Down the Rabbit Hole

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Abstract: This paper presents a real-time interactive media artwork based on pencil sketching and objects detection. First, the proposed artwork detects the object from the background. Next, the pencil sketch method is adapted to the detected object using inversion of gradients. The final image is then generated by combining the sketch image and the segmented object. The artwork can deliver uplifting messages to the audience by disengaging people from their routine and making them a protagonist in their own lives.

1. Introduction

People generally wish to live meaningfully and reach utopia in their lives. Recently, art-engineering works are beginning to play a role in inspiring them. Since interactive media art is built with modern technology, it can be a special and meaningful hobby. Interactive media art is completed with audience participation and interactive communication. In this paper, we propose a real-time interactive media artwork that resembles a collaboration of the real world and fantasy. The proposed artwork separates an object from its background and applies a sketch algorithm on it, rendering it special [1],[2],[3]. Additionally, the proposed artwork reminds them of their forgotten childhood and provides a memorable sensorial experience.

2. Purpose

Although people can lead a rich and varied life with the help of advanced technologies, they actually have dry and insipid everyday lives. In their daily routine, people have forgotten their reason to live and have lost the meaning of life. Art should touch their hearts and provide the opportunity to dream of a better tomorrow. For this reason, the proposed artwork calls people's attention to themselves and disengages them from their mundane lives. The audience who get tired of their daily routine can become the protagonists of their lives for a moment. Additionally, they can forget their tedious lives for a while since the ordinary world turns into an interesting one, leading them to contemplate life calmly. Lastly, it is possible to understand the meaning of the proposed artwork by a little movement in front of the camera. "Down the Rabbit Hole" is the title of the first chapter in "Alice's Adventures in Wonderland," where Alice escapes from boring reality through the rabbit hole. Likewise, people who are sick of their lives can escape from reality through the proposed artwork.

3. Implementation

To detect a moving object, the proposed method separates the object using background subtraction. Next, the pencil sketch algorithm is adapted to the detected object.

A. Object Detection Using Background Subtraction

(a)   (b)

Fig. 1. Object Segmentation: (a) Input Image and (b) the Segmented Result of (a) Using Background Subtraction.

To separate the moving object from the background, several methods have been proposed in literature in recent years [1], [2]. However, there is a problem of sensitivity to drastic illumination change. To solve this problem, the proposed artwork additionally uses a Kinect to perform the robust region of interest extraction for the object.

B. Pencil Drawing for Real-time Interaction

To obtain the pencil drawing result from the real world image, we modified Lu *et al.*'s method [3], which analyzed artist-produced pencil sketches, and focused on two properties of the pencil drawing, line drawing with stroke and tone drawing. However, this cannot be applied to real-time processing because of the high computational cost of the pencil sketch rendering step [3].

For providing interactive artwork to users, the proposed algorithm should be able to perform in real-time. For this reason, we simplify the pencil drawing algorithm of [3] in the following way. First, we perform a high-boost filtering

to amplify the edges and textures of the input image. Lu *et al*. estimated the gradient components for eight directions to simulate line strokes by pencils. Although this approach provides improved results, the high computational cost cannot be avoided. To solve this problem, the proposed artwork estimates the gradient profile using the first and/or second derivative for the horizontal and vertical directions.
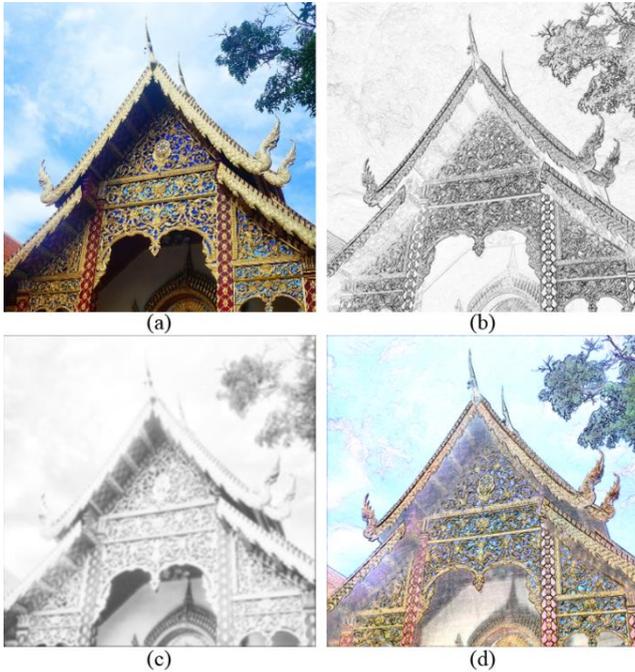

Fig. 2. Result Images of Each Algorithm Step: (a) Input Image, (b) Inversion of Gradients, (c) Tone Map of (a), and (d) Drawing Result.

Additionally, to provide the color pencil drawing result, Lu *et al*. performed the pencil drawing algorithm in the luminance channel and converted it back to RGB color space. To improve the pencil drawing, the proposed algorithm uses the dark channel prior instead of the luminance channel [4]. The proposed algorithm also utilizes various color spaces to provide dramatic pencil sketch results with the tone map generation of [3]. Fig. 2 shows the input image and the result images of each algorithm step.
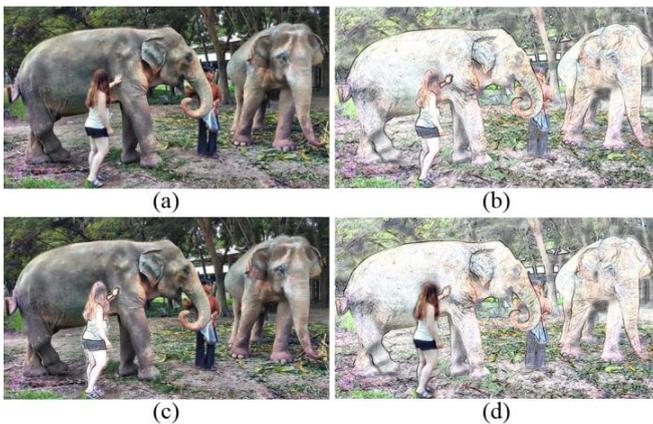

Fig. 3. Concept Art of Proposed Artwork: (a) Input Image, (b) Pencil Drawing Result of (a), (c) Sketched Object with Real Background and (d) Real Object with Sketched Background.

Finally, to generate the result image shown in Fig. 3(c) and Fig. 3(d), we combine the pencil drawing result and the real image using the segmented result shown in Fig. 1. The proposed algorithm selects the region of pencil drawing shown in Fig. 3(c) and 3(d). Fig. 3 shows the concept of the proposed artwork. This method can provide a new dimension to users by combining the real world with fantasy.

4. Conclusion

This paper presents an artwork to encourage people who do not get a 'mental day off'. The proposed artwork heals the wounded hearts of those who are sick of living in a highly developed material civilization, ironically, using more sophisticated software technology. The proposed artwork can provide an opportunity for people to rediscover their own life. The modern city is made of soulless concrete blocks and most people have lost their playground. Down the Rabbit Hole can become a green oasis in the heart of the city.

Acknowledgement

References

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Biography

Seonhee Park was born in Busan, South Korea in 1993. She received her B.S. degree in Integrative Engineering from Chung-Ang University, South Korea, in 2016. Currently, she is pursuing an M.S. degree in Digital Imaging Engineering at Chung-Ang University. Her research interests include super-resolution, remote sensing images, denoising, and image enhancement and restoration for display processing.