METHOD FOR AUTOMATIC CARTOON COLORIZATION

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Common issues

Fig. 1. «Color bleeding»

Fig.2 Color flicker in consequent frames

Proposed solution

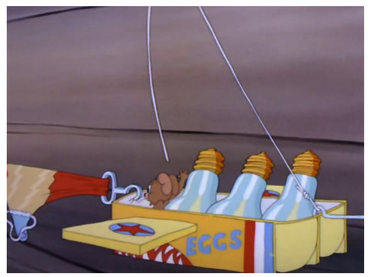

Fig. 3. Most of the time, cartoons consist of large textureless regions

Find segmentation mask using watershed and edge detection

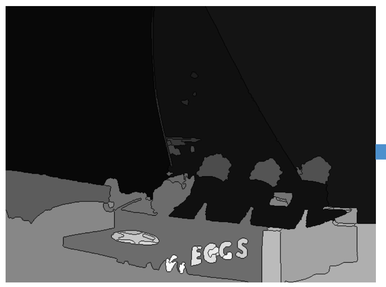

Fig.4. Segmentation mask, where each segment is roughly the same color

$$L_{segment} = L_{intra} + L_{inter}$$

Introduce new loss function based on segmentation mask into the baseline algorithm.

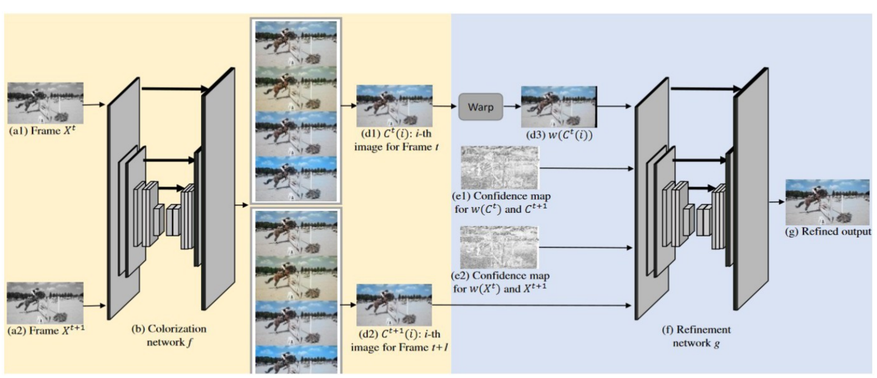

Fig. 5. Baseline algorithm structure

Qualitative results

Fig.6. Examples of consequent colorized frames and ground truths.

Fig. 7. Examples of random colorized frames and ground truths.

Proposed losses description

$$L_{inter} = \sum_{(l,m) \in N_Y t} M\left[\left|f_l\left(X^t;\theta_f\right) - f_m\left(X^t;\theta_f\right)\right|\right]$$

Where M is the operation of taking the mean, l and m are pixels belonging to the corresponding segments on the KNN graph N, X is the source image.

$$L_{intra} = \sum_{l=1}^{n} M\left[\left|f_l\left(X^t;\theta_f\right) - C_l^t\right|\right]$$

Where M is the operation of taking the mean, l are all the pixels belonging to the segment, C is the ground truth frame.

Quantitative results

TABLE I. QUANTITATIVE RESULTS FOR TOM&JERRY COLORIZATION

Loss function combination, networks	Metrics			
	PSNR	*LPIPS*	*MSE Lab*	*CC*
Grayscale	20.54358	0.2544	0.0039	0.3095
Bilateral + RankDiv + Temporal,	20.915756	0.2079	0.0035	0.3114
Bilateral + RankDiv + Temporal, main + refinement network	20.02433	0.2342	0.0036	0.3101
RankDiv + Segment, main network	20.893824	0.2160	0.0038	0.2997
RankDiv + Bilateral + Segment, main network	21.040308	0.2078	0.0036	0.3148
RankDiv + Bilateral, main network	20.819466	0.2114	0.0038	0.3091

For more results, and information about baseline losses and algorithms, see paper.

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