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VIRTUAL HAIR DYE TRY-ON

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INTRODUCTION

In recent years, there has been a growing trend in the use of hair dye as a means of exploring various styles and transforming one's appearance. With the continuous advancement of technology, a new trend has emerged - virtual hair dye. The primary focus of this poster is to introduce a solution for virtual hair dye, with emphasis on the key processes of hair segmentation and recoloring. The proposed solution leverages advanced algorithms and image processing techniques to identify and isolate the hair region in an image. This allows users to preview and apply different hair colors with ease, without the risk or commitment associated with traditional hair dyeing methods. The virtual hair dye technology enables individuals to discover their ideal hair color without any adverse effects.

ABSTRACTION

The problem can be abstracted as follows:

- An image of size w*h with c color channels can be represented as an array of pixels with dimensions (h, w, c) and a target color in RGB format.
- Given an image represented as an array of pixels, we need to build a binary mask to identify which pixels belong to the hair region and then recolor those pixels to the desired hair color.

image

85	3	211
75	11	190
100	111	13

+

hair binary mask

0	1	0
0	1	0
0	0	1

Recolor algorithm

85	90	211
75	98	190
100	111	100

DATASET

CelebAMask-HQ is a dataset with 30,000 high-resolution face images and corresponding segmentation masks for 19 facial attributes. It is used for training and evaluating algorithms in face parsing, recognition, and GANs.

- Manually annotated masks for facial attributes.
- Size: 512 x 512 pixels.
- Classes: 19 classes, including hair.

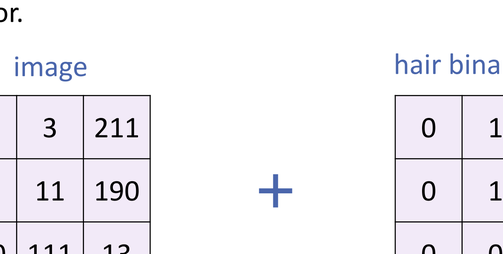


Fig5. Samples of CelebAMask-HQ Dataset

CONCLUSION

The virtual hair dye solution presented in this poster provides a method to change hair color in a portrait image while preserving the hair's shape and texture. By leveraging techniques such as hair segmentation and recoloring, users can preview different hair colors before making a permanent change. However, the recolor algorithm does not work well when changing dark-colored hair to light-colored hair. We have not yet figured out the reason. The future direction of development may include refining the algorithms and improving the user interface.

PROBLEM IDENTIFICATION

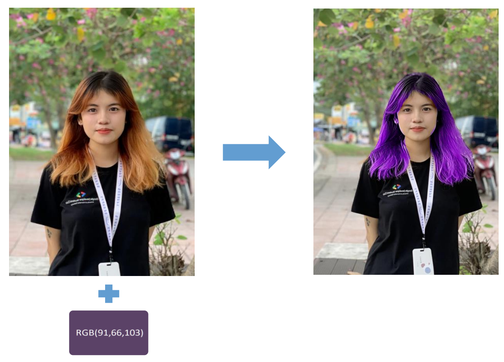
The goal of the Virtual Hair Dye Try-On problem is to identify the hair region of a person in an input image and changes the hair color based on a pre-selected color.

Input:

- A digital image of a colored portrait depicting a real person with visible hair. The hair color and length can vary.
- The image should be in jpg, png, or jpeg format and have an arbitrary size, with a minimum dimension of 128x128 pixels.
- A target color in RGB format.

Output:

- Modified image with changed hair color should accurately match the selected color while preserving the hair's shape and texture.



a. Input *b.Output*

Fig1. Input and output illustration

DECOMPOSITION & PATTERN RECOGNITION

DECOMPOSITION

The overall problem can be split into two primary sub-problems: hair segmentation and hair recoloring. The output of the first sub-problem serves as the input of the second. The hair segmentation sub-problem is then divided into two sub-tasks: face parsing and obtaining the hair binary mask.

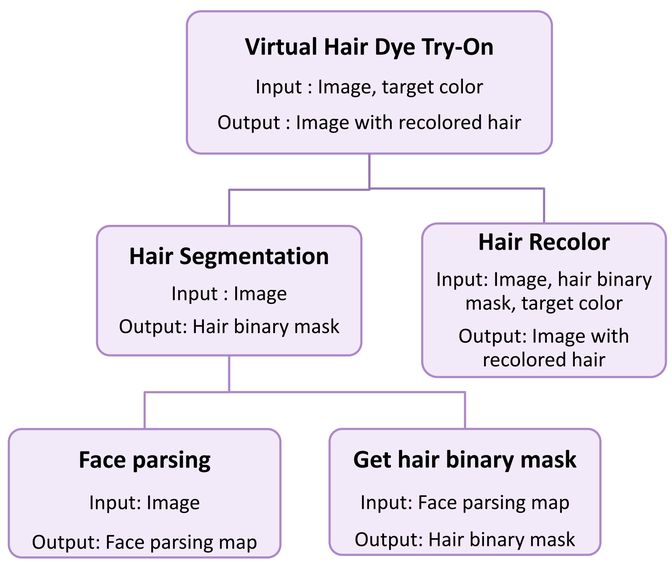


Fig2. Decomposition tree

PATTERN RECOGNITION

Semantic Segmentation

Input: An RGB image of size M x N (width x height).

Output: A matrix of size M x N, where each element is an integer representing the class of the corresponding pixel.

The task of semantic segmentation is to partition an image into distinct regions. Our particular task requires the segmentation of hair and non-hair regions.

Face Parsing

Input: An image containing a human face.

Output: A face segmentation map, which is a pixel-level map where each pixel is assigned a class indicating the region it belongs to within the face: nose, eyes, hair, lips, skin, eyebrows, teeth, or background.

The face parsing problem can be useful in solving our problem by extracting the hair region from the face segmentation map.

Pixel Recoloring

Input: An image and a binary mask that defines the regions needing recoloring, along with a target color.

Output: The modified image where the colors of the specified regions have been adjusted according to the target color.

The Hair Recolor subproblem uses the same input and output as Pixel Recoloring, but focuses on the hair region for recoloring.

ALGORITHMS & EXPERIMENT

BISENET

- BiSeNet (Bilateral Segmentation Network) is a deep learning model introduced in 2018 for real-time semantic segmentation tasks.
- BiSeNet leverages a dual path architecture to capture spatial and contextual information, leading to high accuracy in segmentation.

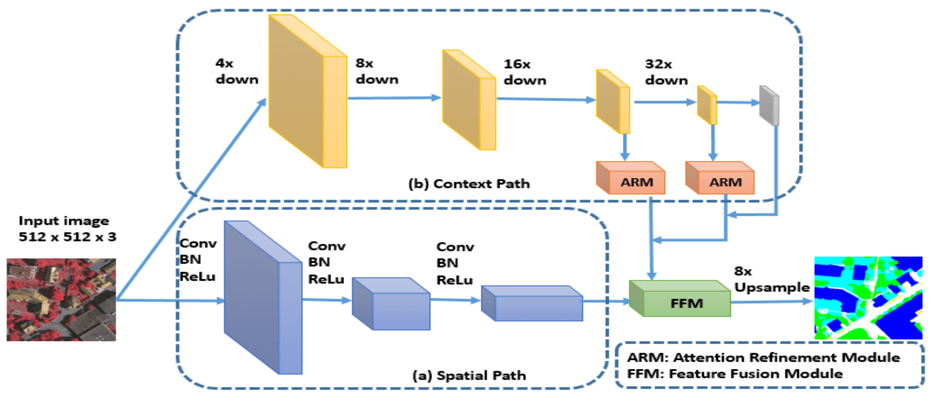


Fig3. BiSeNet architecture

	F1 score	IoU
CelebAMask	0.6838	0.5449

Table 1. Experimental results

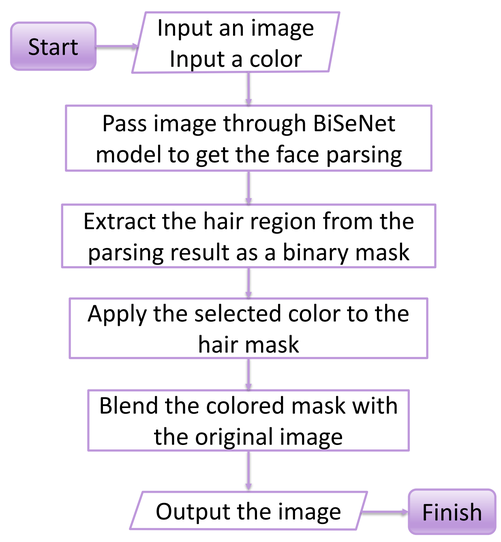


Fig4. Algorithm

METRICS

For hair segmentation sub-problem:

- F1 score
- IoU

For hair recolor sub-problem:

- User ratings (0 -10)