Color for Black-and-White Cartoons

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Abstract

This poster introduces a novel semi-automatic colorization framework which is suitable for cartoons originally shot in black-and-white on classical celluloid films. More specifically we focus especially on the cel or paper based cartoon making technology. In this case usually the background layer is a static image and only the dynamic foreground needs to be colorized frame-by-frame. We also assume that objects in the foreground layer consist of several well visible outlines which emphasize the shape of homogeneous regions.
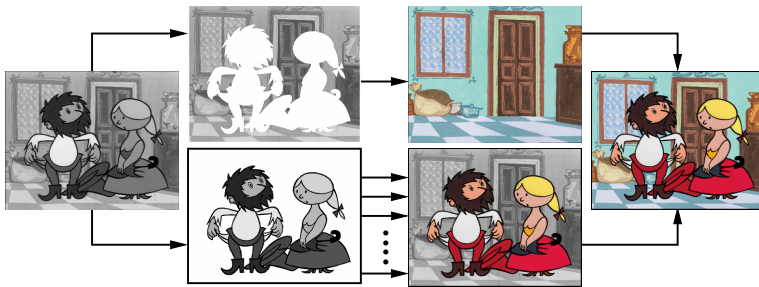
Framework overview

At first robust grey-scale outline detector [2] is used to locate and extract region boundaries which allow us to divide the original image into the set of regions. Region size thresholding and structural prediction is then used to determine which part of the original image belongs to the foreground layer.


Outline based image segmentation also help us to reconstruct one big image which contains only visible parts of the background layer. To do that we register occluded parts of the original background layer from several consecutive frames using camera motion estimation. Afterwards a skilled designer applies color on the whole background layer using standard image manipulation software.
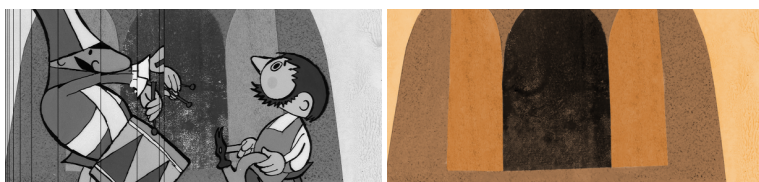
In the foreground layer predefined hue and saturation is applied on each pixel automatically while the final color brightness is modulated by pixel intensity from the original grey-scale image [1]. During this step dust spots and band scratches are also removed automatically exploiting region homogeneity [1].

To estimate the most probable color-to-region assignment for each region in the foreground layer we use our novel color prediction scheme based on the patch-based sampling and probabilistic relaxation [3]. During this step limited manual interaction avoids propagation of prediction errors into uncolored frames and guarantees the final visual quality.
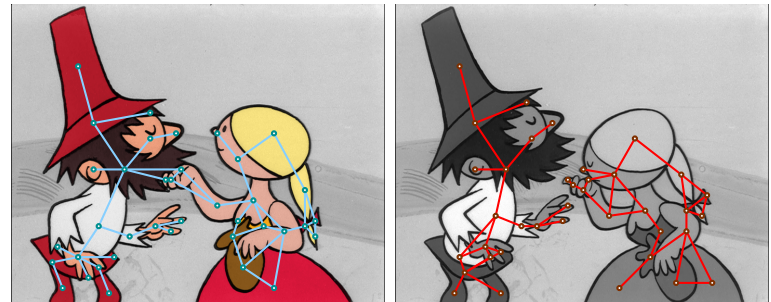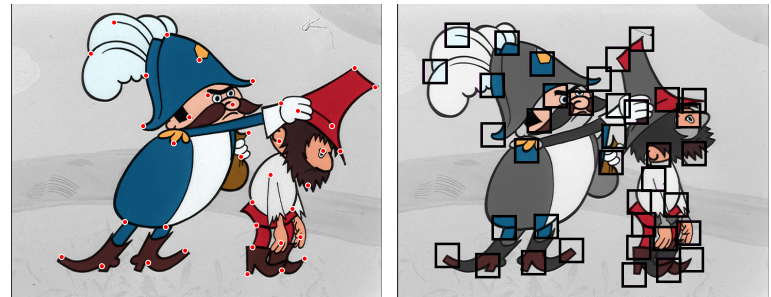
Finally camera motion estimation is used again to extract proper background layer from the already colorized background image. To produce the final color image we make a smooth composition of such colored background with yet colored foreground layer [1].

References

[1] Daniel Sýkora. Inking old black and white cartoons. Master's thesis, Department of Computer Science and Engineering, FEE, CTU, Prague, Czech Republic, 2003.

[2] Daniel Sýkora, Jan Buriánek, and Jiří Žára. Segmentation of black and white cartoons. In *SCCG'03 Proceedings*, pages 245–254, 2003.

[3] Daniel Sýkora, Jan Buriánek, and Jiří Žára. Unsupervised colorization of black-and-white cartoons. In *NPAR'04 Proceedings (to appear)*, 2004.