Photorealistic Aged Face Image Synthesis by Wrinkles Manipulation

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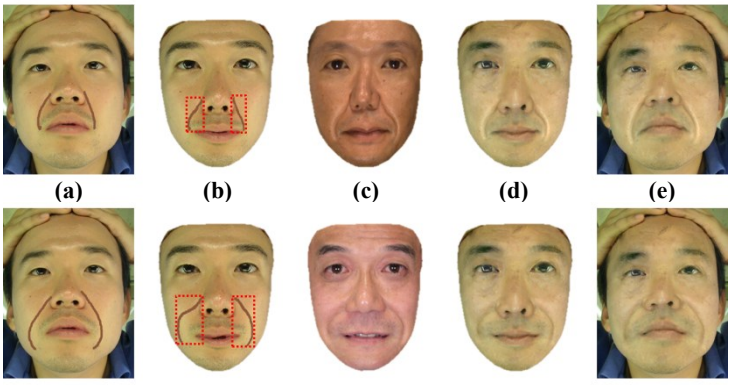

Figure 1: ***Process and Results*** **(a)** Original image with freehand wrinkles (24 year old), **(b)** Image normalized to the average face model, **(c)** Best matched wrinkle image selected, **(d)** Cut&paste wrinkles of (c) into Figure 2(b), **(e)** Image normalized to the original geometry

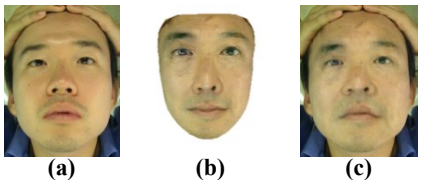

Figure 2: ***Results of Tazoe's Method*** **(a)** Original image (24 year old), **(b)** Result by Visio-lization (45 year old), **(c)** Image normalized to the original geometry

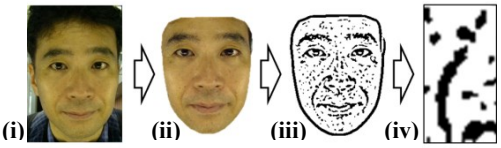

Figure 3:
Extracting wrinkles from the database face image

1. Introduction

Many studies on an aged face image synthesis have been reported with the purpose of security application such as investigation for criminal or kidnapped child and entertainment applications such as movie or video game.

Tazoe et al. [2012] proposed a facial aging technique based on Visio-lization [Mohammed et al. 2009]. Their results described skin texture such as rough or dull skin which helped in determining a person's age.

However, in their method, representing wrinkles—one of the most important elements in reflecting age characteristics—is difficult because the selection of patches is influenced by lighting conditions and individual skin color, rather than a wrinkle's shape or edge.

Additionally, it is difficult to infer the location and shape of future wrinkles because they depend on individual factors such as living environment, eating habits, and DNA. Therefore, we have to consider several possibilities of wrinkles locations.

In this paper, we propose an aged face image synthesis method that can represent clear wrinkles by reducing the influence of the lighting environment and individual skin color owing to an image binarization process. Then, we synthesized realistic aged-related wrinkles by adding artificial freehand wrinkles onto the face image. Our contribution is to provide interactive tool that can create plausible aged face images for criminal investigation or entertainment, and to be able to represent wrinkles at any optional location user want to add them with photorealistic quality.

2. Aged Face Synthesis

2.1 Reconstruction of original image: Here, assuming that, input age is 24, and objective age is 45. First, utilizing Tazoe's method, we divide a 2D face image into small square patches and replace the input patches with patches from 45 year old database. Based on the criteria of Euclidean distance about pixel color information, the most similar patches are selected from the database.

2.2 Wrinkle extraction: First, we draw freehand wrinkle lines on an original image, as shown in Figure 1(a). Then, we normalize it by fitting to the average geometry, and determine the rectangular area of each wrinkle, as illustrated by the dotted line in Figure 1(b). Next, wrinkle extraction from a face image in the database is performed by the following steps(Figure 3):

(i) Select face images which are age at about 45 in the database
(ii) Normalize the images to the average geometry
(iii) Apply adaptive binarization and remove granular noise
(iv) Extract wrinkles with the same rectangle size as input wrinkles

2.3 Selection of the best matched wrinkles: Wrinkles that are the most similar in shape to the freehand wrinkles are automatically selected from the database. The similarity is calculated by pixel to pixel comparison of the database's binarized wrinkle images and the input wrinkle image. Then, the number of pixels with equal binarized values between the database and input images is counted.

2.4 Pasting of wrinkles: The selected wrinkles are pasted into the Tazoe's result using the seamless cloning method proposed by Perez et al. [2003]. This method allows us to preserve the gradients of the best matched wrinkles by applying the selected wrinkles to the appropriate area of a face image (45 year old), as shown in Figure 1(d).

3. Result and Conclusion

As illustrated in Figure 1, the results show that our method can add realistic wrinkles that are similar to freehand wrinkles. The results of Tazoe's method are shown in Figure 2. By comparing our results (Figure 1(e)) with Tazoe's results (Figure 2(c)), it is evident that we succeeded in generating a face that looks 45 years old precisely.

We selected the best matched wrinkles by reducing the influence of lighting conditions and individual skin color by adaptive binarization and consequently could generate elderly faces easily and interactively by adding freehand artificial lines. In the future, it will be necessary to conduct subjective evaluations to verify the performance of our method.

References

TAZOE, Y., GOHARA, H., MAEJIMA, A., AND MORISHIMA, S. 2012. Facial Aging Simulator Considering Geometry and Patch-tiled Texture. *ACM SIGGRAPH2012 Posters Article No.90*.

MOHAMMED, U., PRINCE, S., AND KAUTZ, J. 2009. Visio-lization: Generating Novel Facial Images. In *Transactions on Graphics (Proceedings of SIGGRAPH 2009)*, vol.28, ACM, No.57.

PEREZ, P., GANGNET, M., AND BLAKE, A. 2003. Poisson Image Editing. In *Transactions on Graphics (Proceedings of SIGGRAPH 2003)*, vol. 22, ACM, 313-318.

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