バイラテラル距離に基づくノンフォトリアリスティックレンダリング

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(Non-photorealistic Rendering Based on Bilateral Distance)

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論　文　内　容　の　要　旨

Non-photorealistic rendering (NPR) techniques have been presented for creating non-photorealistic images such as oil paintings and paper mosaic images which can reflect the intension of artists. Thanking to the non-photorealistic rendering techniques, we can show a warm taste of hand-drawn works which are difficult to be expressed in photorealistic rendering images. Generally, the NPR techniques can be divided into two main fields. One is a two-dimensional approach and the other is three-dimensional methods. Currently, in the two-dimensional field, many image generation methods for NPR like stained glass images and pointillism paintings have been presented.

The pointillism is a technique of painting in which small, distinct dots are structured in patterns to form an input image. Based on the color and shape of the point, we can represent the characteristics of pointillism image when generating the stipple image through NPR techniques. With conventional methods, it is hard to distinguish which part the point belongs to when it is near the edges and contours.

Furthermore, as another two-dimensional NPR technique, some methods for generating stained glass images have also been proposed. The real stained glass is composed of lead curves and convex polygon glass parts to depict stained glass and contour lines. The results of the previous methods are poor in reproducibility and artistic expression due to uniform Voronoi cells.

In this paper, to improve the stability of point distribution and reproducibility of detailed contours, we propose a method for generating stained glass images and pointillist paintings by using the bilateral distance. For pointillism paintings, we first present a new Poisson disk sampling (PDS) method with a grayscale ordering of pixels. To emphasize visual recognition and show clear contours with details of objects, we present a method for generating stippling images with adaptively shaped points.

To generate stained glass images, considering the color change and size relationship of parts in input images, we propose a method to create Voronoi cells by using a quad tree division and an anisotropic Voronoi tessellation based on the bilateral distance between points. In order to eliminate isolated cells, we connect the cell boundaries by using a minimum spanning tree. In addition, we propose a method of generating stained glass images of lines embedded in an image with adaptively changing cells according to the distance value and cell sizes.

In this paper, following the introduction in Chapter 1, we propose a method for generating pointillism images from gray scale images by using Poisson disk sampling (PDS) method with a grayscale ordering of pixels in Chapter 2. The result indicates a higher stability of points than the result of previous methods. We present an inverse processing method to recreate the original grayscale image from the pointillism image by using Voronoi tessellation.

In Chapter 3, based on the pointillism image generating method which is mentioned in Chapter 2, we propose a method for generating stippling images with adaptively shaped points.

In Chapter 4, to improve the reproducibility of the input image and keep the contours clear, we propose a stained glass generating method by using quad-tree division and anisotropic Voronoi tessellation of input images. Then we connect the boundaries of isolated cells through a minimum spanning tree method.

In Chapter 5, we propose a method of generating stained glass images of lines embedded in an image with adaptively changing cells according to the distance value and cell sizes. We make the boundary Voronoi cells smoother to match the lines of the input line drawing.

Final Chapter 6 is about the conclusion and future works of this study.