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Spatio-Temporal Information Fusion Network for Compressed Video Quality Enhancement

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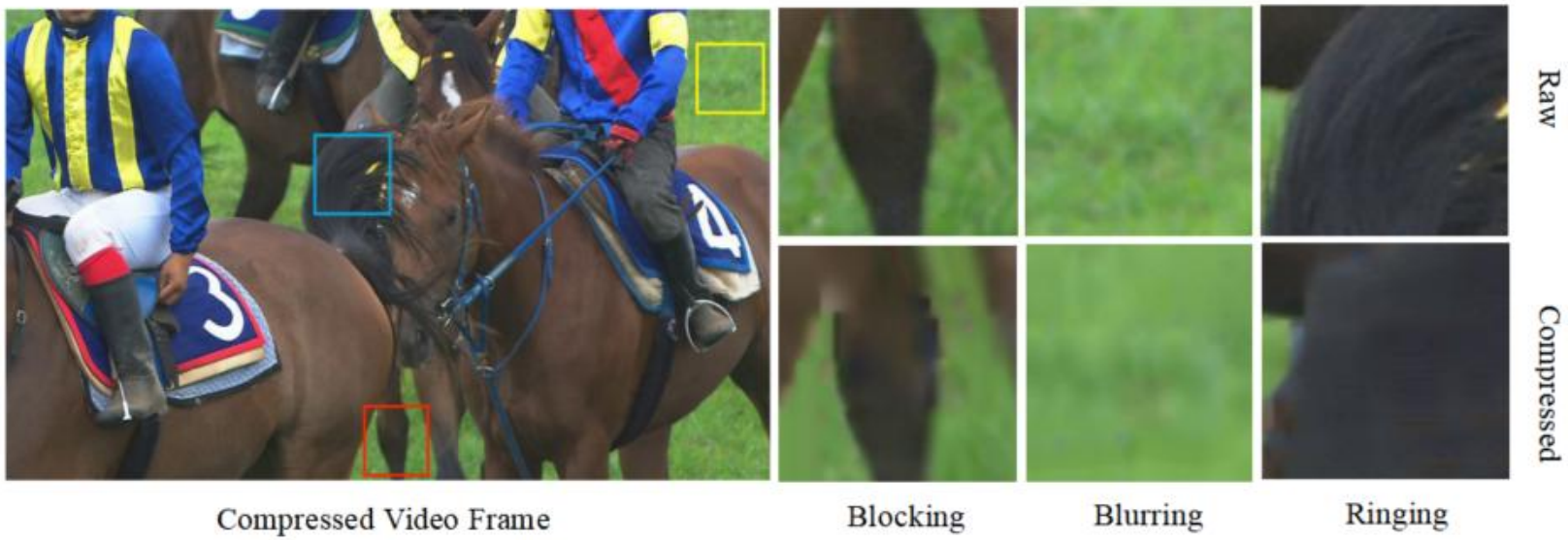
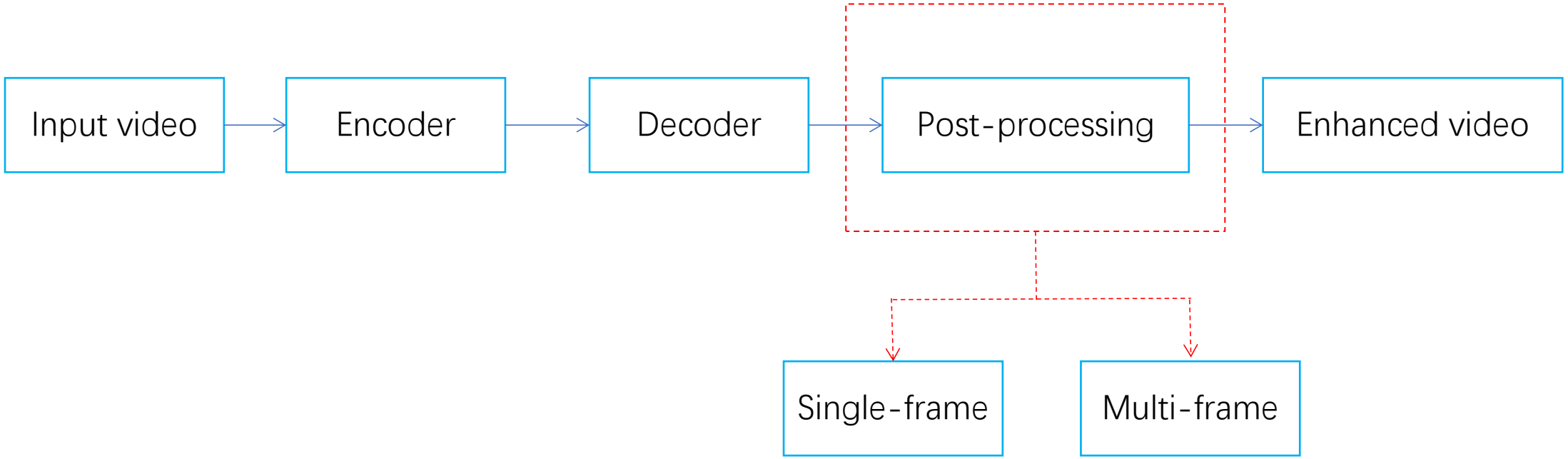
- Speaker：Weiwei Huang
- Report date：Friday, March 24

1. Introduction



To transmit video under limited bandwidth, video compression is indispensable to significantly reduce the bit-rate. However, compression algorithms often introduce various artifacts in the compressed video, especially at low bit-rate. As shown in the figure above, such artifacts may considerably diminish video quality, resulting in degradation of Quality of Experience (QoE).

1. Introduction



According to the number of input frames used, the related work of reducing compression artifacts can be categorized into two groups: single-frame based and multi-frame based approaches, respectively.

2. Motivation

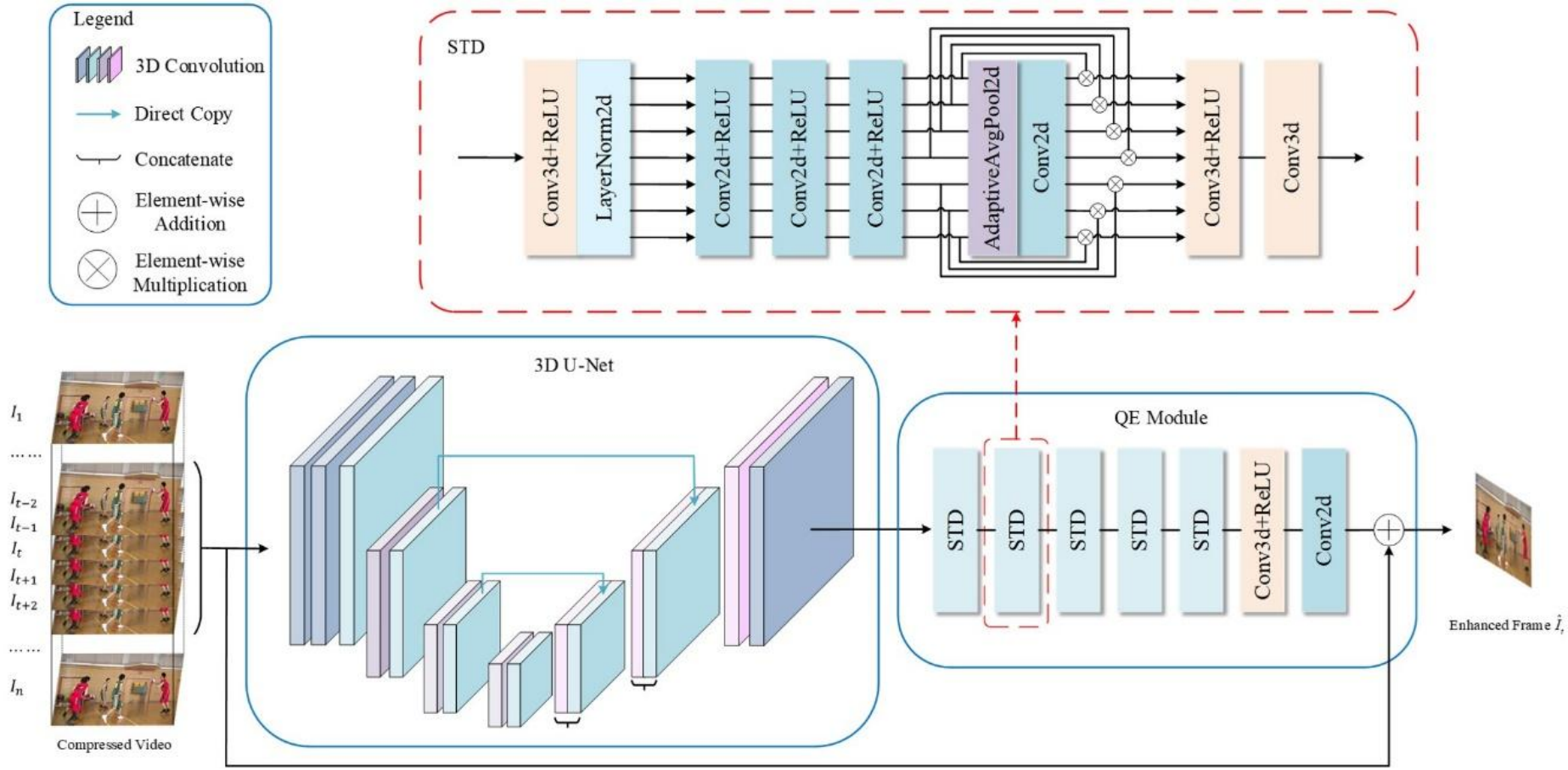
The existing two mainstream multi-frame-based enhancement methods have the following characteristics

1、Methods based on optical flow for motion compensation require additional calculation of optical flow, and the prediction is often unreliable due to compression distortion.
2、The methods of gathering temporal information based on deformable convolution are effective, but difficult to deploy deformable convolution in practical engineering.

Difference between Our Method and the Existing Multi-frame Ones

Instead of using optical flow and deformable convolution solutions, we directly use the fusion characteristics of 3D convolution in three dimensions to model the spatial and temporal domains of video frames, achieving excellent compression video quality enhancement.

3. Proposed Method



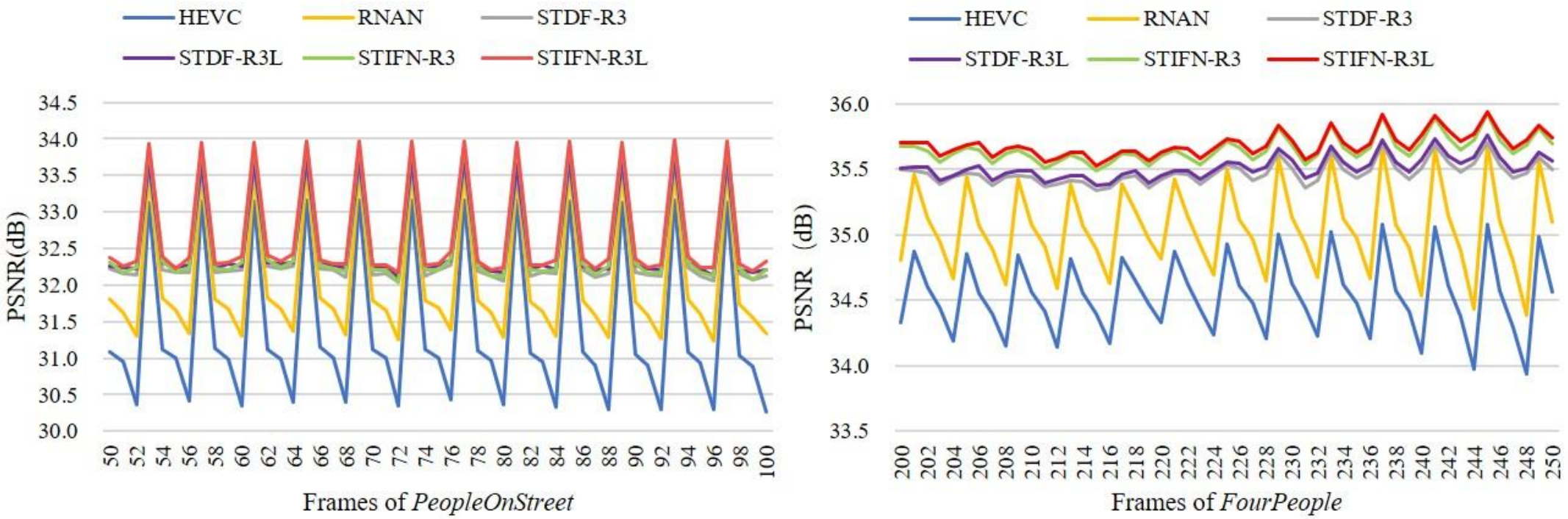
Spatio-Temporal Information Fusion Network

4. Experiment Result

QP	Test Videos		Image QE Methods			Video QE Methods				
			ARCNN [7]	DNCNN [8]	RNAN [13]	MFQE 2.0 [18]	STDF-R3 [19]	STDF-R3L [19]	STIFN-R3 Ours	STIFN-R3L Ours
37	A	*Traffic*	0.27/0.50	0.35/0.64	0.40/0.86	0.59/1.02	0.65/1.04	0.73/1.15	0.76/1.28	0.78/1.32
		PeopleOnStreet	0.37/0.76	0.54/0.94	0.74/1.30	0.92/1.57	1.18/1.82	1.25/1.96	1.26/2.02	1.34/2.10
	B	*Kimono*	0.20/0.59	0.27/0.73	0.33/0.98	0.55/1.18	0.77/1.47	0.85/1.61	0.87/1.56	0.94/1.62
		ParkScene	0.14/0.44	0.17/0.52	0.20/0.77	0.46/1.23	0.54/1.32	0.59/1.47	0.57/1.42	0.61/1.50
		Cactus	0.20/0.41	0.28/0.53	0.35/0.76	0.50/1.00	0.70/1.23	0.77/1.38	0.75/1.34	0.80/1.40
		BQTerrace	0.23/0.43	0.33/0.53	0.42/0.84	0.40/0.67	0.58/0.93	0.63/1.06	0.56/0.93	0.59/0.96
		BasketballDrive	0.23/0.51	0.33/0.63	0.43/0.92	0.47/0.83	0.66/1.07	0.75/1.23	0.73/1.22	0.79/1.27
	C	*RaceHorses*	0.23/0.49	0.31/0.70	0.39/0.99	0.39/0.80	0.48/1.09	0.55/1.35	0.47/1.13	0.49/1.15
		BQMall	0.28/0.69	0.38/0.87	0.45/1.15	0.60/1.20	0.90/1.61	0.99/1.80	0.91/1.76	0.99/1.84
		PartyScene	0.14/0.52	0.22/0.69	0.30/0.98	0.36/1.18	0.60/1.60	0.68/1.94	0.57/1.42	0.65/1.83
		BasketBallDrill	0.23/0.48	0.42/0.89	0.50/1.07	0.58/1.20	0.70/1.26	0.79/1.49	0.81/1.65	0.87/1.70
	D	*RaceHorses*	0.26/0.59	0.34/0.80	0.42/1.02	0.59/1.43	0.73/1.75	0.83/2.08	0.73/1.80	0.79/1.90
		BQSquare	0.21/0.30	0.30/0.46	0.32/0.63	0.34/0.65	0.91/1.13	0.94/1.25	0.92/1.26	1.03/1.44
		BlowingBubbles	0.16/0.46	0.25/0.76	0.31/1.08	0.53/1.70	0.68/1.96	0.74/2.26	0.73/2.28	0.76/2.35
		BasketballPass	0.26/0.63	0.38/0.83	0.46/1.08	0.73/1.55	0.95/1.82	1.08/2.12	0.97/2.04	1.09/2.15
	E	*FourPeople*	0.40/0.56	0.54/0.73	0.70/0.97	0.73/0.95	0.92/1.07	0.94/1.17	1.11/1.31	1.14/1.33
		Johnny	0.24/0.21	0.47/0.54	0.56/0.88	0.60/0.68	0.69/0.73	0.81/0.88	0.93/0.99	0.95/1.00
		KristenAndSara	0.41/0.47	0.59/0.62	0.63/0.80	0.75/0.85	0.94/0.89	0.97/0.96	1.14/1.04	1.19/1.07
	Average		0.25/0.50	0.36/0.69	0.44/0.95	0.56/1.09	0.75/1.32	0.83/1.51	0.82/1.49	0.88/1.55
32	Average		0.19/0.17	0.33/0.41	0.41/0.62	0.52/0.68	0.73/0.87	0.86/1.04	0.80/1.03	0.86/1.08
27	Average		0.16/0.09	0.33/0.26	0.39/0.30	0.49/0.42	0.67/0.53	0.72/0.57	0.73/0.65	0.81/0.72
22	Average		0.13/0.04	0.27/0.14	0.28/0.16	0.46/0.27	0.57/0.30	0.63/0.34	0.67/0.40	0.72/0.43

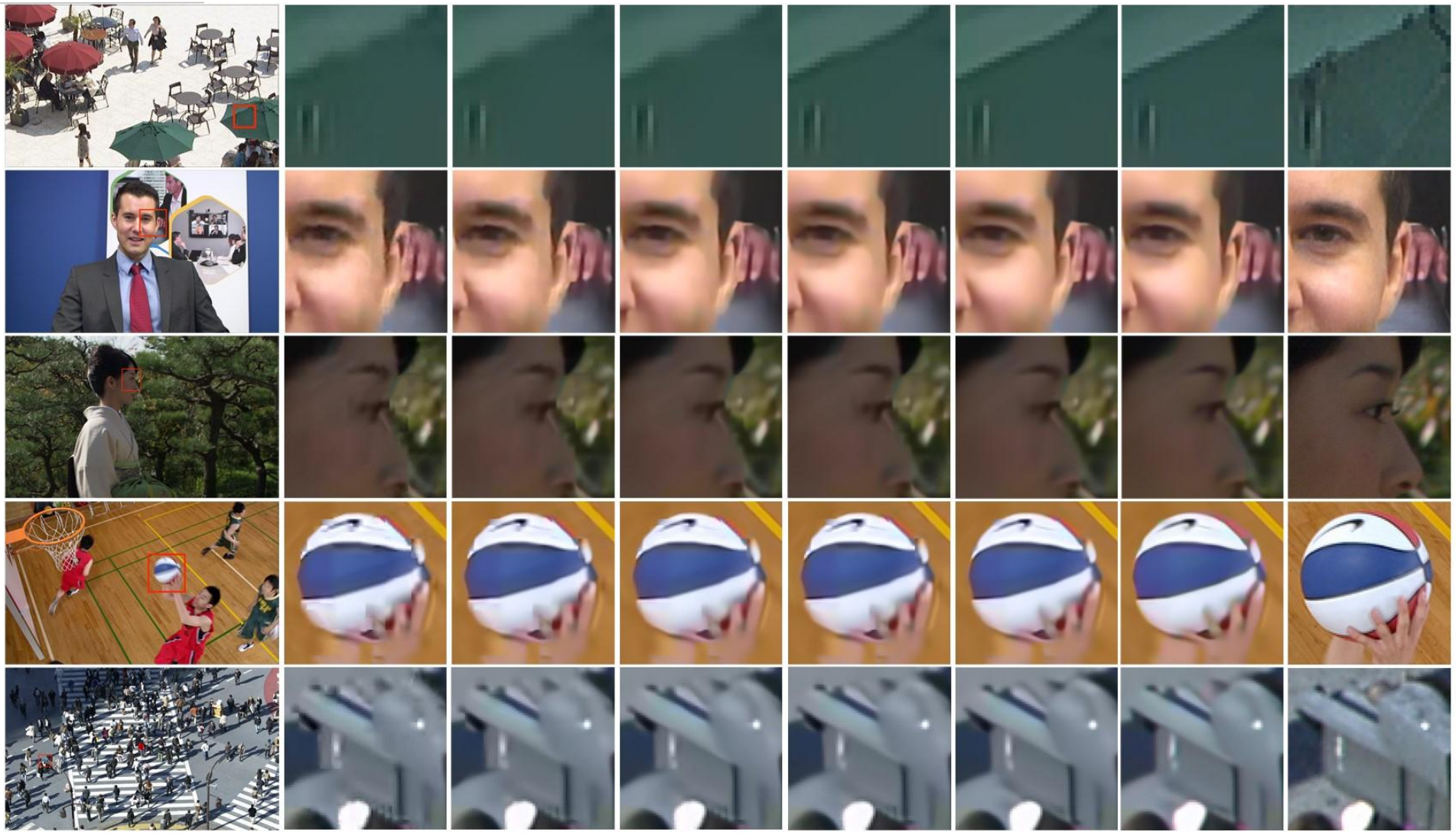
4. Experiment Result

Method	DNCNN	RNAN	MFQE 2.0	STDF-R3	STDF-R3L	STIFN-R3	STIFN-R3L
#Params(K)	556	8957	255	365	1275	374	660



PSNR curves of 2 test sequences at QP 37

4. Experiment Result



Thanks!