

**Background and Motivation:**

“Compression achieved by removing the spatio-temporal redundancies in the videos”

Major blocks in the encoder:

- Motion estimation
- Transform coding
- Entropy coding

**Current video coding paradigm:**

- “Smart” Encoder
- MPEG Compliant Bitstream
- “Dummy” Decoder
- Decoder is deterministic, i.e., it always does what the bitstream tells it to do.

**Why low complexity encoding?**

- Need for low complexity and low power image/video capture in portable devices
- Computational load is shifted to the decoder

**Structure and Randomness:**

A “simple” encoder

Encoder complexity is minimal, and all the computational load is shifted to the decoder

CS measurements

Input: time

Output: space

Frame and the container with cellphones

**Decoder exploits spatio-temporal structure of the underlying videos**

- Temporal decorrelation (Motion estimation and compensation)
- Spatial decorrelation (Wavelets or Total variation)

**Recovery scheme:**

**Pseudocode:**

0. Find Initial frame estimates
1. Calculate motion from frame estimates
2. Use the motion information to refine estimates

**Example convex problem:**

\[
\begin{align*}
\text{minimize} & \quad \sum_k \| A_k x_k - y_k \|_2^2 + \lambda_k \| x_k \|_1 \quad \text{Spatial regularity} \\
\text{subject to} & \quad x_k x_{k-1} \leq \psi_3 \quad \text{Forward motion res.} \\
& \quad B_k x_k - x_{k-1} \leq \psi_4 \quad \text{Backward motion res.}
\end{align*}
\]

**Experiments:**

**Setup:**

- Measurements:
  - Scaling coefficients+Noiselets
  - Boundary frames have more samples
  - Spatial regularization:
  - \( \ell_1 \) analysis with biorthogonal complex wavelets
  - Motion estimation and compensation:
  - ME via complex wavelets local phase
  - MC via bilinear interpolation
  - \( \ell_1 \) analysis on motion residuals

**Results:**

- Recovery results at different MC iterations

**Comparison with M-JPEG (no quantization):**

- coastguard 128x128 - CS
- container 128x128 - CS
- foreman 128x128 - CS
- hall 128x128 - CS

- Step 0 @ R=4.62
  - PSNR = 32.07
  - PSNR = 39.7

- Step 1 @ R=1.4

- Email: sasif@gatech.edu