Pan-Tilt Projector Path Planning for Adaptive Resolution Display

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Abstract

We present a novel multi-projection system whose spatial resolution is not uniform.Recently, projection interactive systems which you can operate by touching with fingers or pens are studied. These systems' projection images need to have high resolution because they are often watched at close range. However, projectors which are used in these systems do not satisfy this condition. And also, the number of pixels of image sensors have more than 10 megapixel, and you can get a billion pixels by panoramcomposition. On the other hand, number of pixels of projectors on the market have only about 2 million pixels of Full HD, and even Super-HD projectors have only about 33 million. So it is out of doubt that they are not enough to display pictures photographically. In contrast, the resolution can be increased by using multiple projectors. Human recognizes in high resolution only by central field, and in low resolution by peripheral vision. So only to array projectors in the shape of a tile makes the region which does not need high resolution has high resolution.Therefore, in this study, we propose the system to realize dynamically reconfigurable pixels.

Keywords: multiple pan-tilt projectors, focus+context display, spatially varying resolutions, dynamically reconfigurable pixels.

1 Focus+Context Screen

Recently, focus+context display has been ploposed as an example of the technique to arrange the limited number of pixels effectively.

Human visual system performs detailed recognition in high resolution in the central field and in low resolution in the peripheral field. Focus+context display is the system that displays the picture by high resolution only in the region which is recognized by central field and by low resolution in the peripheral region.

There are a lot of study examples using this method. For example, Baudisch et al. proposes the method to display the whole image by a projector and display only the region where high resolution is needed by LCD[1]. In contrast, the system which can change high resolution region is proposed. Cotting et al. proposed the system which can display by high resolution a part of region by mobile projector and display by low resolution by a stationary projector[2].

These systems focus on the method for moving projection regions by manual operation, so to control the projective regions automatically has not been realized.

2 Proposed System

We apply multiple pan-tilt projectors to realize dynamically reconfigurable pixels. Each pan-tilt projector has different spatial resolution, and consequently the proposed system displays high resolution image contents with spatially varying resolutions. In this paper, particularly, we refer the case where the movie contents are displayed by the proposed system. In this case, because the region which should be displayed by high resolution is different in each frame, projection image should be moved while being moved. However, image degradation may occur when projection image moves. For example, a motion blur occurs if projection image is moved while displaying something, and the resolution decreases if projection image is moved while not displaying. So if the projection image is moved to a region of each frame simply, image deterioration occurs every time when optimal regions change. Therefore, we propose the optimal method for moving the projection image when movie contents are displayed using the information of user's gazed domain in each frame. In this study, we propose two methods for moving while displaying the projection image(method 1), and while not displaying(method 2) as described in figure1.

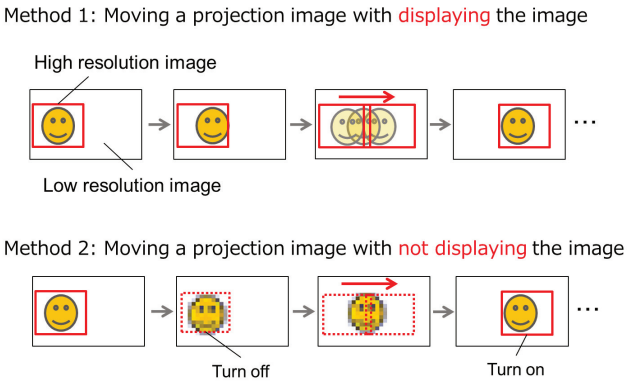

Figure 1: Concept of the proposed method

3 Image Quality Evaluation

We performed an experiment to evaluate a image quality of proposed system. In this experiment, we compare the image quality of 3 methods; One of these is that the projection image is moved to optimal region of each frame(method 0), and others are the method 1 and 2. In the simulation experiment by a monitor, we could get the result that the method 2 was the best, 1 was the second, and 0 was the worst. And in the experiment by the prototype, we compared the method 2 with 0, and we could get the result that the method 2 was the better in 3 contents, and in the other, the method 0 was the better.

References

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