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# GANArtworks In the Mood

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## Abstract

In home decoration, an artwork with a particular combination of colors can convey a positive mood that improves psychological health. In our work, we leverage emotion to color mapping techniques and Generative Adversarial Networks (GANs) to generate artwork that brings a room into a more positive mood. We create a unique workflow to extract the color scheme from a room photo, convert it to an image with target colors that represent the desired positive mood, and then use a conditional GAN to generate artwork with fine control of the color. In this paper, we share our emotion to color mapping pipeline, GAN model training, and evaluation results on the generated artworks.

## 1 Introduction

Room color plays an important role in psychology and mental health [1]. Small changes to home decoration can easily improve mood and evoke positive feelings. However, not everyone is skilled or confident in knowing what home art to choose in order to fit into the desired mood. In our work, we leverage the Generative Adversarial Networks (GANs), emotion to color mapping literature, and the state-of-the-art GAN implementation with color control [2, 3] to transfer the user desired moods into a generated impressionist landscape artworks.

We choose impressionism [15] as our target style of the generated artworks since it is well known by general population given representative artists such as Claude Monet [13] and Vincent van Gogh [14]. Moreover, Impressionist artists often use loose brush strokes and different lights to express their impression of what they see. This contrasts to art in, for example, Trompe-l'œil [16] style, which is depicting realistic objects in 3D spaces. Therefore, impressionism art is a good match for GANs given both are a bit unpredictable and can be tuned with a lot of flexibility.

## 2 Methodology and Workflow

We provide a web application [12] where a user uploads a room photo. Then we extract a color scheme from the photo, and then leverage an emotion-to-color map to determine an emotion. This map is a digitized version of Koboyashi's studies [4,5,6,7], where a set of grouped emotions maps to a simplified set of 10 color hues and 12 shades within each hue. To bridge the gap between this data set and the user's real photo, we enhance the brightness and saturation in the room photo, and normalize the colors with the closest ones in Koboyashi's map. We then use a weighted Euclidean distance function:  $l2\_distance * pixel\_fraction$  to obtain the closest emotion to the user's room. After the emotion of the user's current room is detected, we provide a list of positive emotion groups for the user to select. Then we choose one emotion from the user selected group and impose the original room photo with the corresponding colors. Finally, we pass this imposed user room image into a conditional GAN to generate an artwork that conveys the desired positive mood.

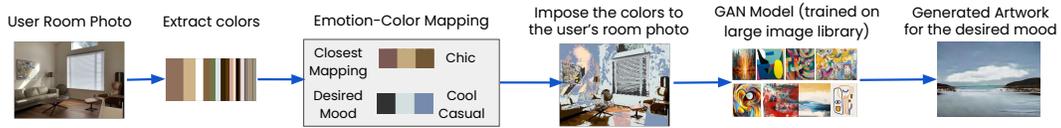


Figure 1: Work flow to generate artworks that promotes the mood of the user's room

### 3 GAN model training and artworks generation

In order to generate quality artwork images that can keep a consistent color scheme with the input image, we adopted conditional GAN (or cGAN) techniques. cGAN leverages the input image to control the output of the generated results through the discriminator and generator training. HistoGAN [3], which is a cGAN implementation based on StyleGAN, is a recent method for keeping color consistency without imposing other style attributes between the input image and the generated image.

Although GANs are one of the most successful technologies for high quality image generation, training an effective model requires a large amount of training data, intensive compute resources, and a long training time. We first used  $10k$  impressionist paintings downloaded from WikiArt website [4] that include all kinds of artworks such as flowers, landscapes, portraits, and sculptures. After  $70k$  epochs, we generated a mix of high quality images with random odd figures. Hypothesizing this was due to a wide range of distribution introduced by multiple types of artworks in our training set, we handpicked  $5k$  impressionist landscape paintings from the WikiArt website. After  $50k$  epochs, the model resulted in mode collapse generating similar images without varieties. After trying various approaches including a set of augmentation techniques with limited improvements, we added another  $5k$  landscape photos from HistoGAN github [10]. This greatly improved the model performance. After  $100k+$  epochs, we generated images that were not only sharp and clear but also with strong impressionism flavors - see Figure 2.

In our training process, we used a *g4dn* instance with a single GPU from AWS EC2 and continuously trained for 10 days. Due to our hardware environment limitations, we trained the model with a network capacity of 16 and output resolution of  $256 \times 256$ . In the model inference phase, we used the imposed user's room photo based on the user selected mood as a conditional input to the trained model. Figure 2 shows a variety of generated images from our final model based on the user's original room photo and the selected desired moods.

We evaluated the GAN model performance using Fréchet Inception Distance (FID), and obtained 14.871 FID score [11]. This outperforms the landscape image generation FID Scores from HistoGAN (23.549) and StyleGAN (24.216) [3]. To evaluate whether the generated artworks convey the target moods, we conducted a user survey on 500 people. Results showed 71.4% of respondents selected the correct moods that our model generated for in the final artwork images.

Our experience in the image generation based on user selected positive moods shows huge potential in using generative modeling for artistic home decoration. As next steps, we shall continue improving mood mapping accuracy, exploring other artwork styles, and generating images with higher resolution.

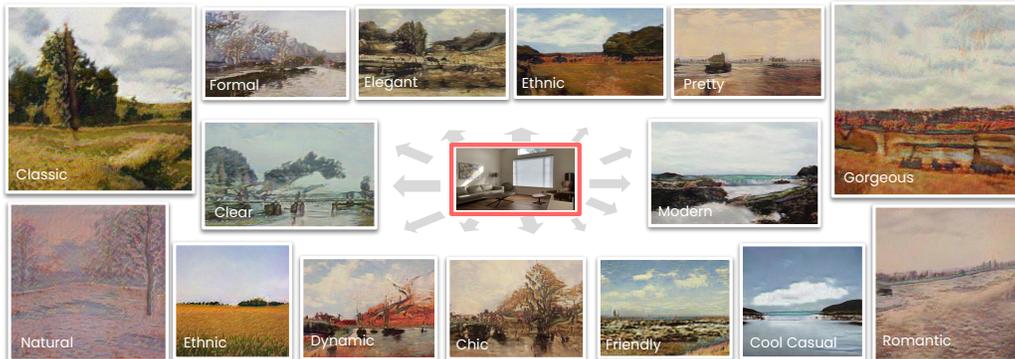


Figure 2: Generated images that promotes the user room into a variety of positive moods

## References

- [1] Sevda Korkmaz, et al., (2016) The correlation between color choices and impulsivity, anxiety and depression. *Electronic Journal of General Medicine*, 13(3):47–50 DOI:10.15197/ejgm.1592.
- [2] Tero Karras, et al., (2020) Analyzing and improving the image quality of StyleGAN. *CVPR*, 1,2,3,5,6,7.
- [3] Mahmoud Afifi, et al., (2021) HistoGAN: Controlling Colors of GAN-Generated and Real Images via Color Histograms. *CVPR*.
- [4] Dongwann Kang, et al., (2018) A method for extracting emotion using colors comprise the painting image. *Multimedia Tools and Applications*, 77:4985–5002.
- [5] Kobayashi S., et al., (1981) The aim and method of the color image scale. *Color Re-search & Application*, 6(2): 93–107.
- [6] Kobayashi S., et al., (1991) Color Image Scale. *Kosdansha International*.
- [7] Lang P.J., et al., (1997) International affective picture system (iaps):Technical manual and affective ratings. *NIMH Center for the Study of Emotion and Attention*. pp. 39–58.
- [8] The Nippon Color & Design Research Institute, (2008) A color scheme to convey the mind. *Kosdansha*.
- [9] WikiArt. <https://www.wikiart.org/>
- [10] HistoGAN github. <https://github.com/mahmoudnafifi/HistoGAN>
- [11] Pytorch based FID score generation tool. <https://github.com/mseitzer/pytorch-fid>
- [12] GanArtist Web Application. [ganartists.com](http://ganartists.com)
- [13] Daniel Wildenstein, (2014) Monet. The Triumph of Impressionism. TASCHEN, ISBN: 3836551012
- [14] Rainer Metzger, Ingo F. Walther, (1988) Van Gogh. The Complete Paintings. TASCHEN, ISBN 978-3-8365-5715-3
- [15] Anthea Callen, (2000) The Art of Impressionism: Painting Technique and the Making of Modernity. Yale University Press, ISBN: 9780300084023
- [16] Martin Benad, Ursula E. Benad, (2004) Trompe-l'œil Today. Illustrated edition, W. W. Norton & Company, ISBN:9780393731309

## 4 Ethical Implications

Beyond the well known ethical implications of using any "deepfake" technologies, this particular project has no extended negative considerations. Creating artworks that promotes the moods of user's rooms helps to improve people's psychological health. Possibly, using the techniques that we described in this paper would make home decoration easier and more fun.

## 5 Supplementary Materials

### 5.1 Strong impressionism flavors in the generated artworks

The images generated from our model convey strong impressionism flavors. Figure 3 compares a couple of generated artworks from our model with one of the most famous impressionist paintings from Claude Monet.

### 5.2 Artworks gallery

The GAN models that we trained on the  $5k$  impressionist landscape and  $5k$  landscape photos often generate breathtaking impressionist landscape images. Figure 4 shows a collection of the generated images based on input room photos with different desired moods.

### 5.3 Licenses and permissions

Our work is based on HistoGAN implementation, which is an open source code with MIT License (<https://github.com/mahmoudnafifi/HistoGAN/blob/master/LICENSE.md>). According to the license



Figure 3: Comparison between model generated images and a real impressionist painting



Figure 4: Artworks generated from multiple trained models on the same training set based on different input photos and desired moods

description, the permissions of usage include commercial use, modification, distribution, and private use. Therefore, we have the proper permission to publish our research results under this MIT License. In addition, we obtained the permissions of using HistoGAN code and data through email communication with the authors.

#### 5.4 Data sets

We used WikiArt impressionist landscape data (<https://www.wikiart.org/>) and landscape photo datasets downloaded from HistoGAN github (<https://github.com/mahmoudnafifi/HistoGAN>). Both are open dataset with no personally identifiable information or offensive content.

#### Checklist

1. For all authors...
  - (a) Do the main claims made in the abstract and introduction accurately reflect the paper's contributions and scope? [\[Yes\]](#)
  - (b) Did you describe the limitations of your work? [\[Yes\]](#) See section 3.

- (c) Did you discuss any potential negative societal impacts of your work? [Yes] See section 4.
  - (d) Have you read the ethics review guidelines and ensured that your paper conforms to them? [Yes]
2. If you are including theoretical results...
- (a) Did you state the full set of assumptions of all theoretical results? [N/A]
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  - (c) Did you include the estimated hourly wage paid to participants and the total amount spent on participant compensation? [N/A]