

COLOR PALETTE GENERATOR WITH K-MEANS CLUSTERING

By - Sayan Das



JUNE 1, 2023

Contents

Introduction.....	2
Data and its processing.....	2
Representation of image	2
Processing the image	2
Clustering using K-means Algorithm.....	3
Results on some sample images	3
Other examples:	4
Conclusion	5
Reference	5

Introduction

In this project, that brings art and technology together, we create stunning color palettes from images. In a world that is increasingly driven by visual aesthetics, understanding the harmonious blend of colors is crucial in various fields, including graphic design, fashion, interior decoration, and digital art. Our project aims to simplify this process by utilizing cutting-edge algorithms to analyze images and generate captivating color palettes that inspire and ignite creativity.

By harnessing the capabilities of artificial intelligence and machine learning, our algorithm delves deep into the intricacies of an image, recognizing patterns, extracting dominant colors. This intelligent analysis enables us to create harmonious and aesthetically pleasing color palettes that resonate with the essence of the original image.

Our platform offers a user-friendly interface that allows you to effortlessly upload any image and witness its transformation into a vibrant palette. Whether it's a photograph, an illustration, or even a snapshot of nature, our algorithm adapts to various genres and subjects, ensuring that the resulting color palettes are relevant and captivating.

Data and its processing

In this project our data would be an image. We have to somehow convert the image in the number. To do that we have to know first how the images are represented. Let's take a look on the representation of an image.

Representation of image

Image representation is different for different kind of images. We only consider the raster images here. Raster images are represented by an array of pixels, the smallest unit of a image. The popular image formats under this type is .jpg or .png etc. We often see the size like (500x400) attached to an image. Let's say in general $n \times k$. It is basically the number of rows and columns respectively in the pixel array. That means there are n pixels through the row and k pixels through the column. There are total $n.k$ amount of pixels.

Each pixel contains only one color (it is the smallest entity of an image). The arrangement of pixel of different colors form the visual impression of the whole image. Now in RGB format every visible color is represented by a triplet (r, g, b) , where r, g, b are taking integer values between 0 to 255. Some special colors in this format are $(0, 0, 0)$ black; $(255, 255, 255)$ white; $(255, 0, 0)$ red; $(0, 255, 0)$ green, $(0, 0, 255)$ blue etc.

Therefore, an image of size $n \times k$ holds $3nk$ ($n.k$ pixels each having 3 values) numerical values. In the project we are given with such an image. We are to process it to apply the model of K-means algorithm and then we are going to extract 6 dominating colors from the image, applying the K-means clustering.

Processing the image

Images in the jpg and png format can be easily read by the PIL package in python. We converted the images to the array format using numpy library. Initially the shape of the array for a $n \times k$ image would be $(n, k, 3)$.

We reshaped the array into the shape (n.k, 3). Here the columns represents the rgb values and the pixels are the rows. We are identifying the pixels as entities or individuals. The reshaped array essentially returns the rgb values of each of the pixels in 3 columns.

Note that the values of the r, g and b has the same range that is from 0 to 255. So there is no need of scaling the dataset.

Clustering using K-means Algorithm

Now we are going to find the dominating colors from a given image. We are going to use clustering algorithm to filter out the most dominating 6 colors.

k-means algorithm or k-means clustering is a popular unsupervised learning algorithm that uses the non-hierarchical clustering techniques to cluster the observations of the dataset. The methodology of the algorithm is described below-

1. Given k clusters, it starts with k randomly selected observations and assign all the observations into the clusters which has the centroid nearest to the observation.
2. Then it re-calculated the cluster centroids, according to the new assignment of point into the clusters, by averaging out the observations within a cluster.
3. Then the algorithm repeats step 2 until the clusters converges.
4. Algorithm returns the observations with the cluster labels

We have applied the k-means on the sample image we have used to building the model. Now the k-means model return the observations with the clusters label. We Have obtained the centroid of the each of the clusters. These centroids will be given by a triplet. These k triplets represents the dominating colors of the images. Since we have given $k = 6$, there will be 6 triplets. Using triplets, we can form the color palette.

Results on some sample images

Now we are going to example, for the code development we have used the following sample image.



Figure 1: sample image 1

After applying the k-means model on this sample image we got the 6 clusters. We have obtained the cluster centroids for each of the 6 clusters. The cluster centroids are as following-

(30, 24, 22), (211, 201, 185), (62, 47, 41), (91, 88, 88), (157, 48, 30), (156, 138, 117)

Each of these 6 triplets represents a unique color, these are the dominating colors of the given image. We obtained the colors corresponding to these triplets and pasted those on a single image to form the palette. The palette is shown below-



Figure 2: Palette for sample image 1

Visually the colors seems to represent the image well.

Other examples:

1. Sample image 2

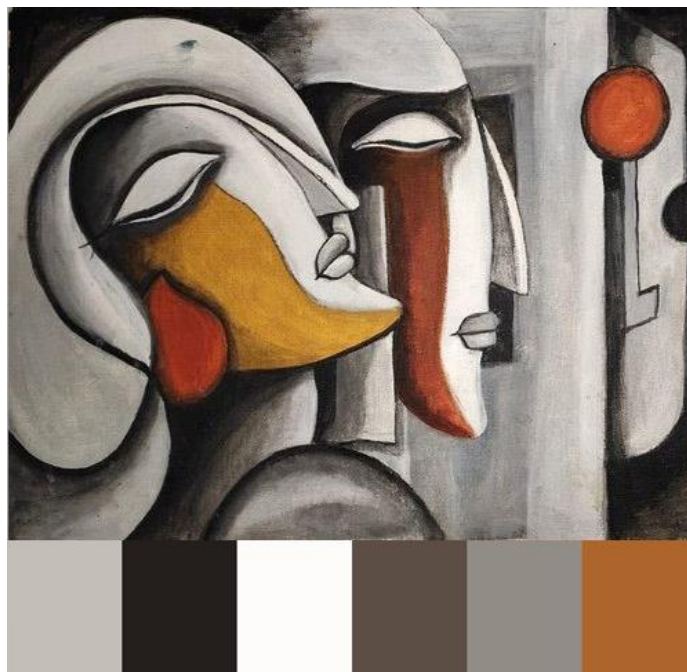


Figure 3: Results for sample image 2

2. Sample image 3



Figure 4: Results for the sample image 3

Conclusion

In conclusion, our project represents a fusion of artistry and technology. By harnessing the power of artificial intelligence and machine learning, we have developed an advanced algorithm capable of analyzing images, extracting dominant colors, and generating harmonious palettes that captivate the senses. Our platform, based on flask app, offers a user-friendly interface that empowers users, whether professionals or enthusiasts, to explore the realm of color and unlock their creative potential.

Through this project, we aim to democratize the process of color palette creation, making it accessible to individuals from various creative backgrounds. No longer confined to the domain of experts, anyone can now effortlessly experiment with colors, find inspiration, and embark on visually compelling design journeys. With our algorithm's ability to adapt to diverse image genres, the possibilities are limitless, be it creating vibrant logos, designing stunning visuals, or curating captivating fashion ensembles.

Reference

The link of the project is given below

1. Project link - <https://github.com/sayandas1302/Color-Palette-Generator>