

Color Segmentation and Palette Extraction App for Use in Recreating Images as Art

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Mobile game platform is becoming more and more popular with good reason. They are easy to learn, easy to access, and they can offer a lot with very little investment from the user in terms of time and money. In contrast, hobbies such as painting can be much more of an ordeal when factoring the time, energy, and costs of simply starting a project. With this in mind, we wanted to create the same experience for users who may have an interest in painting by creating an application. The idea for this application was inspired by the popular paint by numbers activity that allows painters to recreate pieces through a fill in approach. Areas of the image are separated by colors taken from the color palette. One at a time, these areas are filled in, until the entire work is completed. What is great about this activity is its simplicity and effectiveness. Good results can be achieved by those who may be new to painting as a hobby. The application will allow the user to use an image they desire, either one of their own or one that will be provided. The user will then have the option to edit the images by applying a filter that lets them create more interesting pieces from everyday images. The user will then be able to print out their image should they desire. The color segmentation will be handled by a computer vision approach by using image processing techniques to extract the color palette from the image. The segments will then be labeled appropriately according to the colors of the palette. It is through this application of artificial intelligence that users will be able to, accessibly, recreate their own works.

For the palette extraction portion of the project we wanted to take an automated approach by means of k-means clustering. This approach has provided promising results when it comes to accurately extracting brighter colors from everyday environments as well as the speed in which it performs calculations.(Grogan et al., 2018) It is also automated which means that the user will not have to pick out their own colors for the palette, making the application experience easier. Once the palette is extracted, the colors from the palette will replace all the colors that are similar in the original image. At this point a Canny edge detection approach will be applied to define the borders of each color. From this point we can draw in the borders that will be used as guidelines for their piece. The application will be a Java based mobile application and Android Studio will be the IDE of choice for this application. Meanwhile, the computer vision portion of the project will be carried out in Python using the OpenCV and scikit-learn libraries.

Results from the application are expected to be very good in terms of performance. Sources have shown the effectiveness of the k-means method against other applications(Akimoto et al., 2020). In one of the studies looked at, the k-means based palette extraction was able to complete in under one second, which was over 10 times faster than non k-means methods.(Grogan et al., 2018) With proper cleaning of the image, we can expect to see similar results by applying the k-means method for palette extraction.

To get the boundaries between the colors, the use of the Canny algorithm for edge detection will be used for its consistency in producing clear and complete lines. Canny edge detection will be an effective means of determining the color regions here so long as the image has been properly prepared.(Nadernejad et al., 2008) This edge detection algorithm also works primarily with edge detection in greyscale, however, the redistribution of colors to the image should provide more consistency.(Xin et al., 2012)

The rest of the project consists of developing the UI and the implementing additional features such as the addition of filters and printing. The focus of this project is to develop a way to create the separation of images into sections of colors and segment it in a way that is easy for the user to recreate. Therefore, the addition of filters will be most likely be reserved for later work. Art can be a tricky hobby to start getting into as it contains many barriers of entry. One of the most prominent barriers is the thought that painting is difficult for everyone except for the most talented individuals. Another popular deterrent is the cost of entry from the supplies. With the addition of the application, users who may be interested in pursuing a hobby have another way in which they can access this hobby for a low investment.

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