



# Creative Visionaries Through Machine Learning

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**Abstract:** Creative Visionaries uses machine learning and open CV library functions for image processing to convert original image to cartoon for providing fun, and creative images. Beyond this it provides privacy for the image to prevent from morphing using watermark techniques i.e., invisible watermark technique which hides the watermark in the image and prevent from morphing. OpenCV functions are used for edge detection, color quantization and feature extraction, it maintains a balance between preserving image details. This generated cartoon image is used in movies, art, online content and useful for advertisements which attracts the people.

**Keywords:** Edge Detection, Color Quantization, Bilateral Filtering, Cartoon Image, Watermark Image.

## I. INTRODUCTION

Creative Visionaries used machine Learning and OpenCV capabilities to produce a cartoon image from photos. This system was suitable to produce a cartoon that's amusing and life- such like, appealing to communities and anyone anywhere. Technologies like invisible watermarking were also used to cover a person's sequestration.

We're using machine learning, a form of artificial intelligence, so that the computer can comprehend or be trained by a large collection of photos. The computer was trained to acclimate to different styles of images, which is salutary when making print into a cartoon algorithms and models automatically feting and rooting the significant features from an image, which it can also use to convert the ordinary print into a high quality, amusing cartoon. Those performing cartoon images are also watermarked, as an added measure so that only those authorized to use your prints, can.

Creating cartoons isn't only pleasurable but also salutary for numerous business requirements. While some results bear installing complex print editing software like Photoshop, others involve stoner- performed tasks. Machine learning is particularly profitable for our Creative Visionaries design compared to other disciplines because it allows the system to automatically learn and acclimate to different image styles and features, performing in high- quality images.

## II. RELATED WORK

Lei Wang described about cartoon-style image rendering transfer based on neural networks. In this, methodology involved is Convolutional Neural Networks, Style Transfer Techniques, Optimization Algorithms and Attention Mechanisms to create cartoon image. Advantages of this paper is flexible, automatic processing and consistency in output but there are some disadvantages involved in this paper that is, loss of photorealistic details and privacy protection.

Yang Chen, Yu-Kun Lai, Yong-Jin Liu, and their team described about generative adversarial networks (GANs) to transform photos into cartoons. In this methodology involved is smoothing out edges, applying style transfer techniques, initializing the process, incorporating content loss, and using attention mechanisms to create cartoon-like images. Advantages of this paper is efficient and fast transformation but disadvantages is loss of photo realistic images and less privacy.

Diana Earshia V, Veeri Venkata Hemanth Kumar, Raghunath Dinesh Kumar, and others described creating funny animated characters using Generative Adversarial Networks (GANs). In this methodology involves utilizing GANs along with image processing techniques, training process and algorithm, loss function and up sampling techniques. The advantages of this is produces high-quality animated cartoons and generates unique and original designs. The disadvantages are, it takes long training time and not able to handle different types.



Suryansh Tomar and Guru Prasad M S described cartoon-style images using machine learning. In this methodology involves collecting data, identifying edges in the images, applying image filtering techniques, and finally, creating the cartoon effect. The advantages of this high-quality cartoon images that can work well with various types of input images. Disadvantages is that the approach not preserve fine details present in the original images.

Xuan Zhao and Yuxin Zhou proposed described Turn Real People into Anime Cartoonization which involves several techniques. In this methodology involves Photo2cartoon method along with LWAnimeGAN, Coherent Line Drawing, and Paints Chainer for colorization. The advantages of this is efficient and quickly transforms real people into cartoons. However, there are some drawbacks, including the loss of photorealism, complex computational requirements, and a lack of privacy protection measures.

### III. PROPOSED WORK

#### 1. Upload an Image

In this step we read an image file and display it. An image can be of any format like png, jpg, jpeg, etc. Users are presented with various options to upload images, including selecting files from local storage, providing URLs, paths. Sample original image for uploading is shown in Figure 1.



Fig 1. Input Image

#### 2. Blurring

After uploading the image, a blurring or smoothing process is applied. This step involved to reduce the noise, that is distortions occurred in images which reduces the image quality. The reason why we used medianBlur method is to reduce salt and pepper noise.

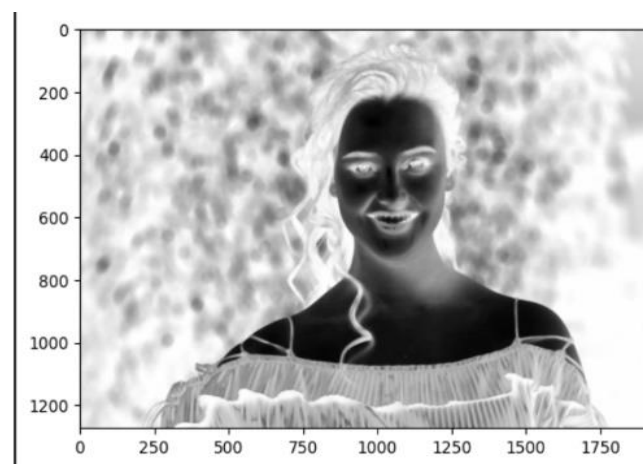


Fig 2. Blurred Image



This noise works by replacing each pixel's value with the median value of its neighboring pixels. This will help in reducing noise and makes image not to loose quality.

However, it is important to improve image quality and maintain balance between noise reduction and preserving important image features to maintain overall image quality.

### 3. Binary Image

In this step we will get binary image as shown in Figure 3 by using adaptive Threshold algorithm. This algorithm calculates the threshold value for each pixel and if intensities of pixels is above threshold then set to 255 (white) otherwise if the intensities of pixels is below threshold then set to 0 (black) which forms a binary. The main reason why adaptive threshold used is to get picture if the lighting changes across the image.



Fig 3. Binary Image

### 4. Color Quantization

The goal of this step is to reduce the colors of image but preserve the image appearance. Actually in an image there will be so many colors which takes more memory, so in order to reduce the memory space by reducing the colors K means clustering algorithm is used.

K means clustering method is used to reduce the colors in the image. This makes amount of data requires to represent the image to be reduced and makes image compression.

#### The process of clustering :

K-means clustering is an unsupervised machine learning algorithm used in image processing for segmentation.

In this image processing, K-means clustering is used to group similar pixels having same color as one cluster and this process continues until it give same colors as original image but actually the colors are reduced in the cartoon image which will not appear like removed colors from image.

The K- means algorithm operates in an iterative manner, rashly perfecting the assignment of data points to clusters until convergence is achieved. The process involves the following way.

**1. Initialization:** Begin by erratically concluding K cluster centroids. These centroids represent the original cluster centres around which data points will be grouped.

**2. Assignment Step:** Each data point is assigned to the nearest cluster centroid predicated on a distance metric, generally the Euclidean distance. This step effectively partitions the data into K clusters.

**3. Update Step:** After all data points have been assigned to clusters, the centroids are recalculated as the mean of all data points belonging to each cluster. This step moves the centroids to the centre of their separate clusters.



**4. Replication Steps:** 2 and 3 are repeated iteratively until convergence is reached convergence is generally determined by either a maximum number of duplications or when the centroids no longer change significantly between duplications.

#### Mathematical Formulation:

Let  $X = \{x_1, x_2, \dots, x_n\}$  be a set of  $n$  data points in  $d$ - dimensional space, and let  $C = \{c_1, c_2, \dots, c_k\}$  a set of  $K$  cluster centroids. The ideal of the  $K$ - means algorithm is to minimize the following objective.

$$J = \sum_{i=1}^n \min ||x_i - c_1||^2$$

Where  $||\cdot||$  denotes the Euclidean distance.

#### Operation in Image Processing:

Operation in Image Processing In the terrain of image processing, the  $K$ - means algorithm finds operation in tasks analogous as image segmentation, color quantization, and cartoonification. By clustering similar pixels together,  $K$ - means can simplify images and extract meaningful features.

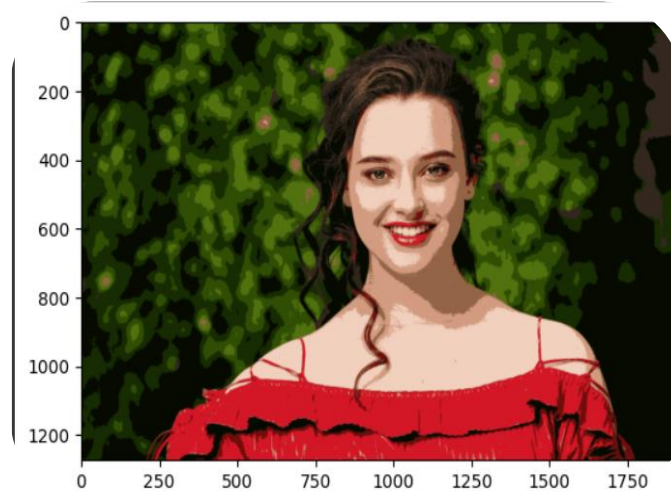


Fig 4. Color Quantized Image

#### 5. Bilateral Filtering

After generating the color quantized image, in this step if there is noise in the color quantized image then it is reduced using bilateral filtering method and produces following output as figure shown below.

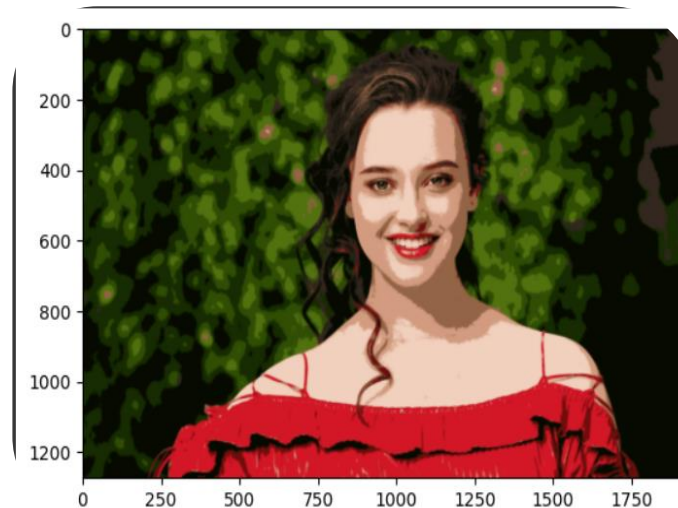


Fig 5. Smoothed Image



## 6. Cartoon Image

After bilateral filtering, bitwise and operation is done to combine color quantized image with binary image to get high quality cartoon image as shown in Figure below.

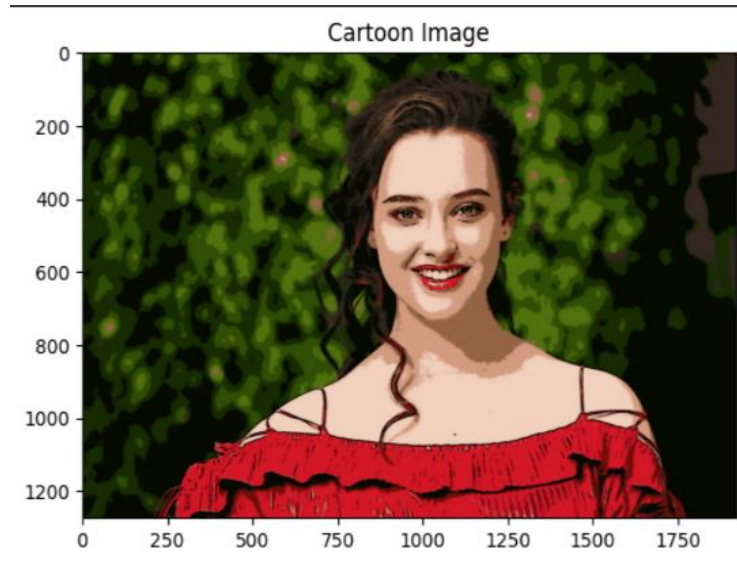


Fig 6. Cartoon Image

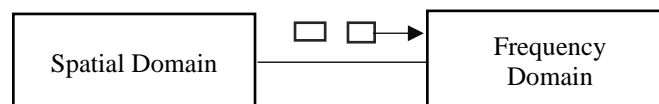
## 7. Watermark Embed

Watermarks are of so many types like visible watermarks, invisible watermarks, public watermarks, fragile watermarks. These watermarks are used for tracing copyright infringement i.e., to prove that the particular image belongs to the particular person and prevent from morphing.

In above watermarks, invisible watermarks are inserted in cartoonification process because it is a way of hiding images or text inside of photos. This is used to prevent from copying our photo by others. This watermarks also used to send secret messages.

This invisible watermarks are stamps used to prove that the particular photo to belongs to the owner. The main aim of using invisible watermark is not to know that a watermark is embedded in the photo so that in case attacker try to morph we can prevent it from morphing and prove that the photo belongs to particular owner. To embed invisible watermark, DCT-DWT algorithm is used.

For embedding the watermark, DCT algorithm is used for energy compaction and embedding .It is used for embedding watermark into frequency domain of the image instead of spatial or time domain because it takes less time to transform from one to another and takes less space.



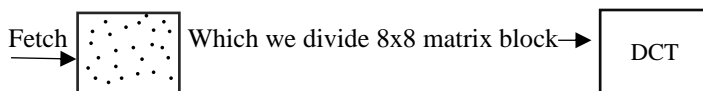
- DCT is used lossy image compression because it has-very strong energy compaction.
- DCT works by separating images into parts as differing frequencies.
- During a step called quantization, where part of compression actually occurred, then the less important Frequencies are discarded so that is why the use term “Lossy”.
- If we convert an image to its DCT it could remove the higher Frequencies to Zero, then convert back to image.



### To Perform DCT Transformation on an Image:

#### The Process of Working:

- First of all the image is broken in 8x8 block of pixels.
- Working from left to right. Top to bottom, The DCT is applied to each block.
- Each block is compressed through the Quantization.
- The array of compressed blocks that constitute the image is stored in a drastically reduce amount of space.
- When desired the image is reconstructed through decompression the process that uses the Inverse Discrete Cosine Transform (IDCT).



#### DCT Equation:

Equation for 1-D DCT of a signal  $x[n]$  of length  $N$ :

$$F(u, v) = \frac{2}{N} C(u) C(v) \sum_{x=0}^{N-1} \sum_{y=0}^{N-1} f(x, y) \cos \left[ \frac{(2x+1)u\pi}{2N} \right] \cos \left[ \frac{(2y+1)v\pi}{2N} \right]$$

Where:

- $F(u, v)$  represents the DCT coefficient at frequency  $(u, v)$ .
- $f(x, y)$  is the pixel value of the input image at position  $(x, y)$ .
- $N$  is the size of the image.
- $C(u)$  and  $C(v)$  are normalization factors given by:
  - $C(u) = \sqrt{\frac{1}{N}}$  for  $u = 0$
  - $C(u) = \sqrt{\frac{2}{N}}$  for  $u \neq 0$

For embedding watermark, DWT is also used which is a technique used to decompose an image into frequency components, allowing for a multi-resolution representation. It break down an image into various levels of details.

### To Perform DWT Transformation on an Image:

#### The Process of Working:

- Choose a wavelet and decomposition level.
- Apply DWT to break image into different levels.
- Subsample the coefficients for multi-resolution and detail coefficients.
- Optionally quantize detail coefficients for compression
- Store or transmit encoded coefficients.
- Optionally reconstruct the image using inverse DWT.

Below figures are watermark images embedded in the image, these watermark images can be of any videos or text or images.



Fig 7. Watermark

## 8. Watermark Image

A watermark in a picture is kind of like a secret hand or totem that the person who made the picture adds to it. It's generally see-through, so it does not block the picture too much, but it's still there.

This watermark frequently has information about who made the picture, like their name, totem, or website. It's sort of like putting your stamp on commodity you created. The main idea behind watermarks is to stop people from using the picture without authorization.

Indeed if someone tries to use the picture without asking, the watermark reminds them who the real proprietor is. It's a way of saying, "Hey, I made this, so please do not use it without talking to me first." While watermarks can be helpful, they are not reliable.

Some people can still remove them using special tools or editing software. But indeed though they are not perfect, numerous artists and generators still use watermarks to try to cover their work and show that they enjoy it. It's like an redundant subcaste of security for their creative stuff.

Below figure is the cartoon image with watermark embedded in it.



Fig 8. Cartoon Image with watermark



**Comparison with existing paper**

On comparison with existing paper i.e. An Effective Cartoonifying an Image using Machine Learning, this paper gives cartoons with high quality image and prevent from morphing using Invisible Watermark Technique.

Below graph shows the comparison between existing paper and this paper using SSIM (Structural Similarity Index Measure) and PSNR (Peak Signal-to-Noise Ratio) metrics.

SSIM metrics is used to find similarities between two images. Here in this paper it is used to find similarities between original image and cartoon image of existing paper and this paper. PSNR metrics is used to measure the quality of image or video. In this paper it used to measure the quality of image w.r.t original i.e. it compares with original image.

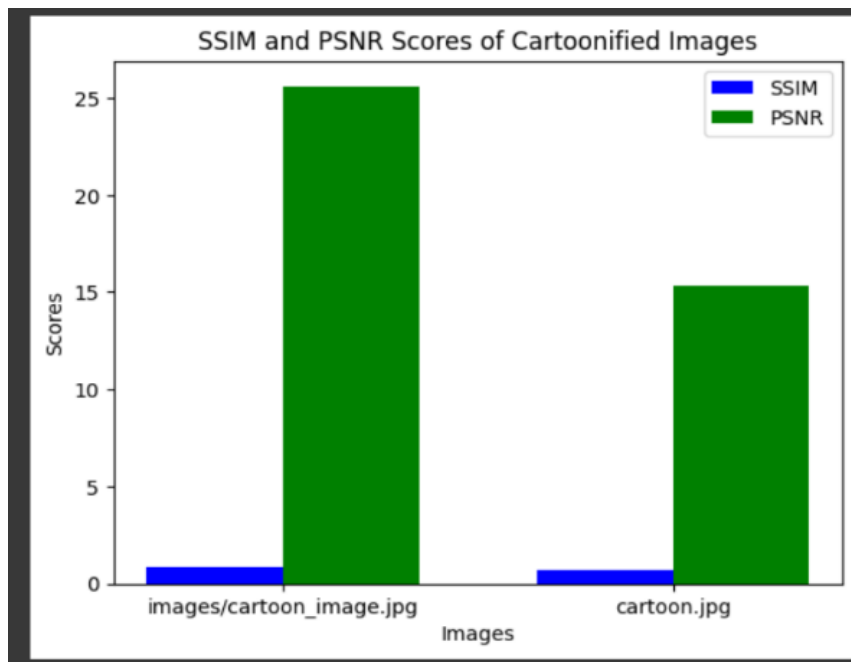


Fig 9. SSIM and PSNR Scores of Cartoonified Images.

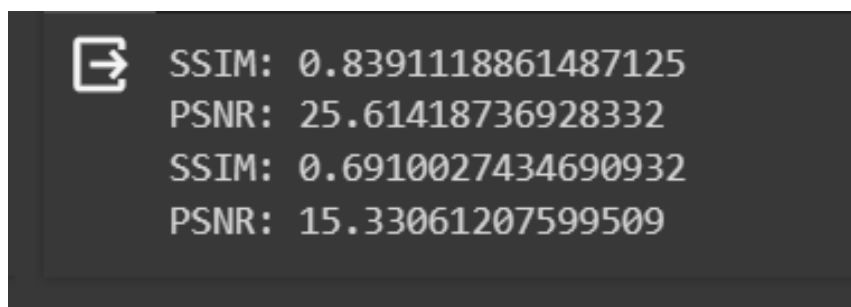


Fig 10. SSIM and PSNR metrics for cartoon images in this paper and existing paper.

**IV. RESULTS**

The paper aims to produce good quality cartoon images by preventing the cartoon image or any image from morphing with invisible watermark technique using DWT and DCT algorithm.

Because of converting an image into cartoon, it safe guards the sensitive information in an image and maintain visual quality of cartoon image.





## V. CONCLUSION

This paper focuses on converting an image into high quality cartoon, by giving good quality cartoon image which is seductive and useful for numerous purposes such as personal pictures for keeping as a dp in whatsapp and so on, trades, business purposes and so on. This paper not only tells about converting an image into cartoon but also introduced a technique called invisible watermark which will not appear to the person because it is embed into the image, which help an image from preventing morphing using invisible watermark fashion.

## VI. FUTURE SCOPE

Despite of all the works we have done there are some spaces to improve. It is possible to convert real images in videos into cartoon images i.e. cartoon videos and also can use some other best techniques for watermarking an image.

Sometimes the photos when clicked while raining are not much clear, so it is better to work on clearing rain water in clicked photos.

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