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Long-term prediction for hierarchical-B-picture-based coding of video with repeated shots

Key words: High Efficiency Video Coding (HEVC); Long-term temporal correlation; Long-term prediction; Hierarchical B-picture structure

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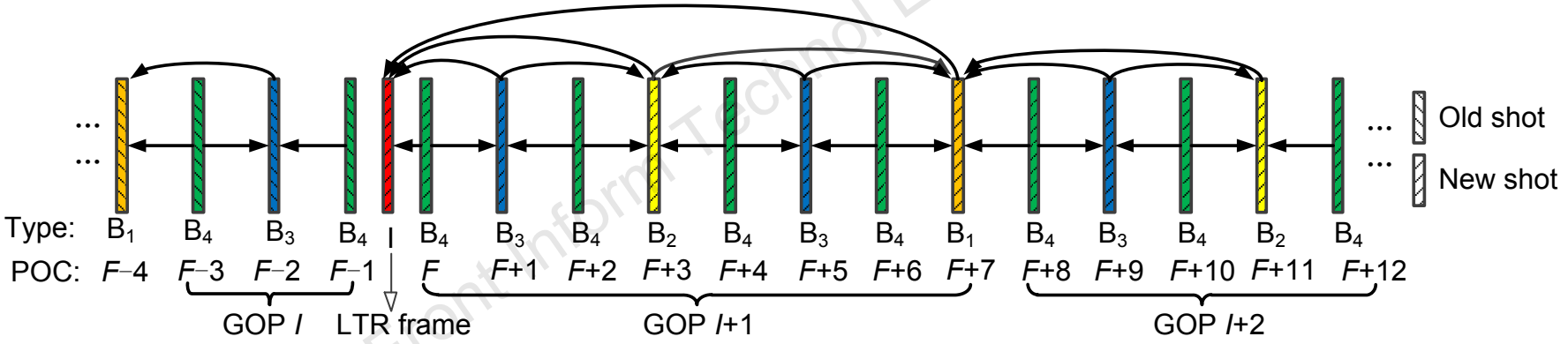
Motivation

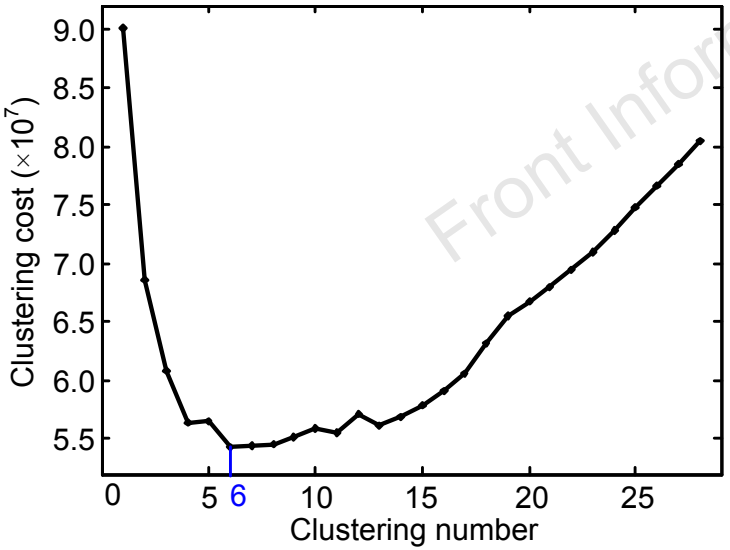
- Videos available to consumers usually contain many repeated shots, such as TV series, movies, and talk shows.
- Current coding method can exploit the temporal correlation in each shot well. However, the long-term correlation between repeated shots has not been used.

Proposed long-term prediction scheme

1. Coding structure of scene change GOP based on the LTR frame



2. Clustering-based LTR frame selection



Clustering cost relative to the clustering number

Cluster	Frame(s)
Class 1	L_1^*, L_3
Class 2	L_2, L_4, L_6, L_8^*, L_{10}, L_{12}, L_{14}, L_{20}, L_{24}, L_{26}
Class 3	L_5, L_7, L_{11}, L_{13}, L_{15}, L_{17}^*, L_{19}, L_{23}, L_{25}, L_{27}
Class 4	L_9, L_{21}^*
Class 5	L_{16}^*, L_{18}, L_{22}
Class 6	L_{28}^*

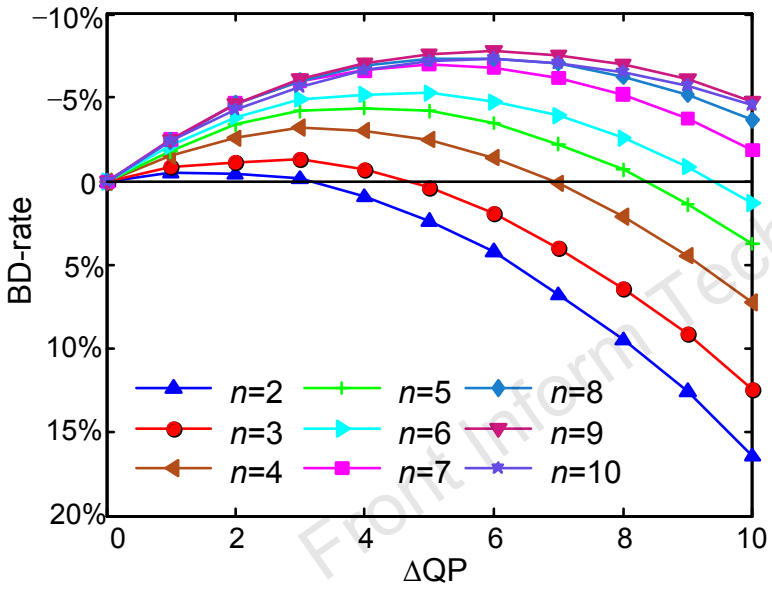
Frames marked with '*' are center frames

The clustering results

3. LTR frame QP calculation

ΔQP—QP difference between QP_L and the QP of LTR frame

n—number of times LTR frame referenced



$$\Delta QP = \begin{cases} 1, & n = 2, \\ 3, & n = 3,\ 4, \\ 4, & n = 5,\ 6, \\ 5, & n = 7,\ 8, \\ 6, & n \geq 9. \end{cases}$$

Coding performance (BD-rate) relative to ΔQP of different *n* values

Illustrative demonstration

Coding performance of AGOP, AGOP LTP, and the proposed LTP scheme

Sequence	BD-PSNR (dB)			BD-rate		
	AGOP	AGOP LTP	Proposed LTP	AGOP	AGOP LTP	Proposed LTP
Bigbang	0.05	0.10	0.48	–1.00%	–1.95%	–9.14%
Cards	0.18	0.20	0.58	–3.57%	–3.95%	–11.43%
Emperor	0.00	0.05	0.75	–0.03%	–1.13%	–14.71%
Girls	0.21	0.26	0.62	–4.42%	–5.60%	–12.75%
Time	0.00	0.02	0.23	–0.05%	–0.37%	–5.29%
QueenMother	0.01	0.03	1.14	–0.30%	–0.72%	–21.84%
Sherlock	0.15	0.18	1.23	–2.99%	–3.62%	–22.86%
Throne	0.19	0.20	0.66	–4.54%	–4.67%	–15.09%
Average	0.10	0.13	0.71	–2.11%	–2.75%	–14.14%

Conclusions

- An LTP scheme has been proposed to use long-term temporal correlations between repeated shots.
  - Coding structure of scene change GOP based on the LTR frame
  - Clustering-based LTR frame selection
  - Adaptive LTR frame QP calculation
- The overall experimental results show that the proposed scheme improves the coding efficiency from 5% to 21% compared with the relevant AGOP LTP scheme.