Fast CU Size Decision based on AQ-CNN for Depth Intra Coding in 3D-HEVC

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The complexity of 3D-HEVC is fairly high due to quad tree structure and traversal searching in depth intra coding. In order to reduce complexity caused by coding unit (CU) size decision in rate distortion optimization (RDO) process, a fast algorithm based on adaptive QP convolutional neural network (AQ-CNN) structure is proposed in this paper as shown in Figure 1. The network extracts deep information of CU automatically to terminate CU partition process early. QP is involved as an external feature and added into the proposed AQ-CNN to better predict and apply to different QPs for one structure.

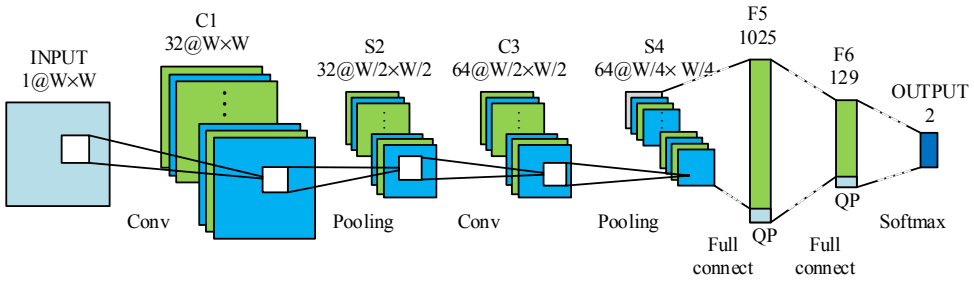

Figure 1: The proposed AQ-CNN structure. For n@ k×k, n and k respectively indicate the number and size of feature maps. Ci, Si, and Fi respectively mean convolutional, pooling and full connection layers.

Firstly, a LCU partition can be regarded as a combination of three binary classification. A separate binary classifier is presented at each level. To predict classification label by given input CU, the proposed AQ-CNN is the classifier for each level.

Then the proposed AQ-CNN structure is the classifier in our algorithm. The proposed AQ-CNN consists of two convolutional layers, two pooling layers, two full connection layers and one softmax layer. Three separate models are trained for different CU size with the same structure but different parameters.

Specially, considering that QP has a great influence on CU partition, QP is concatenated to the two full connection layers for better predicting CU splitting labels. Thus, our AQ-CNN is adaptive for different QPs in one structure and the prediction is more accurate.

Finally, the database for the AQ-CNN training and testing can be obtained successfully by pre-coding standard sequences in 3D-HEVC.

The proposed algorithm is implemented in HTM-16.2 following the common test conditions (CTC). Compared with HTM-16.2, the proposed algorithm achieves an average time reduction of 69.4% for depth intra coding with negligible BD-rate increase on synthesized views for all intra cases.

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