USC | IMSC

media communications

New Compression Techniques for Robust and Scalable Media Communications

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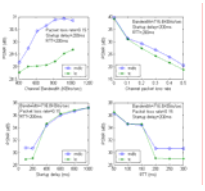
Research Goal

- ▲ Our research aims at improving performance while preserving as much as possible of standard compliance, MPEG-4 FGS and H.26X
- ▲ Areas of work
  - ■ Multiple description layered coding (**MDLC**) for reliable video communication
  - ■ Wyner-Ziv Scalability (WZS) based on the Wyner-Ziv framework for efficient and robust scalable predictive coding
  - ■ Long-term memory motion compensation for high performance video compression algorithm

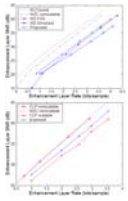
Scalable Media Communications

- ▲ Multiple description layered coding (**MDLC**) for reliable video communication
  - ■ Incorporate both layering and explicit redundancy (MDC)
  - ■ On-line packet Scheduling to make the decision among multiple decoding choices to match the redundancy to channel behavior
- ▲ Wyner-Ziv Scalability (WZS) based on the Wyner-Ziv framework for efficient and robust scalable predictive coding
  - ■ Use nested lattice quantization followed by a multi-layer Slepian-Wolf coders with layered side information (SI)
  - ■ Support embedded representation and high coding efficiency by using the high quality version of the previous frame as SI in the enhancement-layer coding of the current frame

Experimental Results

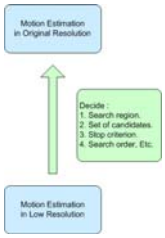


MDLC results



WZS results

Proposed Fast long-term Memory Motion Compensation Algorithm



- ▲ Adaptive search region, set of candidates, and stop criterion based on low resolution motion estimation.
- ▲ Adaptive motion search window location based on multi-resolution search.
  - ■ Locate search regions at better positions.
  - ■ Gain enhancement.
- ▲ Adaptive selection of motion candidates.
  - ■ Spatial / temporal reduction of motion search range.
  - ■ Based on scene characteristics gathered from low resolution sequence.

Performance of the Proposed Search Algorithm

Foreman QCIF

	Full Search	
QP	Bitrate	Speed-up
0	+0.58%	16.38
10	+1.67%	16.42
20	+3.52%	16.24
30	+4.08%	16.04
40	+4.57%	16.01
50	+0.48%	15.46

Mother & Daughter QCIF

	Full Search	
QP	Bitrate	Speed-up
0	0.00%	17.10
10	+0.33%	17.13
20	+0.73%	16.69
30	+0.54%	16.43
40	+1.47%	16.77
50	-1.98%	16.10

+/- bitrate: increase /decrease of the bitrate of the proposed algorithm compared with Full Search.

5-Year Plan

- ▲ Extension of MDC for DPCM to other memory-based coders (e.g., motion compensated video coders).
- ▲ Application of steerable transforms to MDC.
- ▲ Integrated robust media delivery platform, incorporating MDC, FEC, adaptive scheduling and caching.
- ▲ Develop scene dependent adaptive stop criteria for the proposed fast long-term memory motion compensation.