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Sensible Things that Communicate

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Coding of Three-dimensional video content - Depth image coding by diffusion

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Abstract:

Three-dimensional (3D) movies in theaters have become a massive commercial success during recent years, and it is likely that, with the advancement of display technologies and the production of 3D contents, TV broadcasting in 3D will play an important role in home entertainments in the not too distant future. 3D video contents contain at least two views from different perspectives for the left and the right eye of viewers. The amount of coded information is doubled if these views are encoded separately. Moreover, for multi-view displays (i.e. different perspectives of a scene in 3D are presented to the viewer at the same time through different angles), either video streams of all the required views must be transmitted to the receiver, or the displays must synthesize the missing views with a subset of the views. The latter approach has been widely proposed to reduce the amount of data being transmitted. The virtual views can be synthesized by the Depth Image Based Rendering (DIBR) approach from textures and associated depth images. However it is still the case that the amount of information for the textures plus the depths presents a significant challenge for the network transmission capacity. An efficient compression will, therefore, increase the availability of content access and provide a better video quality under the same network capacity constraints.

In this thesis, the compression of depth images is addressed. These depth images can be assumed as being piece-wise smooth. Starting from the properties of depth images, a novel depth image model based on edges and sparse samples is presented, which may also be utilized for depth image post-processing. Based on this model, a depth image coding scheme that explicitly encodes the locations of depth edges is proposed, and the coding scheme has a scalable structure. Furthermore, a compression scheme for block-based 3D-HEVC is also devised, in which diffusion is used for intra prediction. In addition to the proposed schemes, the thesis illustrates several evaluation methodologies, especially, the subjective test of the stimulus-comparison method. It is suitable for evaluating the quality of two impaired images, as the objective metrics are inaccurate with respect to synthesized views.

The MPEG test sequences were used for the evaluation. The results showed that virtual views synthesized from post-processed depth images by using the proposed model are better than those synthesized from original depth images. More importantly, the proposed coding schemes using such a model produced better synthesized views than the state of the art schemes. As a result, the outcome of the thesis can lead to a better quality of 3DTV experience.