低演算量動画像圧縮アルゴリズム及び動画像エンコーダLSIの研究

博士課程修了　劉　欽

研究背景

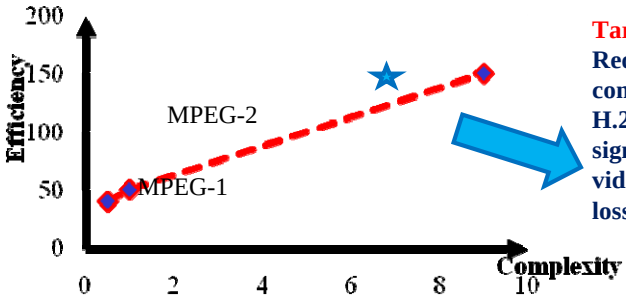
Every day we live in a video's world!

1. Demand for high resolution video quality

2. Limited network bandwidth and storage capacity

3. Demand for portable application

Low Complexity Digital Video Compression



Target: **Reduce the complexity for H.264 with no significant video quality loss**

研究内容

Our Proposed Solution for Video Encoder

Proposed Low Complexity Fast Motion Estimation Search

Major problems	Solutions	Evaluation results
High complexity, Significant video quality loss, Bad detection accuracy, Bad detection efficiency	Adaptive encoding parameter adjustment Cross-Diamond search pattern RDO based skip mode early detection All-Zero Block early detection	Encoding time, Video quality, Detection accuracy, Detection efficiency

Computation reduction from 35% to 75% with negligible video quality loss. (Compared with UMHS)

Proposed Low Complexity Application Specific Instruction-Set Processors

Major problems	Solutions	Evaluation results
Flexibility, Efficiency, Power	Fast ME Algorithm, ASIP Platform, Edge and SAD Calculation Instruction, SIMD	Instruction amount, Clock, and so on

Save 95% instruction, estimated 48% clock cycle reduction for ME processor. (Compared with GPP)

Research Method:

A. Mathematical derivation method

B. Statistical analysis method

主な発表論文

[1] Qin Liu, Yiqing Huang, Satoshi Goto, Takeshi Ikenaga, " Hardware-Oriented Early Detection Algorithms for 4x4 and 8x8 All-Zero Blocks in H.264", ***IEICE Trans. on Fundamentals of Electronics, Communications and Computer Science***, Vol.E92-A, No.4, pp.1063-1071, Apr. 2009.

[2] Qin Liu, Yiqing Huang, Satoshi Goto, Takeshi Ikenaga, "Edge Block Detection and Motion Vector Information Based Fast VBSME Algorithm", ***IEICE Trans. on Fundamentals of Electronics, Communications and Computer Science***, Vol. E91-A, No.8, pp.1935-1943, Aug. 2008.

[3] Qin Liu, Seiichiro Hiratsuka, Kazunori Shimizu, Shinsuke Ushiki, Satoshi Goto, Takeshi Ikenaga, "A 41mW VGA@30fps Quadtree Video Encoder for Video Surveillance Systems", ***IEICE Trans. On Electronics***, Vol. E91-C, No.4, pp.449-456, Apr. 2008.

早稲田大学 大学院 情報生産システム研究科

システムLSI分野システムLSI応用部門　池永研究室