A Hybrid Image-Based Method to Generate Sketching Portrait

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ABSTRACT

In this paper, we describe a hybrid algorithm to create a sketch-like portrait from an input image. First, a user manually selects the face region from the input image. We use an image based method to render the subjects facial features and enhance the shading areas. A stroke based method is then applied to non-face regions to render the silhouette, creases and some dark regions. We show some examples of sketching portraits created by our method and make comparisons to original input images.

Keywords: Sketch, portrait, NPR.

Index Terms: I.4.3 [Image Processing and Computer Vision]: Enhancement—Filtering;

1 INTRODUCTION

Sketching is a classical drawing style that appears in a variety of contexts. Computer generated methods are often used to convert an input image into sketchy styles. But the results are not satisfactory due to the absence of shading variations, vital to express facial information.

Figure 1: The sketch "Angel for the Madonna of the Rocks".

Commercial image processing tools concentrate on edge and silhouette features. Our method includes such features as well, but focuses on rendering a shading effect inspired by the sketching style of Leonard da Vinci (as shown in Figure 1) [3], which emphasizes on the shading and facial features and deemphasizes the surroundings. Our algorithm shares some characteristics with Brooks's method of mixed media portrait rendering [2] such as segmentation and interest in image detail, but our method involves feature and shading enhancement.

2 ALGORITHM

We chose human portrait as our sketch subject due to the great interest from the general public. The objective of our sketching style bears some similar characteristics as Figure 1:
- Exaggerated shading in the face region;
- Curved strokes describing the silhouette and creases;
- Straight-line strokes rendering the dark regions;
- Background blurred away from the face region with a smooth transition.

We implement a method for the above characteristics in the following two stages. In the first stage, based on the given input image, we use image processing to enhance the shading and feature information in the face region. We also blur the image to attain the objective of blurred background. In the second stage, we place curved strokes to render the silhouette and creases and use straight strokes to render the dark regions. We finally perturb the resulting image with a random value to simulate the granulated look of paper texture.

2.1 Shading and Feature Enhancement

In order to manage the shading and feature information, we use the tone management approach introduced by Bae et al [1]. For a given input image, we apply a bilateral filter to get the base layer and the detail layer. For the base layer which contains the shading information, we want to control the proportion of pixels with low intensity, medium intensity and high intensity; we achieve this with histogram matching. Since the detail layer bears the feature information which is generally contained in the low intensity pixels, we discard the high intensity portion by clipping the high intensity part of the histogram. With a similar method we get the feature enhanced detail layer. The process is shown in Figure 2.

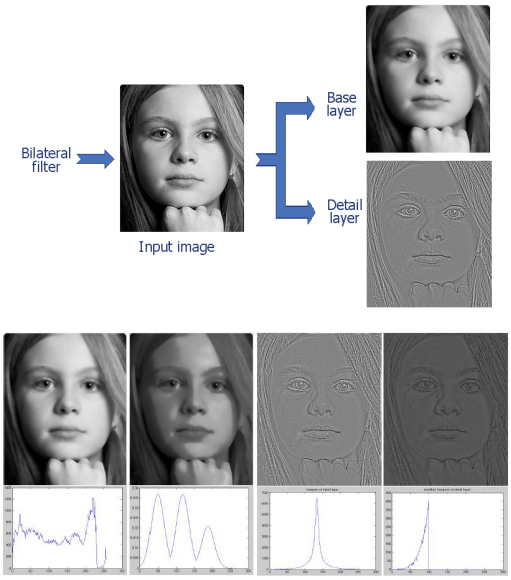

Figure 2: The shading and feature enhancement on two layers.

We then recompose the shading enhanced base layer and the feature enhanced detail layer. To simulate the effect of a background blurred away from the face region, we blurred the non-face region as shown in Figure 3. The face region and non-face region of the original image is segmented manually.

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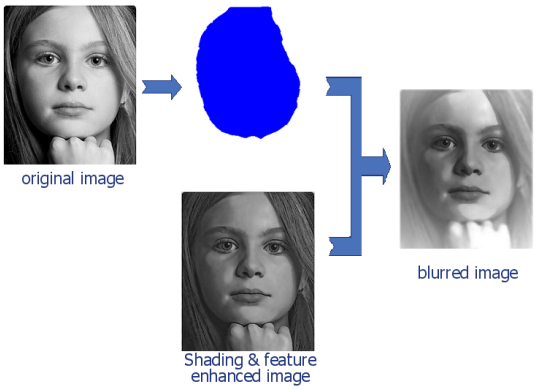

Figure 3: The process to blur the non-face region of the shading and feature enhanced image.

2.2 Stroke Rendering

The strokes of curves that describe the basic shape such as the silhouette and creases are obtained by Canny edge detection. The process is shown in Figure 4. Straight lines are used to render the shading and to imitate some quick pencil scratches which often appear in many sketch works. More strokes are placed in low intensity regions of the image. The result is shown in Figure 5.

3 Results and Discussion

Figure 6 shows some results obtained by the above method. For some input images with flat shading such as the first image, we successfully enhance the original flat shading to three distinct shading levels such as the dark shading in the areas of eyes and cheeks, medium dark shading in the nose, and highlights in the forehead and chin. For the input images with more obvious highlight regions and dark regions such as the second image, we keep the original well shaded information (such as the nose region) and enhance some features (such as the eye region).

Our current algorithm still has some drawbacks. The rendering result depends on the quality of the input image. If the input image is of low resolution, the shading and feature information is difficult to enhance. If the input image contains large areas of flat shading, say a large area of pure white or gray, it is hard for the algorithm to enhance the shading into distinct levels. Another drawback is the segmentation of input image into face region and non-face region. In the current implementation, users need to do the segmentation manually; in principle, face recognition could be used to extract a mask automatically.

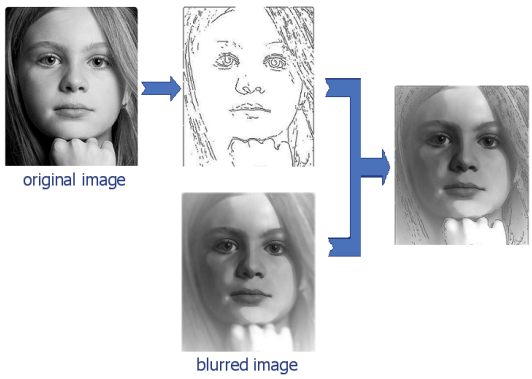

Figure 4: The process to render silhouettes and creases.

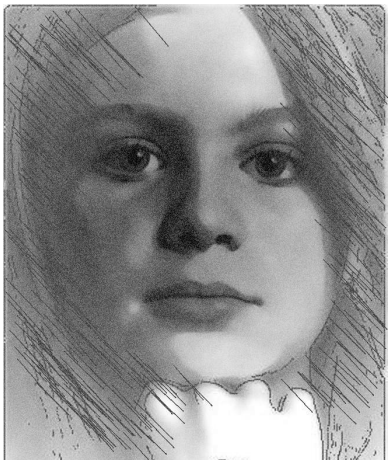

Figure 5: The process to apply strokes on a blurred image.

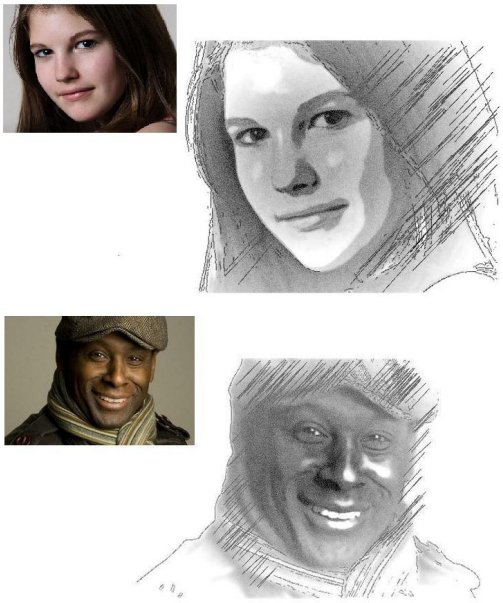

Figure 6: Input images and the output sketch-style portraits.

References

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