A Hybrid Admissible Distortion Checking Algorithm for the B-Spline-Based Operational Rate-Distortion Optimal Shape Coding*

Zhongyuan Lai, Zhen Zuo, Zhe Wang, and Wenyu Liu, *Member, IEEE*
Dept. of Electron. and Inf. Eng., Huazhong Univ. of Sci. and Technol. Wuhan, China
Email: {laizhy, zzhen1990, twolucky.wang}@gmail.com, liuwy@hust.edu.cn

Admissible distortion checking algorithm plays a very important role in both rate-distortion performance and computational efficiency of B-spline-based operational rate-distortion optimal shape coding framework under the minimum-maximum criterion [1]. Existing distortion measurement using chord-length parameterization (DMCLP) is fast but results in extra bit-rate problem [2]. In contrast, the up to date accurate distortion measurement using analytical model (ADMAM) can achieve the smallest bit-rate but is very time consuming [3]. It motivates us to develop a hybrid admissible checking algorithm that can take full use of each advantage.

Recalling the definitions of both DMCLP and ADMAM for each associated contour point, we find that DMCLP is the distance from the parameterized B-spline point while ADMAM is the shortest distance from the approximating B-splines. Consequently, the value of DMCLP is always no less than that of ADMAM. That is to say, if DMCLP upholds the admissible distortion, ADMAM should also uphold it; otherwise, ADMAM should be calculated for further checking. This modification does not change the checking results of the ADMAM checking algorithm; accordingly, the smallest bit-rate property belonging to ADMAM checking algorithm is preserved. In addition, keeping the $O(N_C)$ time, where N_C is the number of the original contour point, it reduces the evoke number of the more time consuming ADMAM such that a considerable part of execution time can be saved. Following this discovery, we develop a *hybrid admissible distortion checking algorithm* (HADCA) by adding an additional ADMAM judgment to the original DMCLP admissible distortion checking algorithm if and only if DMCLP does not uphold the admissible distortion.

The results of the different standard video sequences demonstrate that HADCA can save 7% ~ 48% overall execution time compared with ADMAM checking algorithm. Furthermore, the overall execution time of HADCA is very close to that of DMCLP checking algorithm, which means HADCA can maintain the smallest bit-rate property at the cost of small computational increments.

Reference

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