June 18th 2015

Sensible Things that Communicate

PART OF MID SWEDEN UNIVERSITY

Free View Rendering for 3D Video – Edge-Aided Rendering and Depth-Based Image Inpainting

Author doctoral thesis: Suryanarayana Murthy Muddala

STC Research Centre a part of Mid Sweden University

Abstract:
Three Dimensional Video (3DV) has become increasingly popular with the success of 3D cinema. Moreover, emerging display technology offers an immersive experience to the viewer without the necessity of any visual aids such as 3D glasses. 3DV applications, Three Dimensional Television (3DTV) and Free Viewpoint Television (FTV) are auspicious technologies for living room environments by providing immersive experience and look around facilities. In order to provide such an experience, these technologies require a number of camera views captured from different viewpoints. However, the capture and transmission of the required number of views is not a feasible solution, and thus view rendering is employed as an efficient solution to produce the necessary number of views. Depth-image-based rendering (DIBR) is a commonly used rendering method. Although DIBR is a simple approach that can produce the desired number of views, inherent artifacts are major issues in the view rendering. Despite much effort to tackle the rendering artifacts over the years, rendered views still contain visible artifacts.

This dissertation addresses three problems in order to improve 3DV quality: 1) How to improve the rendered view quality using a direct approach without dealing each artifact specifically. 2) How to handle disocclusions (a.k.a. holes) in the rendered views in a visually plausible manner using inpainting. 3) How to reduce spatial inconsistencies in the rendered view. The first problem is tackled by an edge-aided rendering method that uses a direct approach with one-dimensional interpolation, which is applicable when the virtual camera distance is small. The second problem is addressed by using a depth-based inpainting method in the virtual view, which reconstructs the missing texture with background data at the disocclusions. The third problem is undertaken by a rendering method that firstly inpaint occlusions as a layered depth image (LDI) in the original view, and then renders a spatially consistent virtual view.

Objective assessments of proposed methods show improvements over the state-of-the-art rendering methods. Visual inspection shows slight improvements for intermediate views rendered from multiview videos-plus-depth, and the proposed methods outperforms other view rendering methods in the case of rendering from single view video-plus-depth. Results confirm that the proposed methods are capable of reducing rendering artifacts and producing spatially consistent virtual views.

In conclusion, the view rendering methods proposed in this dissertation can support the production of high quality virtual views based on a limited number of input views. When used to create a multi-scopic presentation, the outcome of this dissertation can benefit 3DV technologies to improve the immersive experience.