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Implementation on Sketch Colorization

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ABSTRACT: Sketch Colorization is a field that has magnificent demand in the market. As compared to the photo colorization, Sketch colorization is more challenging and it may not have proper texture. In this paper, we proposed entropy based gradient approach for sketch colorization. It gives fast responses with good accuracy. Result of the system is also given in the paper. Also there is an option for users to change colorization to keep or discard colorized output and generate another color scheme. There is manual and auto mode in the proposed system. In manual mode, the user has to select the specific color and in auto mode the user gets an automated colorized image.

KEYWORDS*:* Sketch colorization, Gradient approach, Sigma factor, Entropy, Machine Learning, Image Processing, Rendering, and Drafting.

I. INTRODUCTION

During the art creation coloring is considered a time-consuming process. To create a proper colored sketch, it requires proper color composition and shading. A semi-automatic colorization is beneficial to those who are professionals in this field as well as the novice. The goal of this project is to add a gray image such that colorized image is perceptually meaningful and usually appealing.

Pattern recognition is the process of recognizing patterns by using machine learning algorithm. Pattern recognition can be defined as the classification of data based on knowledge already gained or on statistical information extracted from patterns and/or their representation. One of the important aspects of the pattern recognition is its application potential. Face identification is one of the crucial issues, especially for law enforcement. Police department utilizes this technology to search for suspects on the run and missing people. Unfortunately, the photos of the suspects are not always available. The sketches of the suspects drawn by artists based on the information of eyewitnesses are used as substitutes of photos to recognize and identify suspects. However, the direct comparison of sketches and photos is difficult to do because of the significant difference between those images. Image colorization assigns a color to each pixel of a target gray scale image. This framework consists of two stages out of which first is the Drafting stage which guesses color required region and obtain a color draft by splashing various rich variety of colors over the sketch. In the second stage, it tries to fix and refine the result by detecting artifacts and unnatural colors. This model removes water-color blurring and deformity of color. Here, we are implementing a semi-automatic method that allows users to precisely control over colorization on real-world sketches. No extensive input is required from the users. To achieve this, we borrow the idea of drafting from the artist painting practices. Professional artists like to make drafts before the detail painting on sketches.For this we are using entropy and sigma factor concept. By finding the sigma values of any incomplete region, the region will be completed by drawing an imaginary line based on the obtained sigma values. Entropy will be used for coloring purpose. Entropy basically means a sudden change. By comparing the original and suggested colored image by the user, a new final image will be displayed to the user by coloring the whole image.

Sketch Coloring is the most important but time-consuming process. The system faces major challenges like color inconsistency and saturation. This tool will be helpful for those who are facing this problem. Achieving the task is not trivial as it requires both the sense of aesthetics and the experience in drawing. Even professionals may spend a significant amount of time and effort in producing the right color composition, fine texture and shading details. An automatic or semi-automatic colorization system can greatly benefit the community. With the system, novice artists can learn how to color

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and texture, while experienced artists can try out different color compositions and save much time on the tedious colorization.

Coloring is one of the most important but time-consuming steps during art-creation. Creating an impressive and expressive painting requires a nice color composition and also proper usage of texture and shading. Achieving the task is not trivial, as it requires both the sense of aesthetics and the experience in drawing. Even professionals may spend a significant amount of time and effort in producing the right color composition and fine texture and shading details.

II. PROPOSED SYSTEM

Flow of entropy basedgradient approach for sketch colorization is as given in Fig 1.

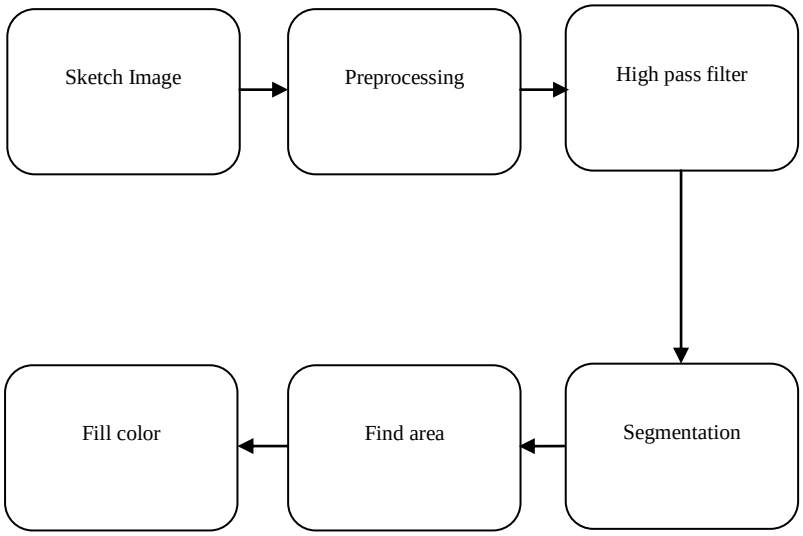

Fig 1: Proposed entropy based gradient for sketch colorization

Sketch is given as an input to the system. Once system accepts the sketch, preprocessing is performed. Preprocessing is necessary to remove the noise in the image. Median filter is used to remove the noise. Median filter is the ideal filter to remove salt and piper noise as it can be occur due to bad light condition or fog on lens while capturing photo of sketch.

High pass filteris used for imagesharpening in the frequency domain. Image Sharpening is a technique to enhance the fine details and highlight the edges in a digital image. It removes low-frequency components from an image and preserves high-frequency components. Preprocessed image is passes through high pass filter to get edges in the images. As edges have maximum information high pass filter is used.

$$HPF = \begin{cases} 0, & I(x,y) < I1 \\ 1, & I(x,y) \geq I1 \end{cases} \quad ...(1)$$

I_1 is a positive constant. $I(u,v)$is the Euclidean distance from any point (x,y).

Entropy of pixels in the filtered image is given as,

$$E = -\sum_{X=0}^{n} P(x) \log P(x) \quad ...(2)$$

Calculated entropy is then used for color shading in further processes.

$$I2 = I * \{ \text{Gradient in x direction} \,||\, \text{Gradient in y direction} \} \quad ...(3)$$

Filtered image is then passed through segmentation algorithm to segment or segregate different objects in the image. Then the area of each object is finding and color is filled according to the equation 1.

Sketch Colorization Algorithm:

i. Input is given as original image and expected image
   Original image: Sketch image
   Expected image: Sketch image with user suggested colors

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ii. Normalize the images by dividing it with 255
iii. Subtract expected image from original image (It subtracts all the common parts from both the images i.e. only the suggested colors remain)
iv. Store the subtracted output in a variable
v. Get the borders of the image with the help of rgb2ntsc function
vi. There are matrices of each color of every image – red, green, blue org_image(:,:,1) = org_image(x,y,z)
In the above equation x represent number of rows, y represents number of columns of image matrix and z represents specific value of color(red=1,green=2,blue=3)
Colon represents that all the rows and columns of image matrix are selected
vii. Calculate the original expected image size
viii. Declare variables and assign them to zero
len=0;
consts_len=0;
width_index=zeros(imgSize*(2*wd+1)^2,1); height_index=zeros(imgSize*(2*wd+1)^2,1);
vals=zeros(imgSize*(2*wd+1)^2,1);
gvals=zeros(1,(2*wd+1)^2);
ix. for j=1:h
for i=1:w
//It works on the color line which we subtracted earlier
//By visiting each pixel, it checks whether the pixel is colored or not and colorizes the uncolored pixel
x. c_var=mean((gvals(1:tlen+1)-mean(gvals(1:tlen+1))).^2);
//It finds out the mean of difference in intensity of color at an input give point and the mean value of intensity at border which accordingly adjusts color inbetween input point and boundary
xi. Calculate the sigma values for incomplete boundaries of the image
//Calculated sigma values helps to complete the incomplete boundaries of the image by calculating the mean value between two incomplete boundaries and drawing an imaginary line between them

III. RESULT

This interface colorizes an input sketch image in two different methods. First one is automatic and second is manual sketch colorization.In automatic sketch colorization, system colorizes the image automatically by considering its own color combinations. It also suggests more than one color combinations for a single sketch image. In manual, it colorizes the image according to the colors suggested by the user. In these two different ways, the user gets final output. Front end of the system is given in following figures.

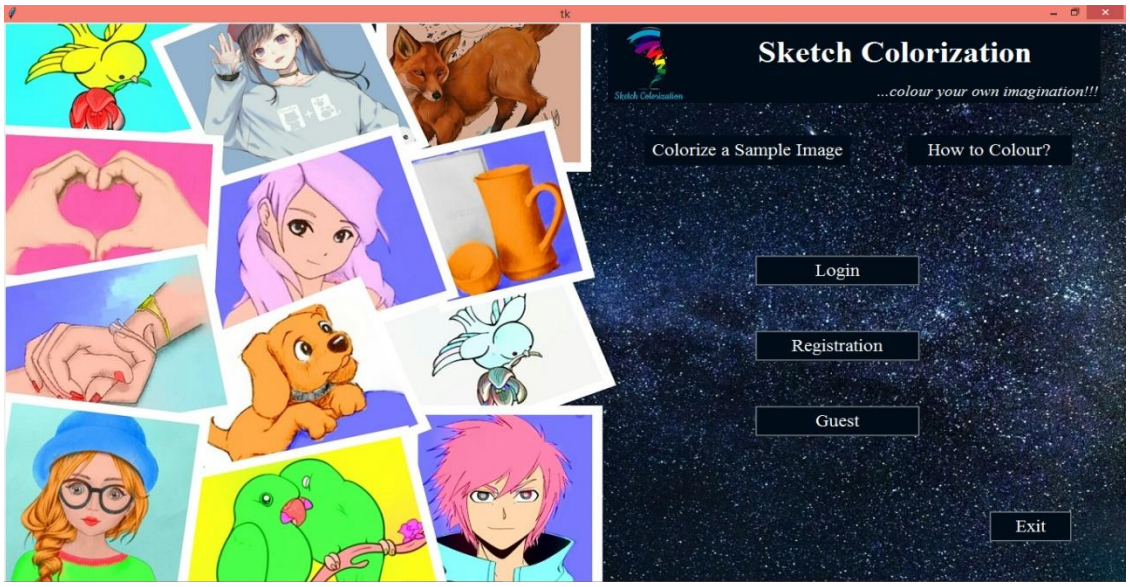

Fig 2: First page of the system

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Fig 2: First page of the system shows the options for the users given when he/she open the application. One has to register so that he/she can keep the track of their previous work. Also there is a guest login option by selecting it one can just use the application without previous history.

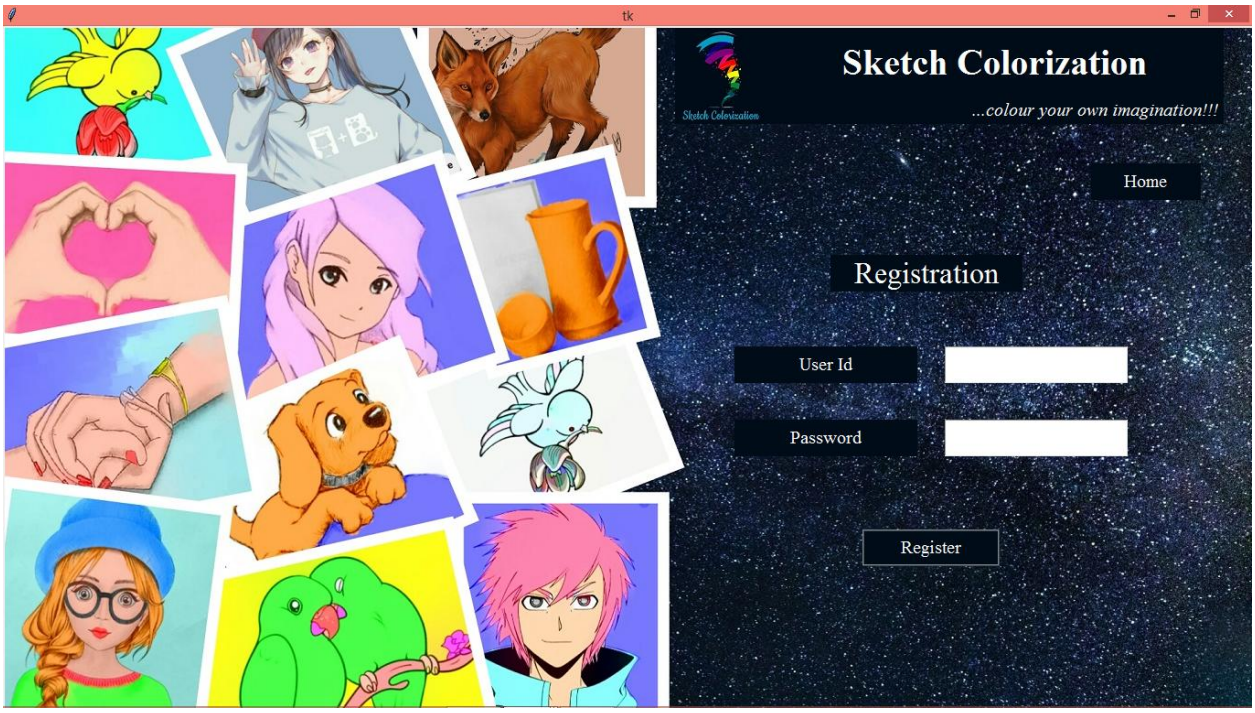

Fig 3: Registration Page

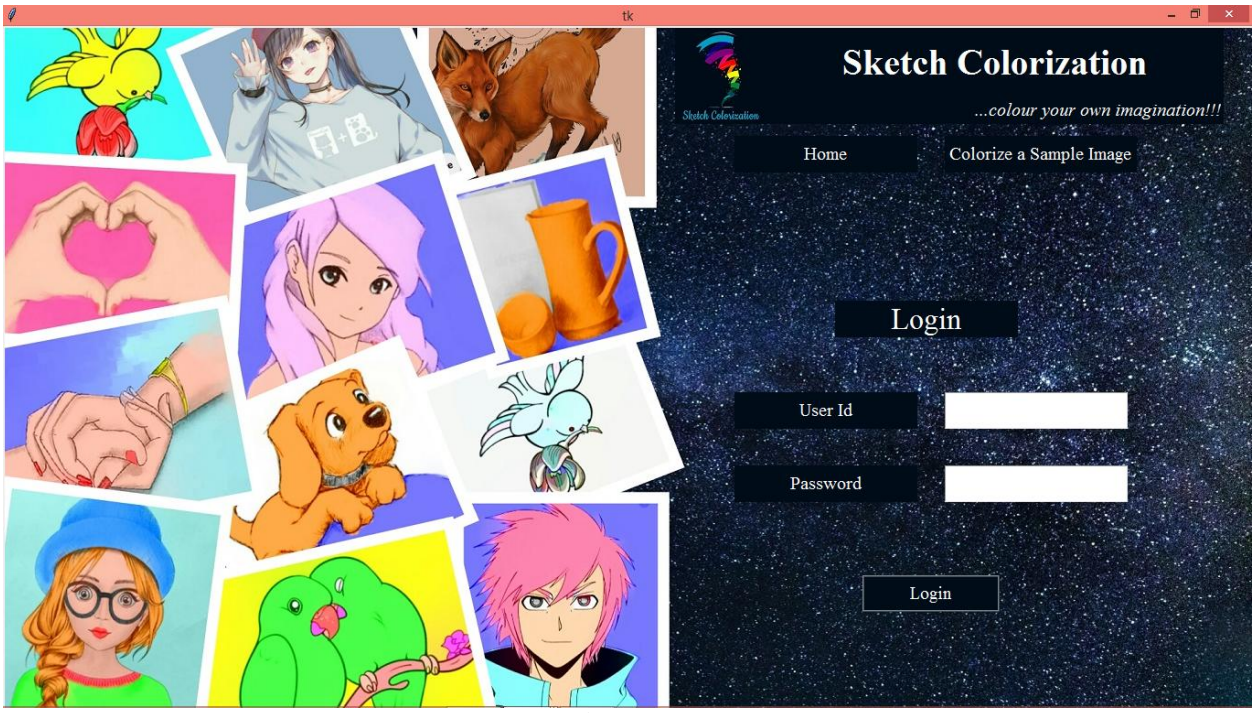

Fig 4: Login Page

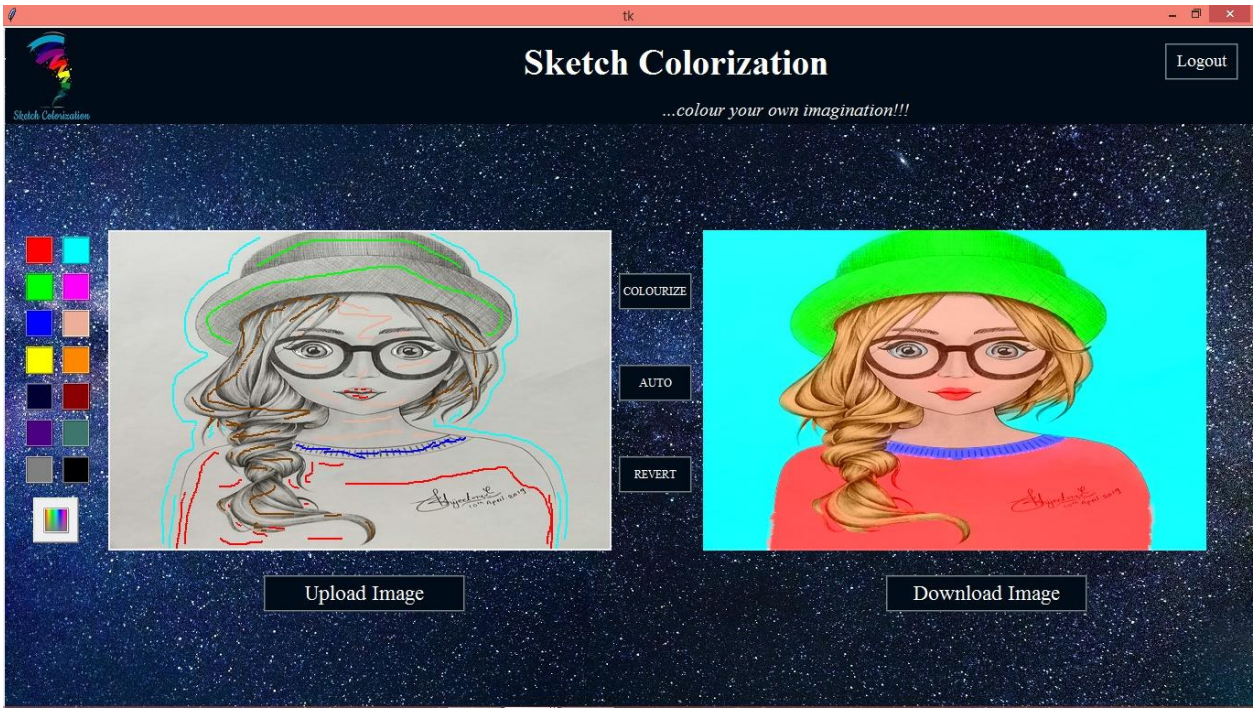

Fig 5: Output of Manual Sketch Colorization

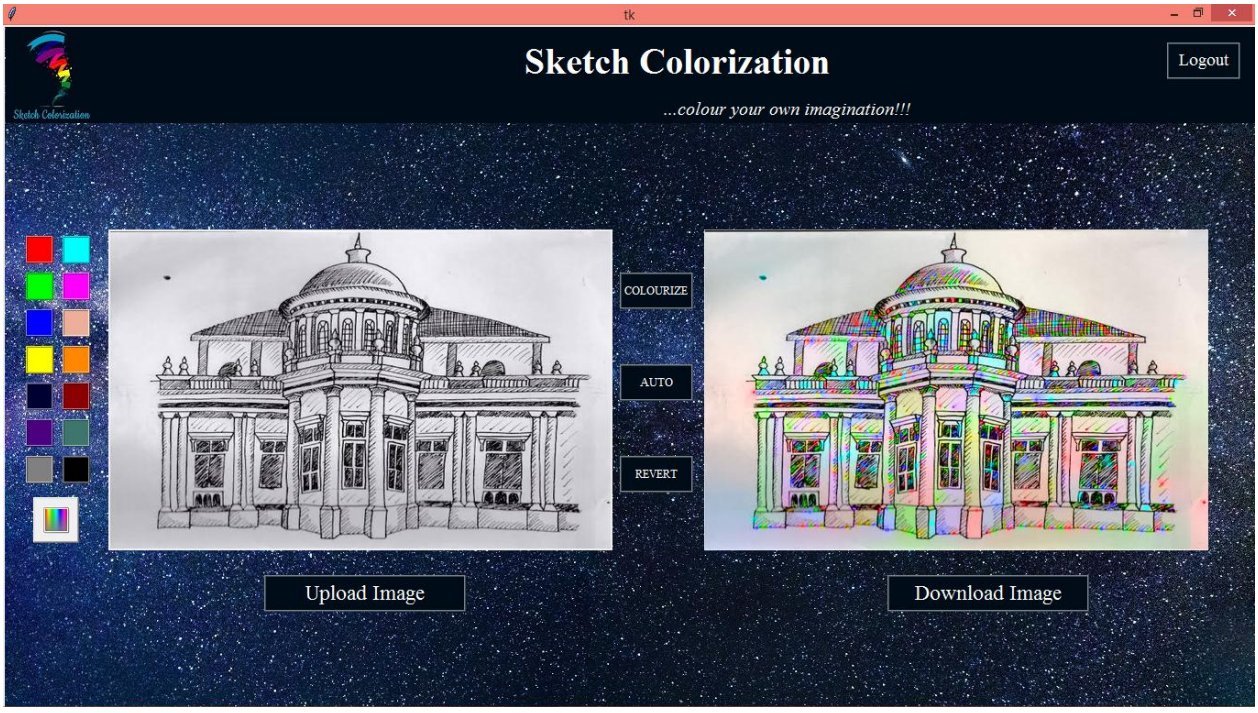

Fig 6: Output of Auto Sketch Colorization

There are two main options to select one is colorize which is used for manual operation and second is auto which is used for automatic colorization.

V. CONCLUSION

Here, proposed entropy based gradient based framework for sketch colorization. This reduces the learning difficulty and raises the quality of the final colorization results. Our colorization system and results achieve the state-of-the-art user experience and visual quality. The proposed refinement model can work independently as a color refinement tool to fix/refine the colorization results of other colorization models.

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