Simplified Depth Intra Coding Based on Texture Feature and Spatial Correlation in 3D-HEVC

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3D-HEVC adopts many high complexity approaches to improve the coding performance of the depth video, a fast intra coding scheme for the depth map coding is proposed based on texture feature and spatial correlation. The coding unit (CU) sizes and intra prediction modes are selected differently due to different depth features. The CU block is divided into smooth block, texture block and edge block by using gray-level co-occurrence matrix (GLCM) and Sobel operator, as defined in Eq. (1).

$$GFV_\theta = (CON, ASM, COR) \qquad \overline{GFV} = \frac{GFV_{0^\circ} + GFV_{45^\circ} + GFV_{90^\circ} + GFV_{135^\circ}}{4} \qquad \text{CU's } texture = \begin{cases} smooth, & \overline{GFV} = (0,1,0)\ \&\&\ NUM_{edgepoint} < T \\ edge, & NUM_{edgepoint} > T \\ complex, & \overline{GFV} \neq (0,1,0)\ \|\ NUM_{edgepoint} > T \end{cases} \tag{1}$$

Where Angular second moment(ASM), contrast (CON) and correlation (COR) are the second order statistical characteristics of GLCM, which are indicated the texture characteristic of CU. GLCM feature vector (GFV) of CU or prediction unit (PU) is defined by Eq. (1) for different θ ($\theta = 0^\circ, 45^\circ, 90^\circ, 135^\circ$).

The homogenous regions can be well predicted by large CU size and the edge regions or the complex regions tend to small CU size. If current CU belongs to smooth region by Eq. (1), CU splitting is pre-terminated to reduce unnecessary coding blocks.

According to the statistical experiment, the probability that P_1 is true is 72%-94% of the total counts in PU mode decision process, about 99% the optimal prediction mode belongs to DC mode, Planar mode or Vertical mode when P_1 is satisfied. The candidate mode list is determined by Eq. (3), the number of the candidate modes is reduced from six or eleven to only three. When P_2 is satisfied, about 82%-94% the optimal prediction mode belongs to depth modelling modes (DMMs), and DMMs traversal counts are reduced by 28%-72%. DMMs are added into candidate mode list if P_2 is true, most of the unnecessary view synthesis optimization (VSO) calculations for DMMs are avoided.

$$P_1 = \{\overline{GFV} = (0,1,0)\ \&\&\ Mode_{leftPU} \le 1\ \&\&\ Mode_{topPU} \le 1\} \tag{2}$$

$$Candidate\ Mode\ List = \begin{cases} [0,1,26],\ when\ P_1\ is\ satisfied \\ generated\ by\ traditional\ method,\ otherwise \end{cases} \tag{3}$$

$$P_2 = \{NUM_{edgepoint} > 0\ \&\&\ Mode_{leftPU}\ or\ Mode_{topPU} \in (DMM1, DMM4)\} \tag{4}$$

A fast wedgelet pattern decision method based on K-Means is developed to reduce the complexity of DMM1. All pixels of PU are clustered to two categories to generate K-Means clustering pattern (KMCP). KMCP is used to match all the wedgelet patterns. In searching the optimal pattern process, if the maximum matching similarity is equal to 100%, VSO needn't be computed, otherwise a portion of the high similar patterns need to calculate VSO. Hence, the VSO traversal times will be greatly reduced.

The proposed algorithms are implemented in HTM-16.0 on the common test conditions. Experimental results show that the proposed algorithm achieves an average time reduction of 40.71% for depth intra coding with increasing 0.32% BD-rate on synthesized views for all intra case.

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