



Picture to Paint By Number

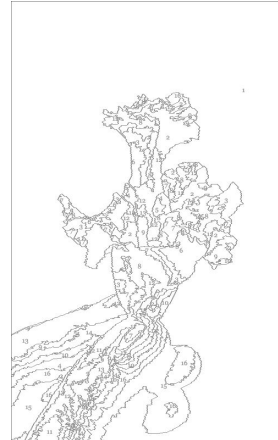
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Project Definition and Requirements



Project Description

Design and implement an application that creates a paint-by-number image for a user-chosen image.





Requirements

1. Open an existing image into your application.
2. Save the image you create to file for later viewing/ printing.
3. Specify the number of colors to use in the painting.
4. Choose the colors to be used in the painting.
5. Choose specific colors present in the image to be used in the painting.
6. Produce the image as if painted using the given palette and outlines.
7. Produce the image containing only the outlines with the number of the paint to use in each region.
8. Offer a “complexity” option that allows both experienced and beginner artists to enjoy Paint-by-number.

Solutions to Requirements



Open an existing image

HTML File Upload

Choose File

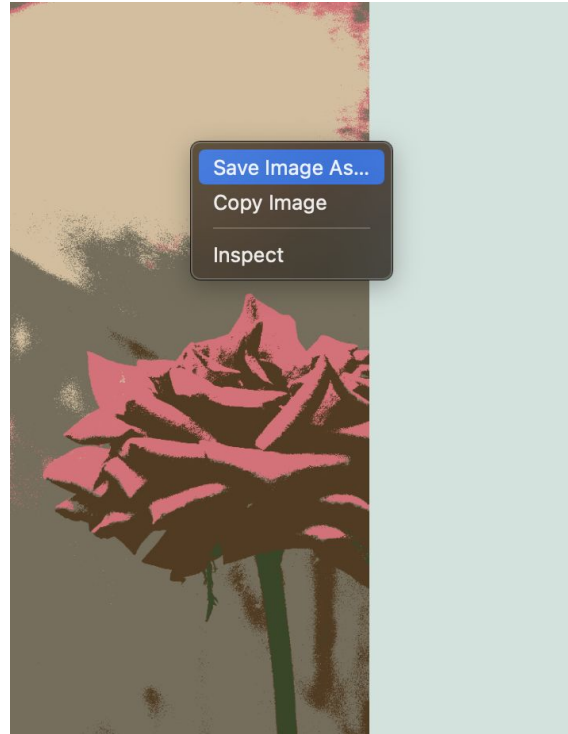
No file chosen

Submit Photo



Save the image

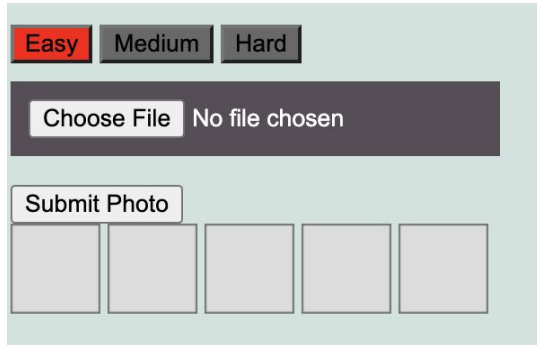
Right click on the canvas



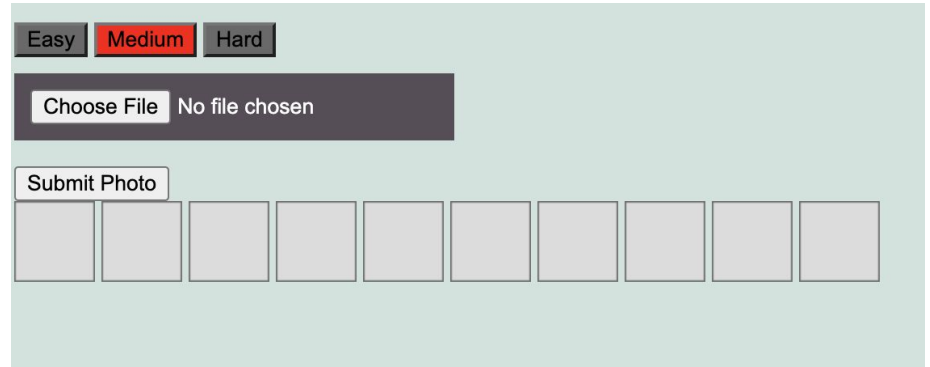


Specify the number of colors/ Complexity

Set levels (easy, medium and hard) that limit the number of colors that can be chosen by the user



A screenshot of a web form interface. At the top, there are three buttons: 'Easy' (highlighted in red), 'Medium', and 'Hard'. Below these is a dark grey bar containing a 'Choose File' button and the text 'No file chosen'. Underneath is a 'Submit Photo' button and a row of five empty square photo slots.



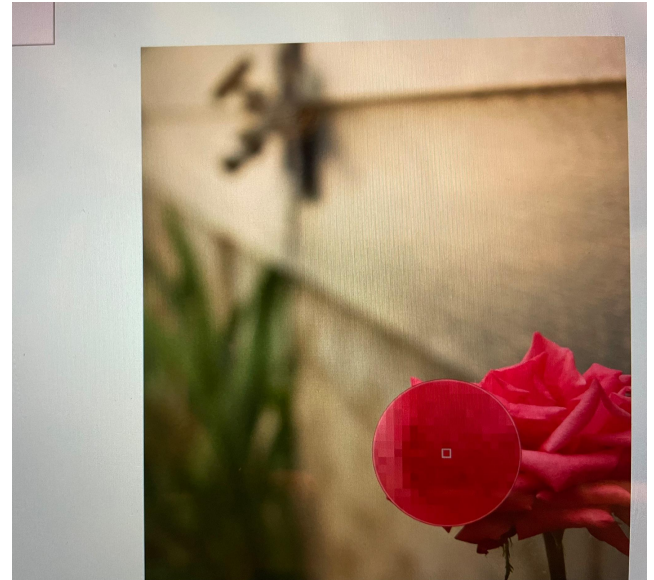
A screenshot of a web form interface, similar to the one on the left but with 'Medium' selected. The 'Easy' button is grey, 'Medium' is highlighted in red, and 'Hard' is grey. The 'Submit Photo' button is present, but the row of photo slots below it contains ten empty square slots instead of five.



Choose the colors to be used in the painting/ choose specific colors present in the image

Javascript eyedropper tool

Problems: Only compatible with some browsers, User can choose a color anywhere on the screen





Produce the image as if painted

KMeans clustering method

Problem: this was originally a very slow process. To speed it up, I adjusted my code to look at every third pixel, and setting the color of the pixels on either side to match the color in the center pixel.



KMeans



Palette:

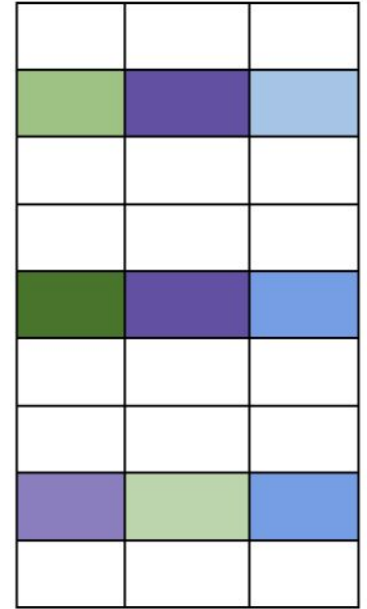
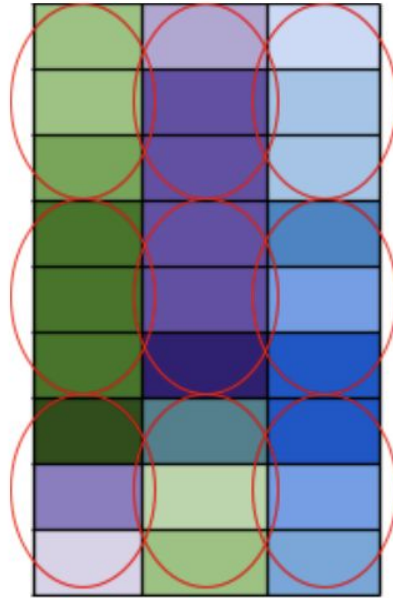
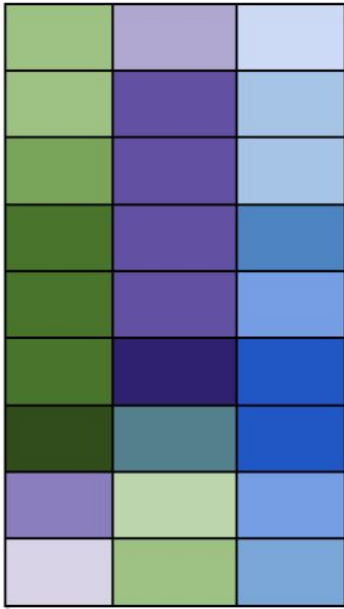


Image Divided into Pixels

KMeans Continued

Palette:



1	3	2
1	3	2
3	1	2

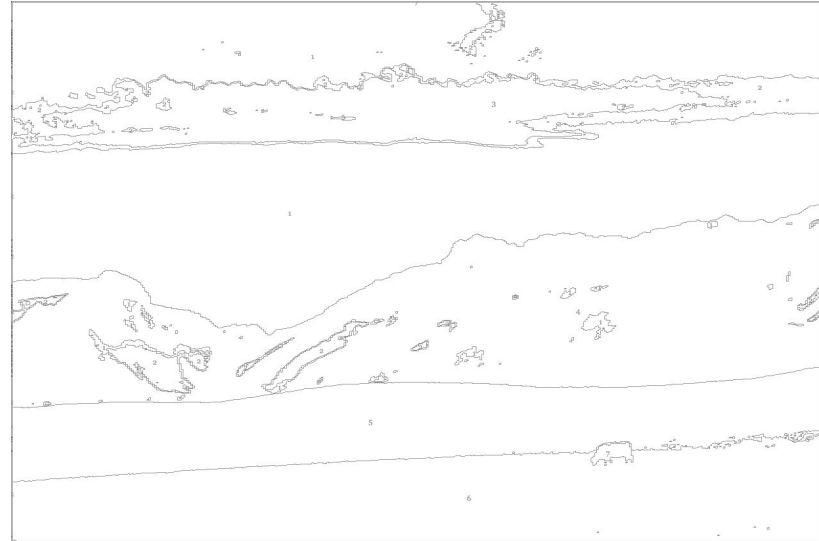
1	3	2
1	3	2
1	3	2
1	3	2
1	3	2
3	1	2
3	1	2
3	1	2

Palette Matrix

Produce the image containing only the outlines with the number of the paint to use in each region

Using my palette matrix, I can determine where the outlines will go based on color changes, and I can look at similar colored regions of the picture and calculate a middle point to put the label.

-Problems: The function that finds label placements runs very slowly

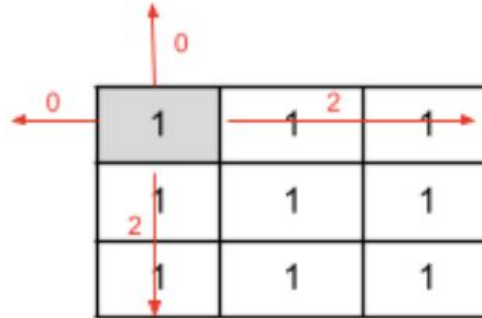


Label regions

1	1	1
1	1	1
1	1	1
2	2	2
2	2	2

Palette Matrix

1	1	1
1	1	1
1	1	1
2	2	2
2	2	2



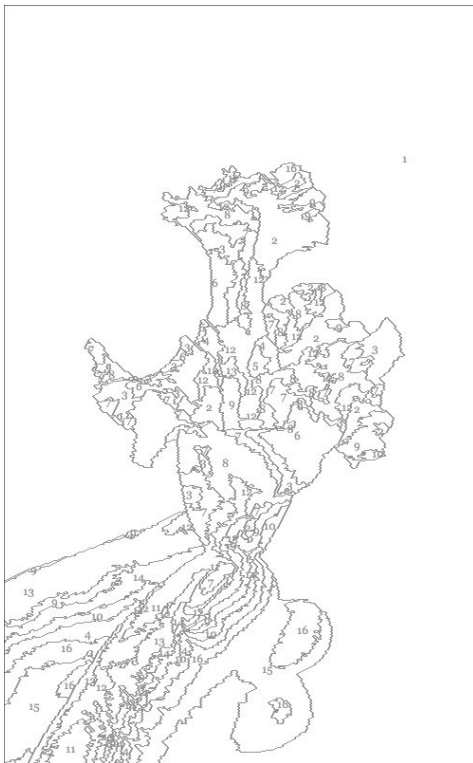
$$0 * 0 * 2 * 2 = 0$$

1	1	1
1	1	1
1	1	1



Demonstration

Level Hard Flower Example





Learning and Development Process



Sources and Methods

- Online resources
- Professors
- Trial and error
- New versions
- Planning ahead/ following a schedule



Extensions

- Increasing the speed of calculating the label placements
- Have a “color” mode where user can click to color in regions using palette colors
- Offer a way for the user to start over
- Include a loading bar so the user knows the program is working
- Allow the user to delete/replace colors in the palette
- Allow the user to print only the photo

Questions?

Calculating Distance Between Colors



Color from image

Color One

R: 249

G: 111

B: 231

Colors from palette:

Color Two

R: 94

G: 212

B: 242

Color Three

R: 244

G: 91

B: 137

Color One and **Color Two**:

$$(\text{Color Two.r} - \text{Color One.r})^2 + (\text{Color Two.g} - \text{Color One.g})^2 + (\text{Color Two.b} - \text{Color One.b})^2$$

$$(94 - 249)^2 + (212 - 111)^2 + (242 - 231)^2 = 34,347$$

Color One and **Color Three**:

$$(\text{Color Three.r} - \text{Color One.r})^2 + (\text{Color Three.g} - \text{Color One.g})^2 + (\text{Color Three.b} - \text{Color One.b})^2$$

$$(244 - 249)^2 + (91 - 111)^2 + (137 - 231)^2 = 9,261$$



Image Data

Image

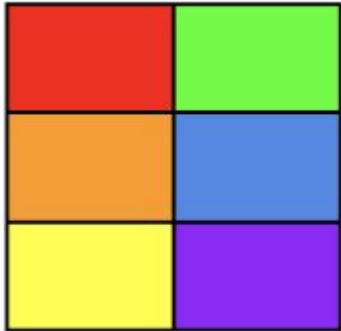


Image Data



Refine



Original Palette:

1	2	3
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1	3	2
1	3	2

Image with corresponding palette colors

Formula to calculate the average of colors:

red: sum of red values/ number of colors

blue: sum of blue values/ number of colors

green: sum of green values / number of colors

(Example) Average of colors associated with Palette Color Two:

red: $(201 + 111)/2 = 156$

green: $(218 + 168)/2 = 193$

blue: $(248 + 220)/2 = 234$

r: 147 g: 196 b: 125	r: 180 g: 167 b: 214	r: 201 g: 218 b: 248
r: 147 g: 196 b: 125	r: 103 g: 78 b: 167	r: 111 g: 168 b: 220

New Palette:

1	2	3
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PERT Chart

