A Future Remote Controller for 3D TV

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Abstract

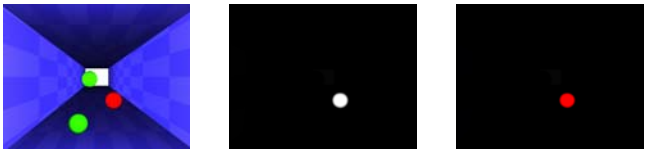
An intelligent remote controller for 3-D TV interface exploits an artificial system of human visual attention for an easy interaction.

1. Objectives and Background

There have been many researches on multi-view image processing for free viewpoint TV. However, most of those studies focused on how to generate free viewpoint images rather than to make the viewers enjoy the most effective sense of 3-D TV. This paper represents an intelligent remote controller as one of the interfacing devices between human and 3-D TV. It enables the viewer easily to have one's viewpoints at a different angle automatically. It also prevents the viewer from disorientating which can be caused periodically by 3-D space navigation system. Typically, in 3-D visual systems, it is feasible for viewers to control the viewpoint interactive without any difficulties. 3-D video game would be a good example to represent the features explained above. However, the condition mentioned is not applied to the viewers watching 3-D TV, since there is another viewpoint that has not been revealed: such as director's or content manufacturer's one. The viewer in general, watches a program that is being telecasted by a broadcasting station. It means that he or she is watching TV program using a viewpoint that reflects a program producer's viewpoint. FTV [1] generates images corresponding to the viewer's viewpoint, but it may not be straightforward to change one's viewpoint while watching it. Therefore, in 3-D TV system, one has to consider such a professional analysis for the instantaneous viewpoint variation. One of the strong points on free viewpoint system (FTV) is that the angle of specific scene can be established by the viewer's viewpoint. In this case, it is required to select a position within the 3-D space that becomes outset of whole image generated. Therefore, we suggest an intelligent approach that automatically generates some reference viewpoints instead of 3D TV viewers. Reference viewpoints are generated by the theory based on human visual attention.

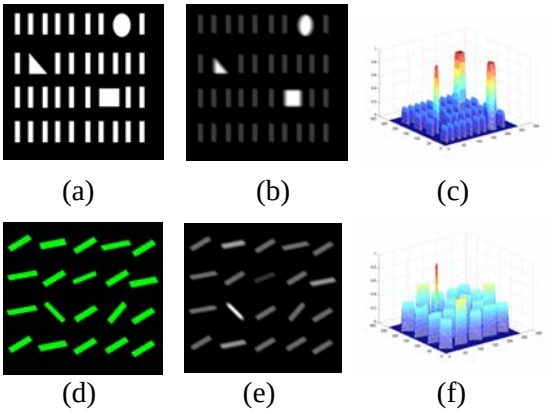
2. Results

Numbers of studies related to visual attention and eye movement have illustrated that human being instinctively tend to observe a few areas on the whole image rather than scan the whole image sequentially, and the visual attention models provide a general approach to control the activities of active vision systems [2]. Models of selective visual attention system have been suggested based on the field of psychology, psychophysics, physiology and etc. Fig.1 is an example of our artificial system of human visual attention, describing how the outset position is obtained to generate a scene that corresponds to the viewer's viewpoint. The suggested system also computes the intensity of salience of an object in the given region simultaneously.



(a) Input image (b) Saliency map (c) Focus of attention
Fig. 1 Schematic diagram represents the proposed attention system based on bottom-up approach.

In fact, several objects or regions are detected with their own saliencies. As a result objects or regions within a scene can be described according to their saliencies. The system computes early visual features from a set of pre-attentive feature maps in a massively parallel manner. Activity from all feature maps is combined at each location, giving rise to responses in the topographic salience map as shown in Fig.2.



(a) (b) (c)

(d) (e) (f)

Fig. 2 Images (a) and (d) show input ones. Images (b) and (e) describe the obtained each saliency map. Graphs (c) and (f) describe corresponding salient intensity. As shown, the attention system reasonably detects spatial saliency from surrounding environments.

A future remote controller is realized as computation based on human visual attention system. Focuses of attention are displayed on the remote controller with different viewpoints on the screen as candidates. The proposed remote controller system is intelligent in which it provides the viewers with several attractive viewpoints solving the disorientation problem. Through the experiment on 3-D TV, the concept of 3-D image is understood using a desktop computer assuming that it has the capabilities of networking and computation shown in Fig. 3. 3-D TV is being networked with PDA; smart remote controller, using wireless Internet. Zigbee and Ultra-Wideband (UWB) are possible candidates for the networking above. PDA is used as a smart remote controller for the purpose of displaying numerous candidate viewpoints. The viewpoints are generated and computed on the 3-D TV screen and transmitted to PDA. The proposed remote controller is expected to be an extremely useful device for the future 3-D TV viewers.

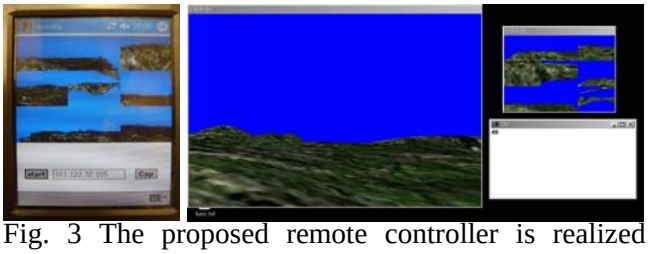


Fig. 3 The proposed remote controller is realized using a PDA and the wireless Internet. 3D TV first computes some candidate viewpoints and transmits them to the PDA. A viewer selects a candidate viewpoint using a touch screen and the corresponding scene is displayed on 3D TV.

3. Impact

FTV is the epoch-making device which is able to display 3-D images in accordance with a desired viewpoint described in [1]. On the other hand, it could cause some inconvenience to those who are not familiar with navigation device. It may take a period of time and require a little bit of skills to be comfortable with the device. The proposed intelligent remote controller solves the problem by providing the viewers with some reference viewpoints. It is computed using the theory of human visual attention. Therefore, in a sense, our approach implicitly suggests that the nearest-possible solution may be the human visual attention system which can instinctively select the position of viewpoint.

4. References

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