Flow-Guided Temporal-Spatial Network for HEVC Compressed Video Quality Enhancement

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In this work, a flow-guided temporal-spatial network (FGTSN) is proposed to enhance the quality of HEVC compressed video. Specially, we first employ a motion estimation subnet via trainable optical flow module to estimate the motion flow between current frame and its adjacent frames. Guiding by the predicted motion flow, the adjacent frames are aligned to current frame. Then, a temporal encoder based on bidirectional ConvLSTM with residual structure is designed to discover the variations between current frame and its warped frames. Finally, the reconstruction frame is generated by training the model in a multi-supervised fashion. Our method takes advantage of temporal-spatial information to enhance the compressed video Quality
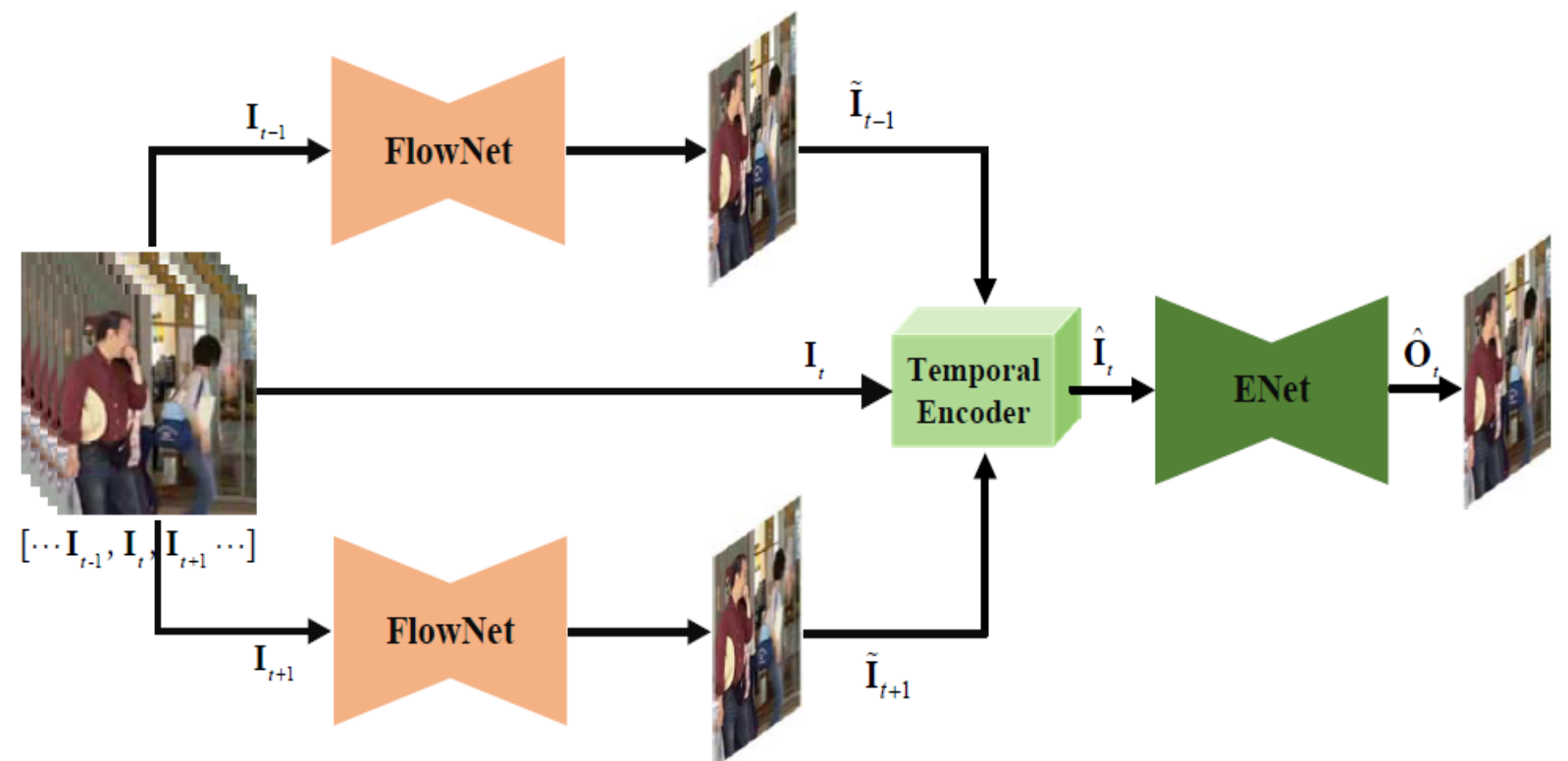
The Framework of our proposed FGTSN method
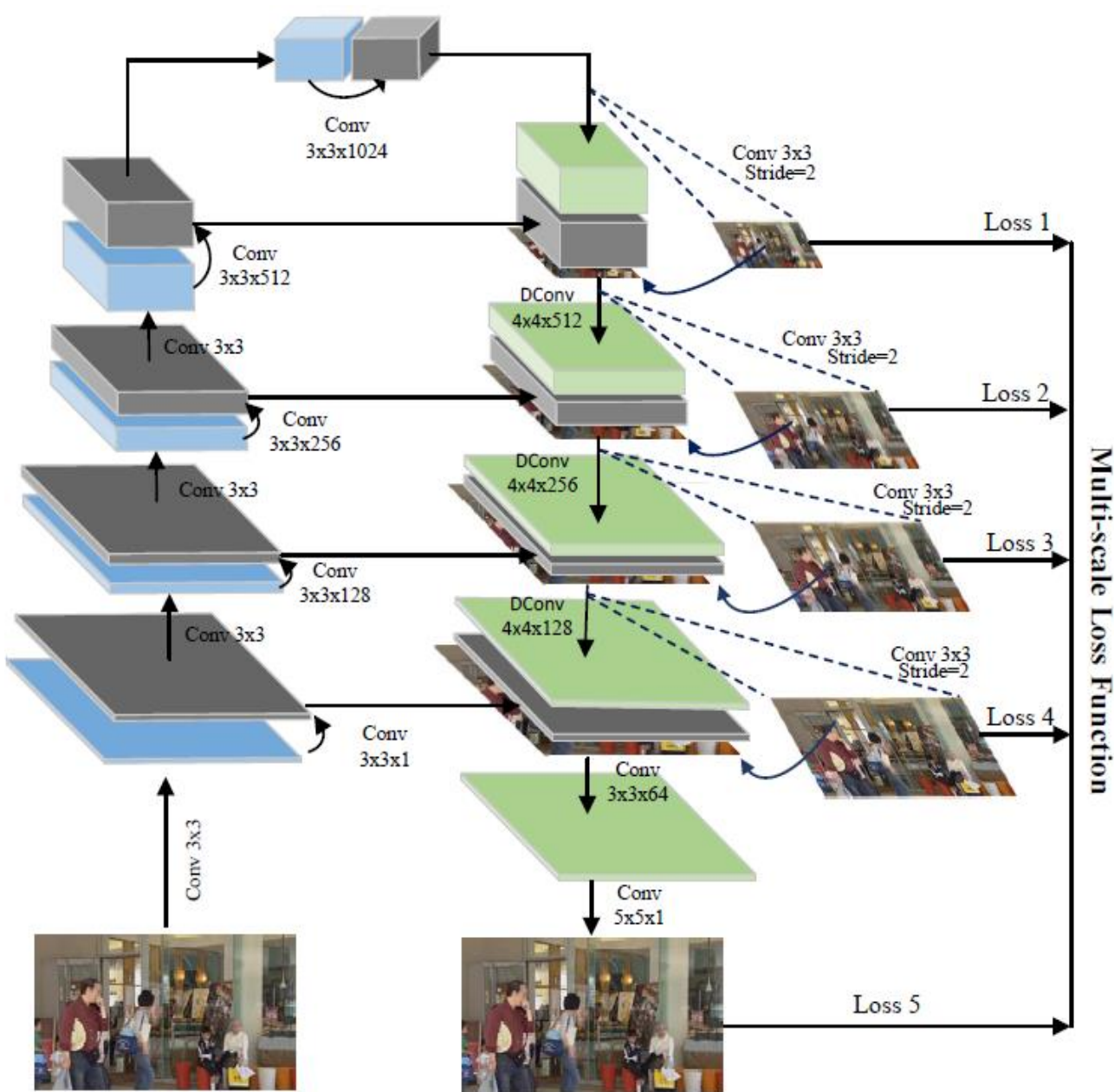
The proposed multi-scale ENet structure

Overall ΔPSNR (dB) results of different methods under LD

QP	Class	Seq	ARCNN [3]	QECNN [4]	DCAD [5]	MFQE [6]	SDTS [7]	FGTSN (ours)
37	A	PeopleOnStreet	0.4579	0.5517	0.5286	0.7526	0.7818	**0.8223**
		Traffic	0.2864	0.3213	0.3208	0.4215	0.4636	**0.4684**
	B	Kimono1	0.2439	0.2502	0.2557	0.3927	0.4066	**0.7537**
		ParkScene	0.1658	0.1769	0.1644	0.3135	0.3568	**0.4548**
		Cactus	0.1886	0.2334	0.2659	0.3263	0.3709	**0.4823**
		BasketballDrive	0.1753	0.2164	0.2540	0.1738	0.1932	**0.3951**
		BQTerrace	0.1148	0.1617	0.2527	0.2394	0.2303	**0.3298**
	C	BasketballDrill	0.1313	0.2037	0.2844	0.2656	0.2761	**0.4361**
		BQMall	0.0673	0.1194	0.1962	0.2670	0.2807	**0.3828**
		PartyScene	-0.0337	0.0062	0.1083	0.0413	0.0624	**0.3026**
		ParkScene	0.1909	0.2596	0.2643	0.2414	0.2602	**0.4641**
	D	BasketballPass	0.1315	0.2456	0.2726	0.4687	0.4691	**0.5084**
		BQSquare	-0.1283	-0.0607	0.1527	-0.0275	0.0131	**0.3162**
		BlowingBubbles	0.0774	0.1416	0.1347	0.2976	0.3474	**0.3855**
		RaceHorses	0.3166	0.3590	0.3887	0.4770	0.5247	**0.7248**
	E	FourPeople	0.3813	0.4686	0.5140	0.5741	0.6085	**0.6313**
		Johnny	0.2635	0.3496	0.3736	0.4792	0.4468	**0.5076**
		KristenAndSara	0.3158	0.4080	0.4837	0.5055	0.5461	**0.6838**
		Average	0.1859	0.2451	0.2906	0.3416	0.3688	**0.5028**
42		Average	0.2009	0.2417	0.2622	0.3747	0.4163	**0.5167**

* All comparison methods are retrained over the same training dataset according to authors' recommended parameters.

The experimental results show that our proposed FGTSN method significantly improves the quality of HEVC compressed video at different QPs under LD configuration, much better than the state-of-the-art quality enhancement methods.