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Source	**GIST (Gwangju Institute of Science and Technology)**
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Title	**[FTV AHG] View Synthesis for Linear and Arc Video Sequences**
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1. Introduction

This document reports the accuracy of depth quality of linear and arc sequences using the View Synthesis Reference Software (VSRS) [1]. Fig. 1 indicates the structure of view synthesis. Virtual view generation is critical in free-viewpoint imaging. The main objective of this report is to provide optimal depth precision level blending conditions for improved synthesized view quality.

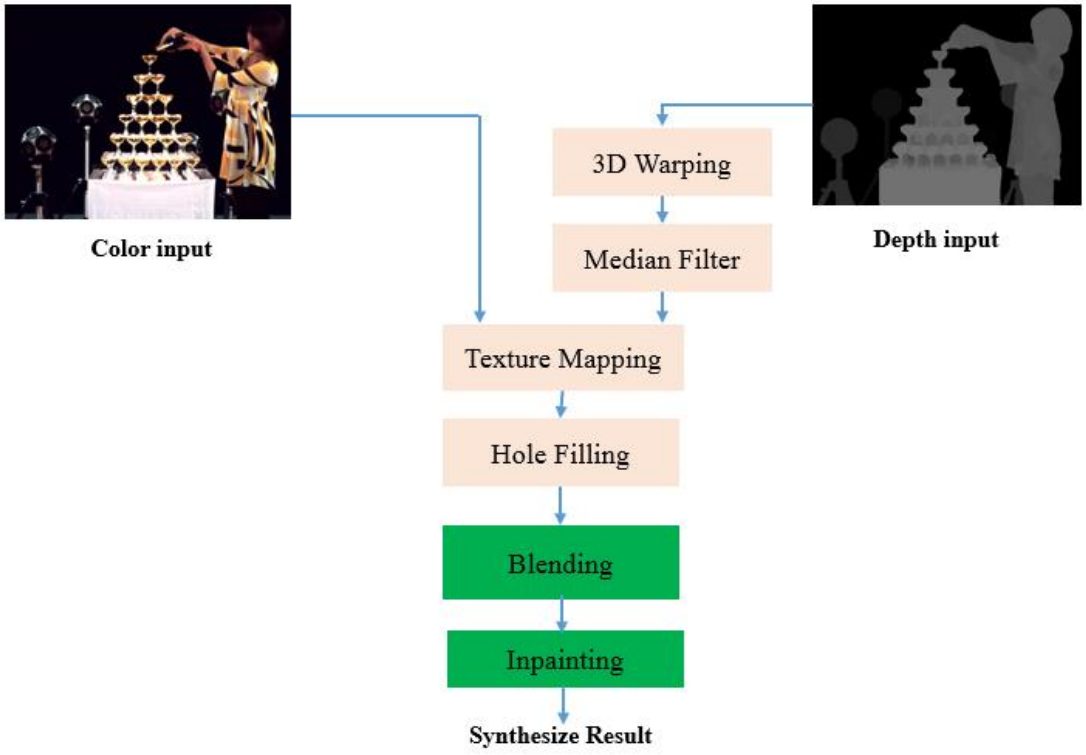

Figure 1. Flowchart of view synthesis in VSRS

2. Parameter option

2.1 Blending

In VSRS, left and right color images and the corresponding depth image is used for generating the virtual view image. Using 3D warping, VSRS generates left- and right-image based virtual view-point images. The virtual view point camera structure is illustrated in Fig.2.

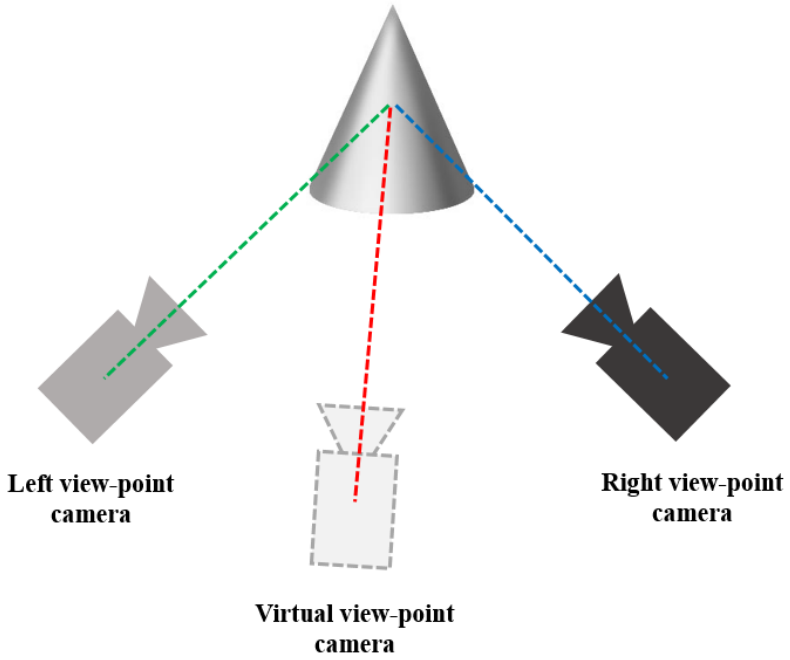

Figure 2. View blending in VSRS

VSRS provides two options for view blending. The first method blends the virtual view-point image with generated left and right view-point based virtual image. If many parts of left and right image are highly related to each other, then weighted blending method draw a high quality virtual image.

$$I_v = \alpha \cdot I_{v,l} + (1-\alpha) \cdot I_{v,r}\ , \alpha = \frac{|t_x^v - t_x^r|}{|t_x^l - t_x^r|}$$

$I_{v,l}$ and $I_{v,r}$ indicates a generated virtual view based on left and right reference image respectively, and parameter t represent the temporal variation.
However, if they have low relationship with respect to virtual view-point image, then only the left or right image based blending method can generate better virtual view-point image.

2.2 Depth precision

The depth precision parameter indicates an accuracy of depth prediction. The depth precision has 3 different predictive options.

```
Precision                              1   # 1...Integer-pel, 2...Half-pel, 4...Quater-pel
```

Option 1 predicts the depth value, which corresponding to current pixel and option 2 and option 3 predict the depth value within half and quarter respectively. Since the arc camera array has longer

base line than linear camera structure, the precision selection take affect to quality of synthesized image.

3. Experiment results

Considering the two parameter options '*ViewBlending*' and '*Precision*', experiment has been performed with different conditions. To compare the effects of precision level and blending usage, the *Linear* and *Arc* camera array sequences are used for test. Figure 3 shows the generated virtual image using '*Precision*-1' and different '*ViewBlending*' options (on/off). Similarly, Figure 4 represents differently generated virtual view with same parameter value with '*Precision*-4'.

Figure 3. Synthesized view with *Arc* sequence (BBB_Flowers)
Precesion-1, *ViewBlend*-off(Left) and *ViewBlending*-on(Right)

Figure 4. Synthesized view with *Arc* sequence (BBB_Flowers)
Precesion-4 *ViewBlend*-off(Left) and *ViewBlending*-on(Right)

As represented in experiment results, quarter-pel precision leads to better results than integer-pel precision in terms of subjective quality. Likewise, the virtual view quality is more reasonable especially near the object boundary region when adopting view blending. Fig. 5 and Fig. 6 show the generated virtual view results of linear sequences. The results demonstrate the effects of view blending and precision levels. Generally, view blending draws similar results between linear and arc sequences. However, when applying the higher level of *Precision* option, it can generate more accurate virtual image in *Arc* test sequence than *Linear* one.

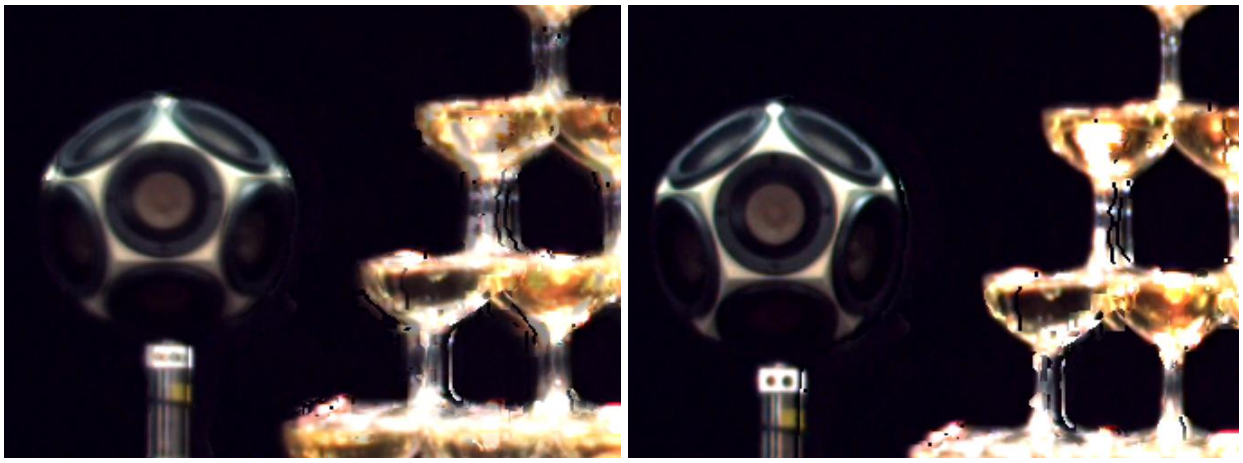

Figure 5. Synthesized view with *Linear* sequence (Champagne)
Precesion-1, *ViewBlend*-off(Left) and *ViewBlending*-on(Right)

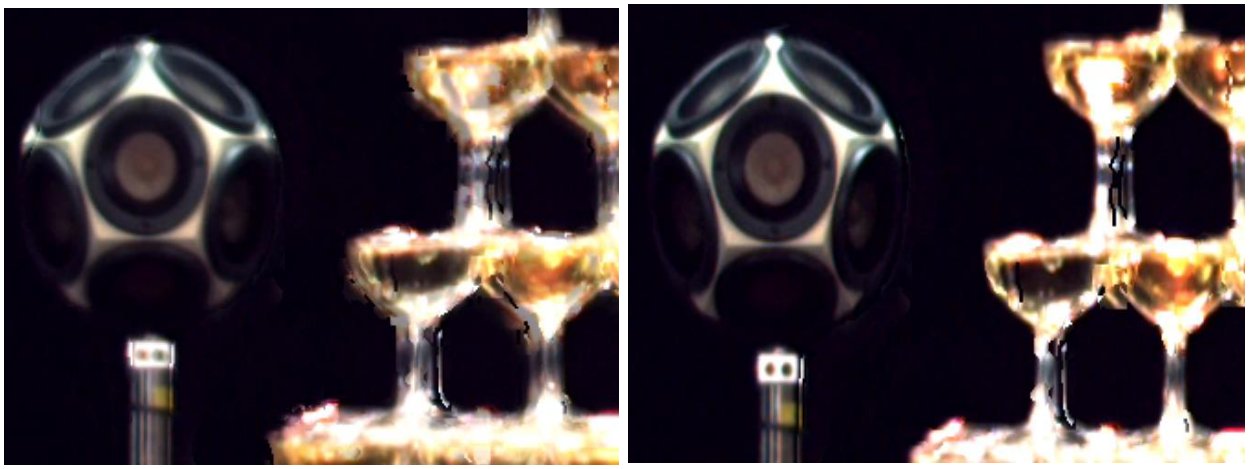

Figure 6. Synthesized view with *Linear* sequence (Champagne)
Precesion-4, *ViewBlend*-off(Left) and *ViewBlending*-on(Right)

3. Acknowledgment

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4. References

[1] O. Stankiewicz, K. Wegner, M. Tanimoto, M. Domański, "Enhanced Depth Estimation Reference Software (VSRS) for Free-viewpoint Television," ISO/IEC JTC1/SC29/WG11, MPEG2013/M31520, Geneva, CH, Oct. 2013.