8x8 Transformation Based All Zero Block Detection For H.264/AVC Encoder

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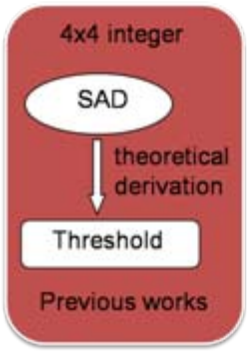
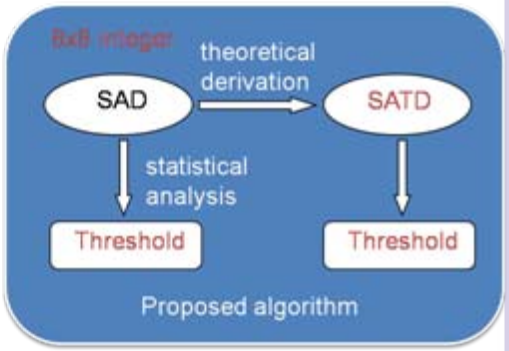
Background

- H.264/MPEG-4 AVC is the latest international video coding standard, with very good performance and **enormous computations**.
- **Adaptively transformation tool** was added to enhance for the growth of HDTV market demand by JVT currently, which consumes more computations.
- **Reducing the complexity** of an 8x8 integer transform and quantization has became an urgent problem.
- Our research introduce **all zero block algorithm** to solve these problem.

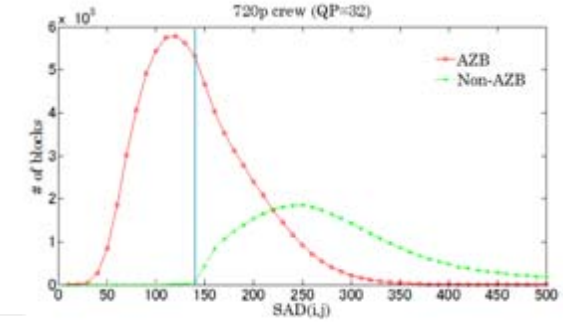
Proposals

- SAD value based early termination algorithm for 8x8 integer DCT and quantization
- SATD value based early termination algorithm for 8x8 integer DCT and quantization



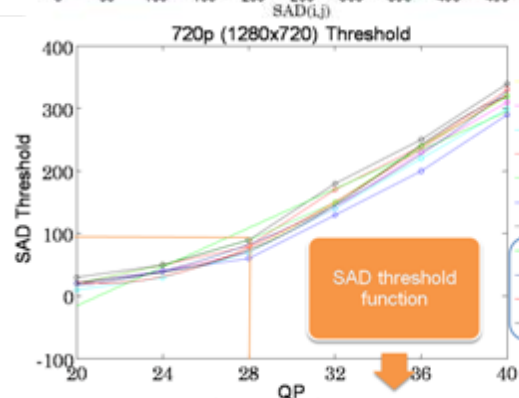


Research approach



AZB and Non-AZB distribution test

AZB threshold decision



AZB threshold curves

SAD threshold function

Linear Least Squares

$TH_{QCIF}(QP) = 0.033\times QP^3 - 2.16\times QP^2 + 51.8\times QP - 409$

$TH_{CIF}(QP) = 0.026\times QP^3 - 1.56\times QP^2 + 33.3\times QP - 230$

$TH_{720p}(QP) = 0.013\times QP^3 - 0.603\times QP^2 + 16.3\times QP - 170$

Therefore, If $SAD \le TH(QP)$ it is an AZB.

$$SATD = \frac{1}{2}\cdot\sum_{v=0}^{7}\sum_{u=0}^{7}|G(u,v)| = \frac{1}{2}\cdot\sum_{v=0}^{7}\sum_{u=0}^{7}\frac{\sigma_G(u,v)}{\sqrt{2}} \cong \frac{218\sigma_f}{\sqrt{2}}$$

$$SAD \cong \frac{64\sigma_f}{\sqrt{2}}$$

$$SATD \cong \frac{109}{32}SAD$$

SAD and SATD relation derivation

SATD threshold function

QCIF $TH(QP) = 0.113\times QP^3 - 7.36\times QP^2 + 176.44\times QP - 1393.16$

CIF $TH(QP) = 0.0886\times QP^3 - 5.31\times QP^2 + 113.43\times QP - 783.44$

720p $TH(QP) = 0.0886\times QP^3 - 5.31\times QP^2 + 121.94\times QP - 953.75$

Computational Saving

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