An Efficient Intra Coding Algorithm based on Statistical Learning for Screen Content Coding

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INTRODUCTION

Screen content video (SCV), different from natural video, contains amount of stationary or moving computer graphics, animation and text. HEVC coding tools is inefficient to compress videos with screen content due to these characteristics.

HEVC based Screen Content Coding (SCC) is developed to enable significantly improved compression performance for SCV. New coding tools (Intra Block Copy (IBC), Palette mode, Adaptive Color Transform (ACT), etc.) achieve high coding efficiency but impose enormous computation burden on encoders.

The screen based applications became more and more popular in recent years, including cloud applications, screen sharing, remote education, etc. Real-time applications need low-latency coding technique. Consequently, fast coding algorithms are desirable for SCC.

HISTORICAL REVIEW

The existing fast intra coding algorithms can be categorized into three classical methods: texture based fast intra mode prediction (TBMP), adjacent information based CU size prediction (AI-SP) and machine learning based CU size prediction (ML-SP).

TBMP uses the main texture direction to reduce the mode candidates used in intra prediction.

AI-SP obtains the depth information or coding information from neighboring blocks [9]. Such information is used to predict current CU depth range or make an early termination decision.

ML-SP uses data mining technique and designs several learning based models to predict the optimal coding parameters. Three-output classifiers are usually used to solve the hard samples as left figure [11] shows.

These method are proposed for HEVC, which don't consider the characteristics of SCV and can't achieve high complexity reduction in SCC.

OBJECTIVES

Take characteristics of SCV to predict the content-type and size of each block.

Put forward a more apropos framework to reduce the coding complexity.

THE PROPOSED APPROACH

FEATURE SELECTION

Statistical information of current CU
- Maximum gradient magnitude (MGM) and variance (VAR) indicate the flatness of current CU;
- Color number (CN) and the number of pixels whose gradient magnitude equals to zero (ZGN) within current CU;
- Minimum difference between the DC values of four sub-CUs (MDCSU) shows local smoothness of current CU.
- Coding and context information of current CU
- RD cost (RDC) and coding bits (BIT) have strong correlation with CU partition and mode

TRAINING AND TESTING

Database
- Data set is divided into four equal size sub-CUs.
- Classifier: Decision Tree (DT)
- An example of the trained DT

RESULTS

Test conditions
- SCC Test Model (HM) reference software version 5.0 is modified for the proposed scheme. The configuration parameters used in the paper is the “Intra, main”. Four tested Quantization Parameters (22, 27, 32, and 37) are adopted. One hundred frames of 11 test sequences are used in the test under common test condition.

Experiment results

CONCLUSIONS

This paper introduced an efficient fast intra-coding scheme for screen content coding using machine learning.

The proposed algorithm brings 48.89% encoding time saving with 2.72% BDPR increase compared to author SCM-5.0, which outperms state-of-the-art methods.

REFERENCE

[19] Y. Kawakami , etc, Content based mode and depth skipping with Sharp and Directional Edges for intra prediction in Screen Content Coding, in ICASSP, Mar. 2016.