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.
- Spatial / temporal reduction of motion search range.
- Based on scene characteristics gathered from low resolution sequence.

Performance of the Proposed Search Algorithm

<table>
<thead>
<tr>
<th></th>
<th>Foreman QCIF</th>
<th>Mother &amp; Daughter QCIF</th>
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<tbody>
<tr>
<td></td>
<td>Full Search</td>
<td>Speed-up</td>
</tr>
<tr>
<td>QP</td>
<td>Bitrate</td>
<td>Speed-up</td>
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5-Year Plan
- Extension of MDC for QPAM 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.