mac OS, iOS, and all...

### 1.2 Requirements:

**Python:** We use python as a programming language for building the application.

**cv2:** We use cv2 for image processing.

**Numpy:** Mainly NumPy is used for dealing with arrays. Here the images that we use are stored in the form of arrays. So for that, we use NumPy.

**Matplotlib:** Matplotlib is used for visualization purposes. Here we plot the images using matplotlib.

**OS:** Here in our application os is used for dealing with paths like reading images from the path and saving the image to the path

### 1.3 Steps To Develop Image To Cartoon

1. Importing the required modules
2. Building a File Box to choose a particular file
3. How is an image stored?
4. Transforming an image to grayscale
5. Smoothing a grayscale image
6. Retrieving the edges of an image
7. Preparing a Mask Image
8. Giving a Cartoon Effect
9. Plotting all the transitions together
10. Functionally of save or download button

---

## 2. LITERATURE SURVEY

Following research papers are studied in details to understand the proposed recommendation technique and experimental result for predicting the output .

**2.1 MD.Salar Mohammad, Bollepalli Pranitha, Shivani Goud Pandula, Pulakanti Teja Sree.(2021). "Cartoonizing the Image" an International Journal of Advanced Trends in Computer Science and Engineering, Volume 10, No.4, July – August 2021.**

In this paper, Processing technique is used to cartoonize an image. Image Processing - In the field of the research processing of an image consisting of identifying an object in an image identify the dimensions, no. of objects, changing the images to blur effect and such effects are highly appreciated in the modern era of media and communication.

There are multiple properties in the Image Processing. Each of the property estimates the image to be produced more with essence and sharper image. Each image is examined to various grid.

Each picture element together is viewed as a 2-D Matrix. With each of the cell store different pixel values corresponding to the each of the picture element

**2.2 S.Rajatha, Anusha Shrikant Makkigadde, Neha L. Kanchan, Sapna, K. Janardhana Bhat, "Cartoonizer: Convert Images and Videos to Cartoon-Style Images and Videos" an International Journal of Research in Engineering, Science and Management Volume 4, Issue 7, July**

In this paper, Cartoon GAN, where GAN stands for Generative Adversarial Network is used to transform images (snapshots) to the finest cartooned image (animated image).

With the help of the loss function and of two types named as Adversarial loss and content loss, we got a flexible as well as a clear edge defined images.

Also with the help of CV2 which is Computer Vision, we have transformed video into animation (cartoonized video).

**2.3 Zengchang Qin, Zhenbo Luo, Hua Wang, "Auto-painter: Cartoon Image Generation from Sketch by Using Conditional Generative Adversarial Networks", International Conference on Image Processing, 2017.**

Recently, realistic image generation using deep neural network has become a hot topic in machine learning and computer vision.

In this paper, the sketch-to-image synthesis problem is investigated by using Conditional Generative Adversarial Networks (CGAN). The new model is not only capable of painting hand-drawn sketch with proper colors, but also allowing users to indicate preferred colors. Experimental results on two sketch datasets show that the auto-painter performs better than existing image-to-image methods.

Auto-painter is a supervised learning model, given a black-and-white sketch, the model can generate a painted colorful image based on given sketch-image pairs in the training data.

**2.4 Harshitha R, Kavya S Muttur, Prof. Jyothi Shetty Dept. Computer Science, RV College of Engineering, Bangalore . "Cartoonization Using White-box Technique in Machine Learning" (2020).**

In this paper, White-box Technique is used to cartoonize the image. By observing the cartoon painting behaviour and consulting artists, this paper propose to separately identify three white-box representations from images.

The surface representation that contains a smooth surface of cartoon images. The structure representation that refers to the sparse colorblocks and flatten global content is the celluloid style workflow.

And the texture representation that reflects high frequency texture , contours , and details in cartoon images.

**2.5 Akanksha Apte, Ashwathy Unnikrishnan, Navjeevan Bomble, Prof. Sachin Gavhane, "Transformation of Realistic Images and Videos into Cartoon Images and Video using GAN" an International Journal of Research in Engineering, Science and Management Volume 4, Issue 7, July2021.**

In this paper , a method is proposed that is white-box controllable image cartoonization framework with the help of GAN , which can generate high-quality cartoonized images and videos from real-world photos and videos.

Images are decomposed under three cartoon representations surface , structure and texture representation.

Image processing models such as OpenCV , PIL , etc are used to extract three representations for network training , and result styles could be controlled by adjusting the weight of each representation.

Extensive qualitative and quantitative experiments, as well as user studies, have been conducted to validate the performance of the method.

### 3. METHODOLOGY

#### 3.1 Cartoonizing the Image:

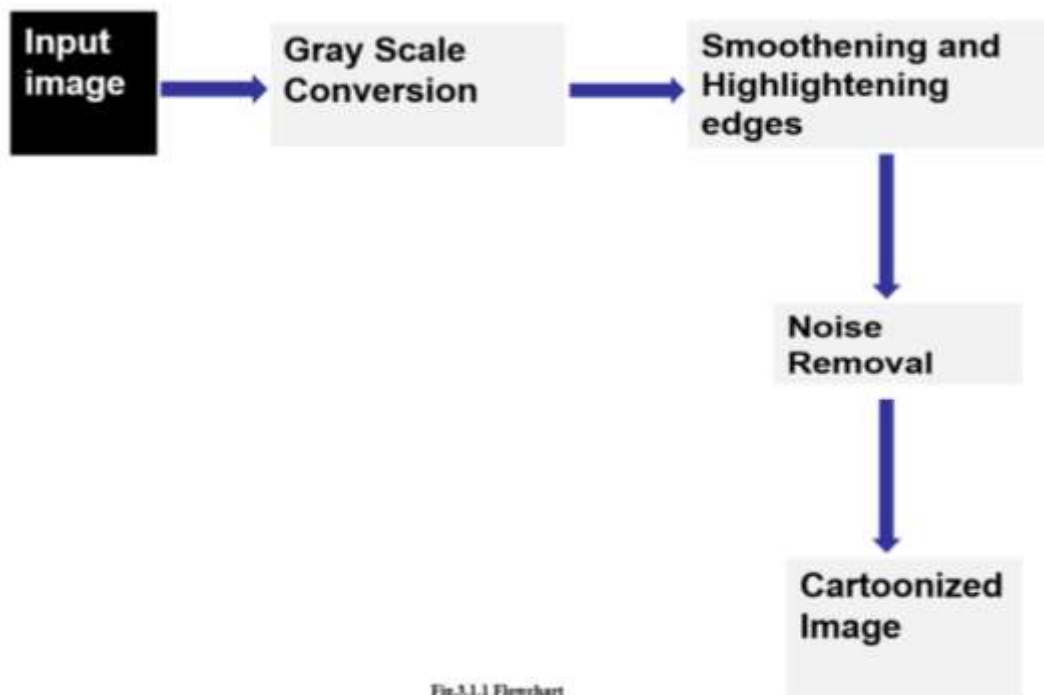


Fig.3.1.1 Flowchart

- The process to create a cartoon effect image can be initially branched into 2 divisions –To detect, blur and bold the edges of the actual RGB color image. To smooth,quantize and the conversion of the RGB image to grayscale.The results involved in combining the image and help achieve the desired result.
- In order to convert the image given by the user to cartoon ,first it is converted to grayscale. Here, our first step is to convert the image into grayscale. Thus, we use the BGR2GRAY flag. This returns the image in grayscale. A grayscale image is stored as grayScaleImage.
- To smoothen an image, we simply apply a blur effect. This is done using medianBlur() function. We use bilateral Filter which removes the noise. It can be taken as smoothening of an image to an extent. Here, we will try to retrieve the edges and highlight them. This is attained by the adaptive thresholding technique. We perform bitwise and on two images to mask them. This finally CARTOONIFY our image.

#### 3.2 Cartoonizer: Convert Images to Cartoon-Style Image:

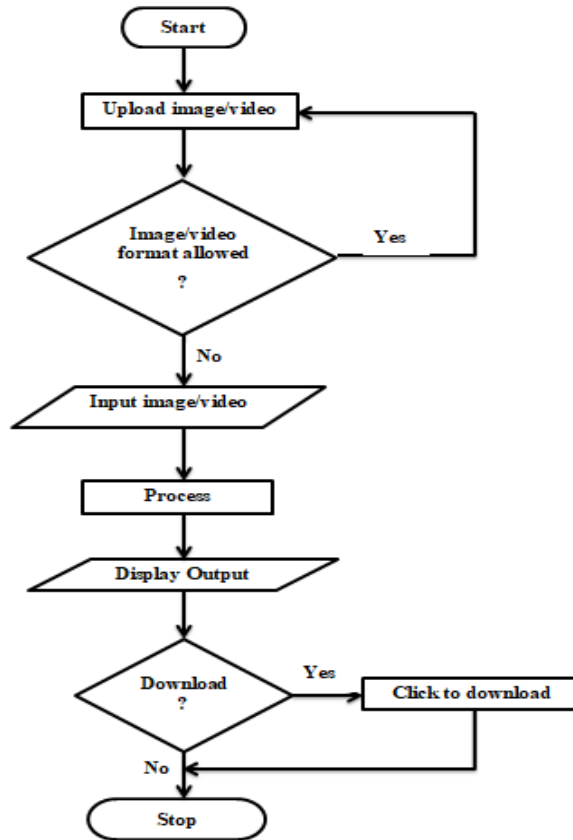


Fig.3.2.1.Flowchart for Workflow of Webapp

- Above Figure represents Flowchart for cartoonizer webapp. Firstly, the user clicks on the button select the image or video. After the system opens window for local storage. System checks for image/video formats allowed. Then the selected image or video will be uploaded to convert into cartoon image/video. After the successful upload of image/video the system processes input and produces the output. After the cartoonized output gets displayed on screen, the user may download the image/video by clicking on download button. Downloaded result will be stored into the local storage. Finally, the user can come out of the system.
- After the cartoonized output gets displayed on screen, the user may download the image/video by clicking on download button. Downloaded result will be stored into the local storage. Finally, the user can come out of the system.
- For videos, the video being uploaded must have size less than or equal to 30mb. If the video is longer than 15sec, then it is trimmed to 15sec and converted to cartoon-style video. Audio will be added to the cartoonized video. First 15sec of the video will be considered.

3.3 Auto-painter: Cartoon Image Generation from Sketch by Using Conditional Generative Adversarial Networks:

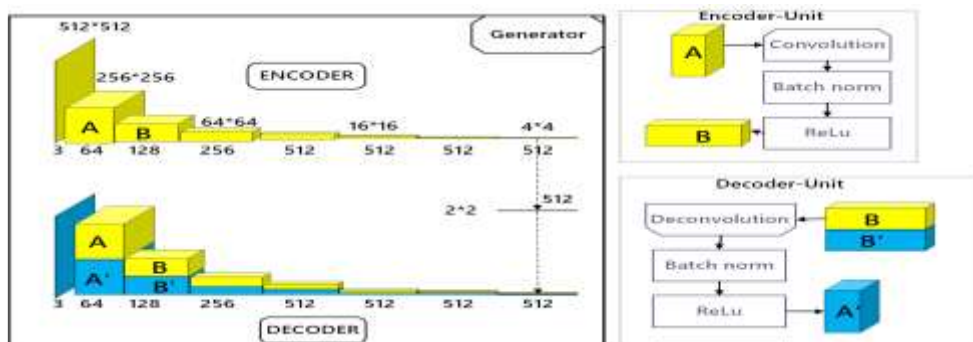


Fig:3.3.1 Generative Adversarial Networks

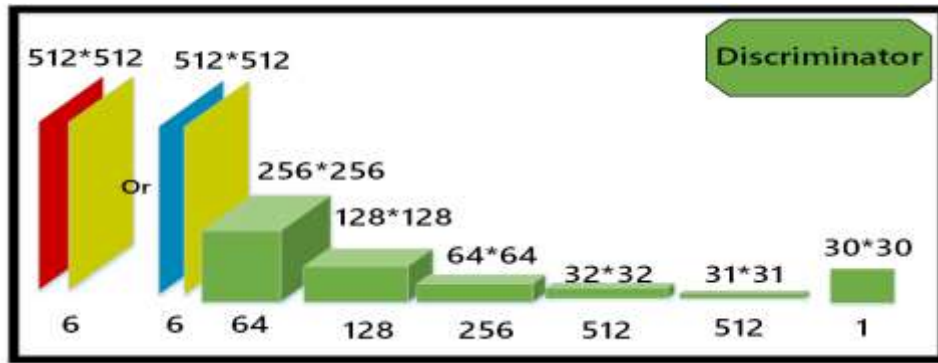


Fig.3.3.2 Discriminator

Support As we can see from Figure , in order to decoding out low-level information of sketch, we concatenate encoder layer A to the decoding layer A' for generating the final colorful cartoon image, where A contains the sketch edge information and A' mainly contains trained color painting information.

- In first figure, the yellow blocks represent layers in encoder, and blue blocks are decoder layers. In each layer of decoding, the corresponding layers of encoder are concatenated to current layer to decode the next layer. E.g., B and B' are concatenated to obtain A' through deconvolution. The right-hand side figure is the patchGAN discriminator: input of discriminator is either the pair of sketch (yellow block) and real target image (red block), or the pair of sketch and generated image (blue block).
- The discriminator only has the encoder units comparing to the generator, it aims to classify whether the input sketch-image pair is 'real' or 'fake'. The network is trained to maximize the classification accuracy. As we can see from Figure, the output of the discriminator is a matrix of probability, in which each element gives the probability of being real for a pair of correspond patches sampled using Markov random field or PatchGAN. In our research, we take the patch size of  $70 \times 70$  and output a probability matrix of  $30 \times 30$ . The convolutional layers between the input and the output extract the high-level features of the input pairs.

### 3.4 Cartoonization Using White-box Technique:

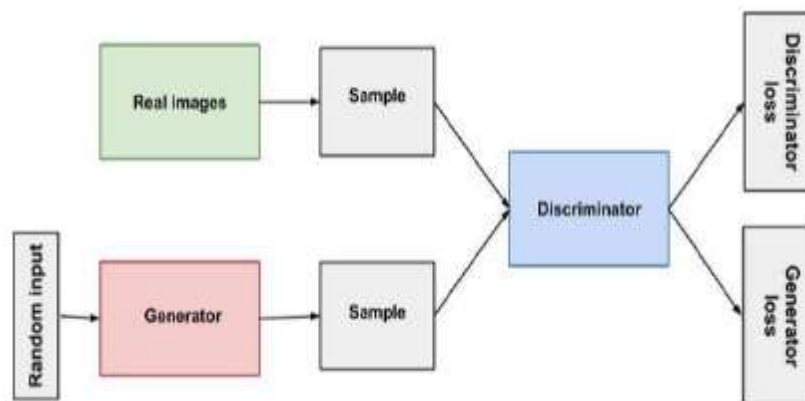


Fig.3.4.1 White Box Technique

- It is an image synthesizer that helps to generate new data using joint probability. To generate new images it uses Generator and Discriminator. The generator makes images and Discriminator checks images to be real or fake and then sends feedback to the generator thus asking him to generate better data. The more both networks are trained, the better images we get.
- The input image is dissolved in three parts wiz Surface Representation, Structural Representation, and Texture Representation. A GAN model with a generator G and two discriminators Ds and Dt are introduced. The goal of Ds is to characterize surface features extracted from model outputs and cartoons, whereas Dt is responsible for separate textural information from model outputs and cartoons. To pluck high-level features and to impose a spatial constraint on global content between outputs and provided paired cartoons we use pre-trained VGGNetwork.
- GAN method is implemented with TensorFlow. A discriminator Ds is proposed to verify whether result and paired cartoon images have similar surfaces, and regulate the generator G to learn the information stored in the extracted surface representation. we implement Felzenszwalb algorithm to segment the areas. To impose a spatial constraint on global content between outputs and provided paired cartoons we use pretrained VGGNetwork.

3.5 Transformation of Realistic Images into Cartoon Images using GAN:

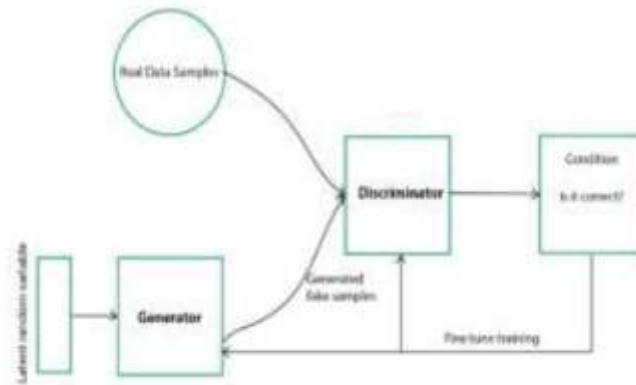


Fig.3.5.1 Generator and Discriminator

- GAN i.e. “Generative Adversarial Networks” algorithm is used for the implementation. GAN is a combination of a generative model and a discriminative model. The generative model creates new instances of data that resemble the training data.
- Conversion of Video is basically similar to getting an animated video out of the normal one. The video is first divided into frames and saved into an array, then passed through the generator and discriminator with the help of OpenCV to get the animated(cartoonized video).Similarly an Image can be converted into Cartoon Image in its own method using different techniques.

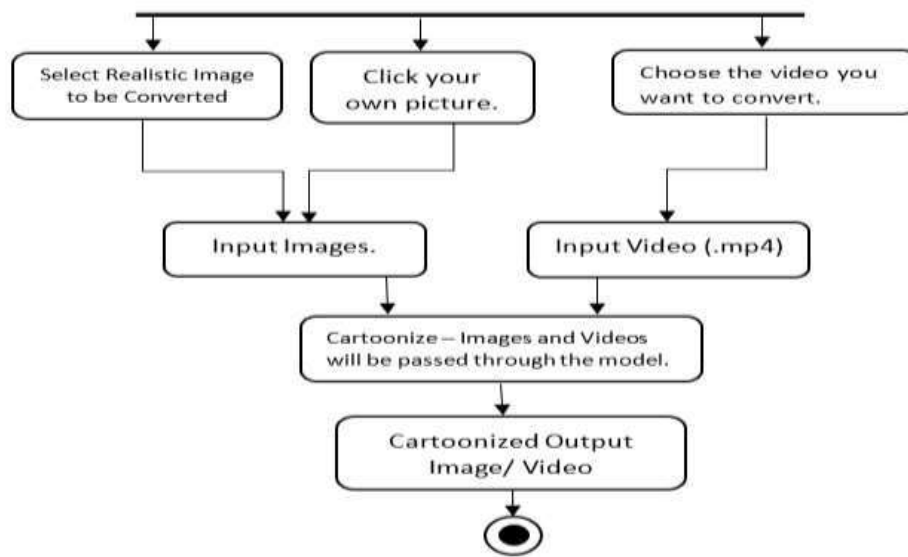


Fig.3.5.2 Flowchart for GAN

The above activity diagram shows the working of the proposed method. Where it gives an overall brief idea on how the images and video taken from the camera are converted into cartoon style (Animation).

4. RESULTS & DISCUSSION

4.1 Cartoonizing the Image:

```

C:\Users\user> python imagecapture.py --config yolov1.cfg --weights yolov1.weights --classes yolov1.txt
do you want to capture the image or upload it-enter capture for capturing and upload for uploading/upload
enter image naming.jpg
    
```

Fig.4.1.1 command for uploading the image

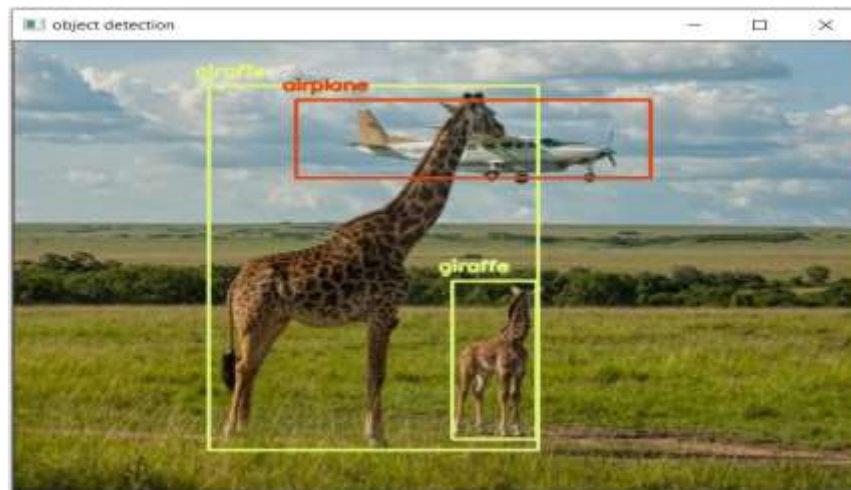


Fig.4.1.2 image window with the detected objects

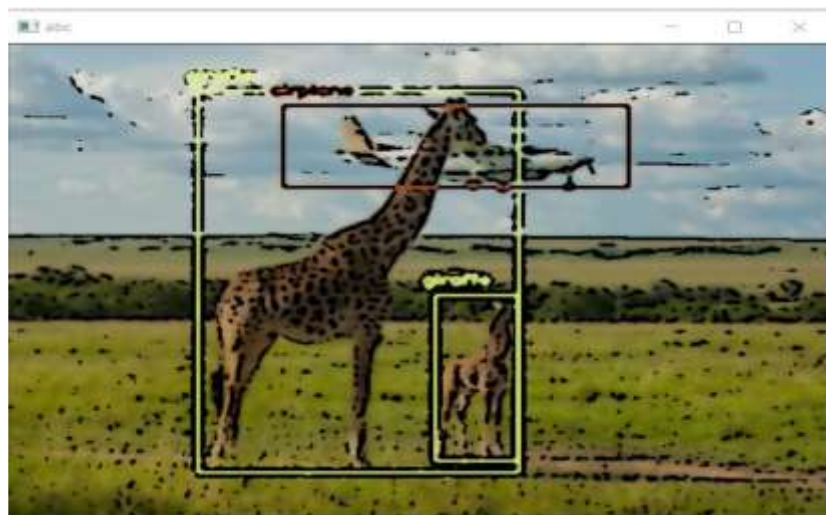


Fig.4.1.3 Cartoonified Image

#### 4.2 Cartoonizer: Convert Images to Cartoon-Style Image:



Fig.4.2.1 Real and Cartoonized image of a cats

#### 4.3 Auto-painter: Cartoon Image Generation from Sketch by Using Conditional Generative Adversarial Networks:

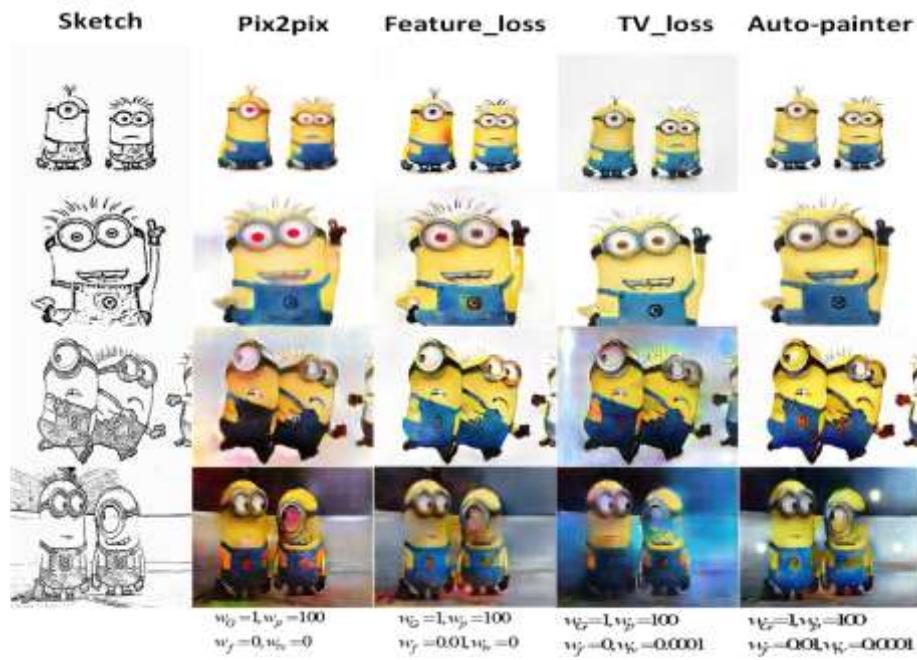


Fig.4.3.1 Cartoonization using GAN

Given an input image of resolution 512 x 512, the auto-painter can generate a painted colorful output image within 1 second, which enables instant feedback to design an interactive image editing tools. The auto-painter trained on the Minions provides a tool for users to design virtual images of 'minions style'. As it shown in the left-hand side of Figure 5, based on the given initial sketch, one can modify the original sketch, the glass or the gesture, etc. It is interesting that even on the simple hand draw sketches, the auto-painter can result in 'minions style' images.

**4.4 Cartooniation Using White-box Technique:**

This model is the fastest among four methods on all devices and all resolutions, and has the smallest model size. Especially, this model can process a 720\*1280 image on GPU within only 17.23ms, which enables it for real-time High-Resolution video processing tasks. This model applied on diverse real-world scenes, including natural landscape, city views, people, animals, and plants.



Fig.4.4.1 Cartoonization using White Box

**4.5 Transformation of Realistic Images into Cartoon Images using GAN:**

In the below results, the first image consists of the real world which is taken from a video clip and later after using Cartoon GAN with the help of OpenCV we get the cartooned image of the video as you can see below:-





**Fig.4.5.1 Cartoonization using GAN**

## 5. CONCLUSION

- The Main theme of this paper is to get high quality cartoonized image from the normal image. And this can be done using different techniques and methods as discussed in above papers. Generally to convert any general image into cartoon, it requires more skills, technique and also consumes much time to get a proper cartoon but now a days with developed technology it became easy. The time required in this method is comparatively very less. Hence the latest methods became popular for getting cartoon images.
- There are different techniques for converting an image to cartoon. Based on User requirements, suitable technique is used to get an efficient output. And with developing technology many new methods/techniques are introduced for better implementation and best results. Even Videos can be animated using these techniques. So with this different algorithms are implemented.
- Finally it can be concluded that an image can be converted into a cartoonized image with suitable techniques which gives efficient output and less time consumption. Though many applications are developed for Cartoonizing, implementation using Python or any other language gives better understanding and better outputs.

## 6. REFERENCES

1. MD. Salar Mohammad, Bollepalli Pranitha, Shivani Goud Pandula, Pulakanti Teja Sree. (2021). "Cartoonizing the Image" an International Journal of Advanced Trends in Computer Science and Engineering, Volume 10, No.4, July – August 2021.
2. S. Rajatha, Anusha Shrikant Makkigadde, Neha L. Kanchan, Sapna, K. Janardhana Bhat, "Cartoonizer: Convert Images and Videos to Cartoon-Style Images and Videos" an International Journal of Research in Engineering, Science and Management Volume 4, Issue 7, July 2021.
3. Zengchang Qin, Zhenbo Luo, Hua Wang, " Auto-painter: Cartoon Image Generation from Sketch by Using Conditional Generative Adversarial Networks", International Journal on Image Processing, 2017.
4. Harshitha R, Kavya S Muttur, Prof. Jyothi Shetty Dept. Computer Science, RV College of Engineering, Bangalore . "Cartoonization Using White-box Technique in Machine Learning" (2020).
5. Akanksha Apte, Ashwathy Unnikrishnan, Navjeevan Bomble, Prof. Sachin Gavhane, "Transformation of Realistic Images and Videos into Cartoon Images and Video using GAN" an International Journal of Research in Engineering, Science and Management Volume 4, Issue 7, July 2021.
6. Silviya D'monte, Aakash Varma, Ricky Mhatre, Rahul Vanmali, Yukta sharma
7. Chinmay Joshi, Devendra Jaiswal, Akshata Patil Department Name of Organization: Information Technology Name of Organization: Kc College of Engineering Management Studies and Research City: Kopari Thane (East) Country: India