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# A Novel Fusion Method for 3D-TV View Synthesis Using Temporal and Disparity Correlations

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**Abstract:** View synthesis like Depth-image-based-rendering (DIBR) plays a significant role in 3D content creation for 3D-TV. However, perceptual errors introduced by current view synthesis often result in severe distortions in synthesized images. In this paper, we propose a novel view synthesis fusion (VSF) method which adaptively exploits temporal and disparity correlations to improve the quality of the synthesized picture. The proposed VSF method defines a robust correlation assessment metric for fusing several pre-created virtual view candidates. Unlike conventional methods, the proposed fusion algorithm is applied for both hole and non-hole areas. Experimental results show significantly outperforming peak signal-to noise ratio (PSNR) and subjective visual quality by the proposed method compared to other conventional methods.

**Keywords:** 3D-TV view synthesis; Depth image based rendering (DIBR); Image fusion; Temporal correlation; Disparity correlation

## 1. Introduction

Three - dimensional television (3D-TV) and next generation-Free-viewpoint television (FTV) are promising technologies to support incredible 3D experience to viewers [1]. In FTV, viewers not only watch 3D content but also immerse themselves into the virtual scene.

Generally, the virtual view or synthesized view generation in FTV is based on depth image based rendering (DIBR) technique [2]. However, the current DIBR method employs only the disparity correlation between views to create a so-called synthesized view; thus, unable to take full advantages of available synthesized information. A critical problem arising in DIBR is that the regions covered by the foreground objects in the original views may be dis-occluded in the synthesized view. This problem may cause holes in the synthesized picture, and also referred to as the hole or dis-occlusion problem which severely degrades the quality of synthesized views.

Several view synthesis algorithms have addressed how to reduce the distortion associated with the hole or dis-occlusion [3-8]. In [3], Kumar *et al.* employed disparity correlations between adjacent views for filling the hole regions in the synthesized picture. The authors in [4] introduced a plane sweep scheme to reduce potentially

negative effect of the hole filling on the quality of the synthesized image. Since the quality depends on the actual synthesis process, additional boundary artifact processing can be employed to adjust the quality of the synthesis and reduce the hole region. For small hole regions, Tanimoto and *et al.* [5] proposed to use a median filter to eliminate the hole while, for large hole regions, employing the neighboring pixels to remove the hole existing along the edges or boundaries of these regions. In order to improve the reliability of the synthesized view, the authors in [6] introduced a scheme named reliability reasoning on 3D warping which can assess the reliability of each pixel value in the synthesized view and then withdraw the unreliable pixels from the virtual view.

During the standardization of compression technology for 3D-TV, a software called View synthesis reference software (VSRS) has been developed [8]. VSRS is an efficient view synthesis method based on DIBR which takes two reference views and two depth maps as input to generate the synthesized view. VSRS and the aforementioned methods are mostly based on the DIBR technique which employs only the disparity correlation between views to synthesize and render the synthesized views. However, it is shown in [9] that the synthesis can be improved by extending DIBR to the temporal axis.