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EDGE PRESERVING ENERGY MINIMIZATION OF FACIAL SKIN SMOOTHENING

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Abstract-*The facial skin smoothening by edge preserving energy minimization using adaptive region aware mask. By using region aware mask three major skins attribute homogeneity, lighting, and color is used to beautify the face. This paper intends an input image which is decomposed into three different layers by using edge-preserving filter. After decomposing the facial landmarks and significant edges as the restraint, layer masks which are generated based on the guided image of energy minimization technique. Next, facial land marks and important features are extracted as input constraints for mask generation. The Experimental results show that the proposed method determines the ability to beautify the face.*

Keywords: Facial Enhancement, Edit Propagation, Edge Preserving Energy Minimization.

I.INTRODUCTION

Photography is actually the art of capturing the beauty of life, the act of appreciating 'the moment,' and used as personal database in one quick snapshot. people continuously have tried to improve the result and got more beautiful faces by applying various retouching techniques. A universal definition of beauty remains ambiguous, but our perception of facial attractiveness indicates that machine-based analysis of facial beautification will probably have many useful applications, as well as roles in research. This paper presents a novel system to remove facial wrinkles, scars and pores for an image. The facial skin complexion and color are important attractive factors, and most people consider that a good picture should be scar free and have smooth facial colors

Facial skin smoothening is a widely used technique. This is used for advertisement, magazines, and websites which manipulate large amount of facial image every day. There are some commercial image-editing software systems are available (such as Adobe Photoshop) but still it is a time-consuming task. Furthermore, image enhancement and image sharing are becoming more popular as social networks (e.g., Facebook, LinkedIn, and Flickr).Most users require immediate facial beautification with the minimum number of operations to avoid tedious manipulations. Thus, it would be useful to develop a face image beatification technique that is effective, convenient, and flexible.

In this paper, specifically focus on facial skin beautification [1]–[3],which is one of the most important and time-consuming tasks, during face image retouching facial skin is manipulated, the edited regions should be selected accurately by a facial mask to avoid ocular artifacts. It is possible to draw (or paint) a mask manually, but it complicated. Therefore, it is necessary to simplify the task of mask generation during facial skin beautification. For face image retouching there are many studies such as facial geometric beautification [4], digital facial makeup [5], personal photo enhancement [6].

2. LITERATURE REVIEW

According to the recent research there are two types of method is used to generate the facial mask for facial skin beautification. The first method regards facial mask generation as a specific image segmentation problem, which involves integrating the skin color or shape into a segmentation model [1]–[3]. This approach avoids the annoying task of mask painting, but the mask boundaries often fail to follow the region boundaries closely, which may introduce visual artifacts.

The second method is used for improving mask generation which is constructed much simpler and more collective. The method which is used to manipulate the tool called as edit propagation technique [7], [8]–[10] which diminish sparse or spots throughout the entire

image according to the pixel affinity [10].The main advantage of edit propagation is to produce the boundaries between the different region.

The automatic region aware mask generation method is used to overcome the problem of above method basically it is used for facial skin beautification which is based on edge preserving energy minimization framework introduced by Lischiniski *et al.* [11].

The main advantage of edit propagation is its edge-aware property, which produces flexible transitions between the boundaries of different regions without any user interference. For this region, generally this method has been applied to many image-editing problems, such as colorization [8], high-dynamic range [9], image matting [10], and tonal adjustment [7]. At the time of facial skin beautification, different regions need to have different edge-aware levels, depending on their editing properties. Yet, existing edit propagation methods based on homogeneous parameters which may fail to produce specific variable propagation effects for facial masks.

To overcome the problem of edit propagation technique the method which is used to propose called as automatic region aware mask generation method for facial skin beautification, which is based on edge preserving energy minimization framework which is introduced by Lischiniski et al. [11]. The original model applies sparse user scribbles as input constraints and to propagate the values of inputs to other regions, according to the gradient property of a guided image. To simplify this first to replace the user scribbles with rough regions, which are selected by face feature detectors. For adaptive edit propagation, the original model is divided into two aspects. First, it generalize the guided image to a guided feature space, in which it gets more feature information [12], [13], [14] is used to guide the propagation.

The facial skin smoothening framework encompasses into three skin properties which can be manipulated into two schemes: automatic and interactive. First the input image is extracted from the data base .The image which can be extracted is decomposed into three layers with respect to each skin property which is based on edge preserving smoothing filter[18].Next facial mask is generated for three layer which allow the users to control the beautification by adjusting its skin parameter. The skin parameter which is adjusting it is optimized automatically on data and knowledge base.

3. FACIAL SKIN BEAUTIFICATION FRAMEWORK

Some related techniques which are used for facial skin beauification is facial geometry beautification, facial attractiveness prediction, skin manipulation, and some commercial systems. There are also some related techniques are used such as photo enhancement, edit propagation, and face segmentation.

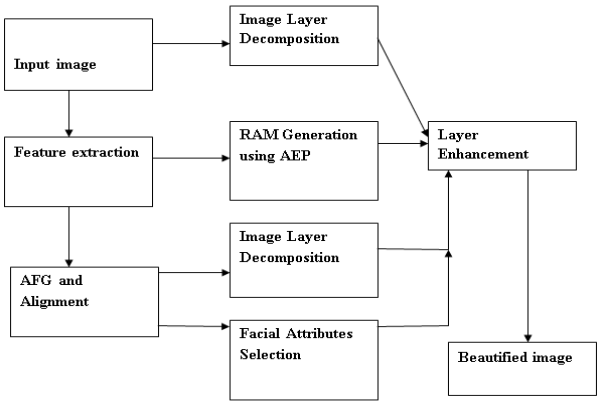


Fig-1: Process of Facial Skin Beautification Framework

Facial attributes that effect the attractiveness studied by Blanz and Vetter [19], [20] using 3-D morphable models to generate attractive faces. There are three main attributes that influence facial attractiveness [15]-[17] such as skin homogeneity, lightining, color. The skin segementation map generated by Lee *et al.* [3] used (GMM) Gaussian mixture model. The automatic skin color enhancement performed by Chen *et al.* [2] based on color temperature and using a bilateral filter with poisson image.

For facial skin beautification there are two key components in the framework: first key is region-aware mask generation and second key is image layer enhancement. Facial skin enhancement generate the mask for a specific layer as well as image layer handling automatic and interactive manipulation based on the related psychological knowledge and average face formed from an example set.

The preprocessing steps in all the faces consist of the images are located, along with their basic features. This is done by first generating a bounding box around each face, later on it identifying the location of the chin, nose, mouth, eyes, and eyebrows of each person.

Face detection is accomplished using a multi-view face detector based on the Viola-Jones technique [21], which emerges in such a way that the classifers in the early stage quickly discard simple non-face regions and in the latter stage it has designed to classify more

complex cases. Using AdaBoost algorithm each classifer is made up of a set of weak binary classifers, which are learned from a training set.

In this paper to extract face from given image, many algorithms have been proposed. Viola et al. proposed an efficient face detection technique [21].

3.1 IMAGE LAYER DECOMPOSITION

In image layer decomposition our framework manipulates separately the skin lighting, homogenity, and color. A picture is separated into three image layers according to the skin attributes, as shown in fig. 2. The input image *I* is converted into CIELAB color space which is commonly used in human perceptual and facial attractiveness [16].The converted input image is composed into two layer one is lightness layer L^* (I_L^*) and two color layer $a^*(I_a^*)$ *and* $b^*(I_b^*)$.The chromaticity channel (color) are regarded as color layer I_C. Next the edge preserving smoothing filter is applied to the luminance chnnel(lightness) to capture its large-scale variations, which is regarded as the lighting layer *IL*. Last, the lighting layer is subtracted from *IL*∗ and the result is obtained as the detail layer *Is.* The edge-preserving smoothing filter is based on a weighted least square frame work WLS framework [18] to separate the lighting and detail layers. The WLS filter is more suitable for detail manipulation as compare to the bilateral filter [22]

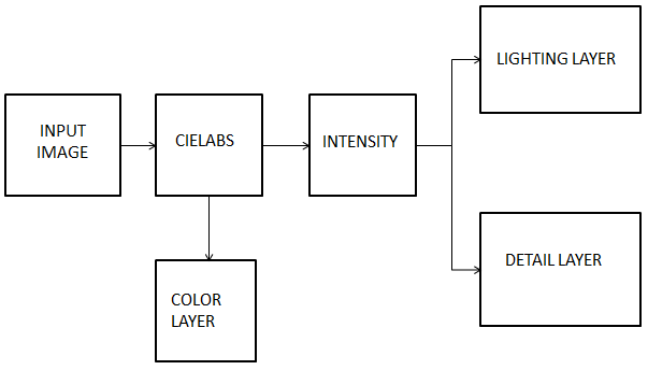
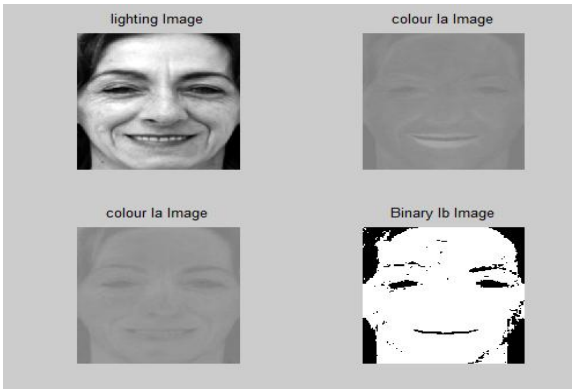


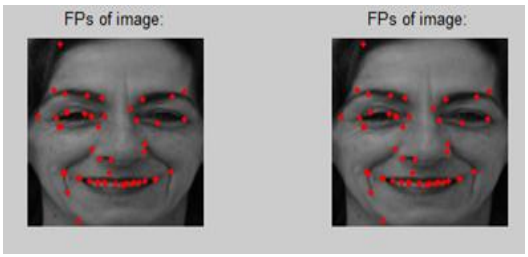
Fig-2: Process to Separate the Input Image into Facial Skin Layer

3.2. FEATURE EXTRACTION

The main aim of feature extraction is to locate significant facial regions, which are used as the input image for mask generation. Important features of facial components such as eyes, nose, mouth, lips. All this important feature detectors integrate into the framework, but this implementation is not an easy task. By analyzing these features in this paper it include facial components and regions with meaningful facial attributes. For analyzing these important features we use the Viola–Jones face detector [21] and the active shape model (ASM) [23] which locate the 86 landmarks in the facial components.



(a)



(b)

Fig-3: Feature Extraction

In facial skin smoothening fig.3 represent the extraction of features.It is nothing it takes the detail from the image, here we use the DCT for the feature extraction. DCT is nothing but the discrete cosine transform.After extracting features from the image, the extracted features in the form of numerical.

3.3. ADAPTIVE REGION AWARE MASK

The region aware mask generation is used to manipulate the skin or to remove unwanted details such as (spots), wrinkles or it adjust facial attributes (such as the skin color) in certain face skin regions, without disturbing other information in such regions like background as well as the edited region control the degree of adjustment using specific layer masks for skin lighting, smoothness, and color enhancement. The region aware mask generation method is using the adaptive edit propagation techniques which remove the tedious mask painting. In our method, first we extract the facial features which are treated as input constraints. The

constrained regions are propagated pixel values flexibly throughout the entire image according to the guided information .Basically Implementation of adaptive region aware mask generation is based edge preserving energy minimization. Which was originally proposed by Lischiniski *et al.* [11] for tonal adjustment?

$$M = argmin_M \{\sum_z w(z)(M(z) - R(z))^2 + \sum_Z h(\nabla M, \nabla G)\} \quad 1$$

$$h(\nabla M, \nabla G) = \lambda \left(\frac{\|M_X\|^2}{\|G_X\|_P{}^{\alpha(Z)} + \varepsilon} + \frac{\|M_Y\|^2}{\|G_Y\|_P{}^{\alpha(z)} + \varepsilon} \right) \quad 2$$

Equation (1) represent the data term, which shows that mask M satisfies the facial constraint R. The weight w is used to indicate the constrained pixel, where $w \in [0, 1]$. A larger weight value indicates that the values of M and R will be more similar. In R, the constrained region is determined by the extracted facial features. The second term in (1) is the smoothing term, which is responsible for keeping the gradients of the mask M as low as possible, except across the significant gradients in G. generalize the guided image from the original model of Lischiniski *et al.* [11] to a guided feature space, which means that richer facial information can be used to guide the propagation. Equation (2) shows the details of the smoothing term,

3.4. DETAIL LAYER

The deatil layer of features extracted from the image of input is in the form of numerical data.The detail layer of frequency called as low frequency data and high frequency data.

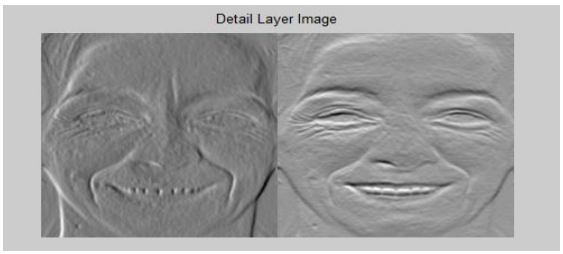


Fig-4: Detail Layer

3.5. CONTROL POINT EDGES

The use of Edge detection create the landmarks or called as control points of different layer .For different layer of region different masks is generate. The control points of edges shows the features point where the implementation is done by using canny edge detector algorithm.

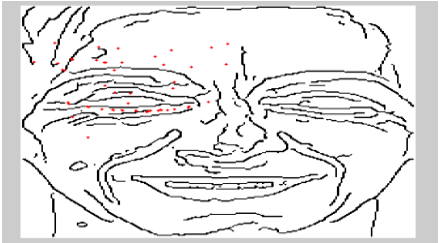


Fig-4: Edge Detection

3.6. EXPERIMENTAL RESULTS

The performance of the facial skin beautification system is evaluated by subjective examination. Based on several original input portraits, it can be observed that the proposed system generates visually pleasing portraits, and the resultant portraits are more attractive than the original ones. Overall, our proposed human facial beautification system is quite useful for beautifying the portrait. The qualitative experiment evaluation for our method was performed on database, that is, the FEI database [24], The GUI system is used to access our facial skin beautification. During automatic skin manipulation user enhanced the image using push button as well as in GUI system.

Fig.-5: GUI system for facial skin beautification. Here, we illustrate a screenshot of a prototype of our facial skin smoothening application Comparisons With original image

Result of facial skin enhancement worked on data base implementation first it extract the face from the image of input stored in the database folder then simultaneously feature is extracted and layer decomposition such as, lightning, color, smoothness, for this three layer mask is generated by using region aware mask which removes the noise, blurriness, artifacts clearly as compare to other method. By visualization its clearly shows that facial skin enhancement is enhanced image better with respect to MSE and PSNR

4. CONCLUSION

In this paper, by using facial technique, system can enhance the skin by developing unified framework for specific facial smoothening in terms of the skin homogeneity, lighting, and color. In this framework skin smoothening first extract the face from the input image as well as decomposition of image layer by using edge preserving smoothing filter based on WLS[18] to separate the lighting and detail layer. This method is used to generate the mask for specific facial beautification. The region-aware mask allows the user to perform more flexible and effective skin manipulations.

The important facial features include facial components. (e.g., eyes nose and mouth) which assume that significant edges in the face region are caused by meaning full facial attributes (such as expression, beards, or hair).canny operator is used in the system for edge detection .Further we proceed to enhance the image by using edge preserving energy minimization which generate the mask as well as GUI system that facilitates automatic and interactive facial skin smoothening.

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BIOGRAPHY

Priyanka Mehra received the B.E. degree in Instrumentation & Control from IITM College RGPV, University Bhopal MP India, in 2007. Currently, she is a pursuing Master of Engineering from Imperial college of Engineering and Research, Wagholi, Pune, Maharashtra SPPU University. Her current research interests include," Edge Preserving Energy Minimization of Facial Skin Smoothening".