Segmentation of Colour Regions from Two-Colour Halftone Prints

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Abstract

To evaluate print characteristics on the basis of scanned microsamples of printing sheets, it is necessary to carry out the segmentation of particular colour regions, printed with process inks. The accuracy of the evaluation of print characteristics strongly depends on the successful segmentation of the colour regions involved in a print sample. This paper describes the colour region segmentation based on the combination of thresholding and edge detection methods.

Keywords

Halftone print, print characteristics, colour, segmentation, edge detection.

1. Introduction

Colour publications are printed with using four process inks – yellow (Y), magenta (M), cyan (C) and black (K) - by various technologies of industrial press. The results of such printing are halftone dots of various sizes printed with various process inks. We can measure and evaluate the basic characteristics, which determine quality of the print, from the halftoned two-colour print samples.

The print characteristics used to examine print quality which are measured in the solid and halftoned areas are:

Optical density of the ink layer which determines quality of ink printing on the paper, *Dot area* which determines enlargement of print dots and *Ink trapping* which determines quality of ink printing to ink layer printed sooner) .

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These parameters can be evaluated also from two-colour print samples scanned with a CCD camera and processed with image analyses methods. The usual practice is to perform the segmentation of an individual process colour and their overprint regions from the print sample, and then evaluate the print characteristics. In this case these are optical density inside the segmented regions, ink trapping gained from these densities and geometrical dot area. Two-colour print samples are usable for this purpose, because of the possibility of evaluation of all three characteristics from one sample.

The crucial point for the successful evaluation of print characteristics is the exact segmentation of colour regions in the sample. There are many methods, how to accurate results of segmentation [1]. The combination of thresholding grey-level image gained from original colour image by separation process, and edge detection in the original colour image was used for this purpose.

2. Combined segmentation method

This method is based on using colour separation of the sample into a grey level image, in which the region of the separated colour has the minimum brightness [5].

On the fig.1 see separations of blue and yellow regions gained by separation process.

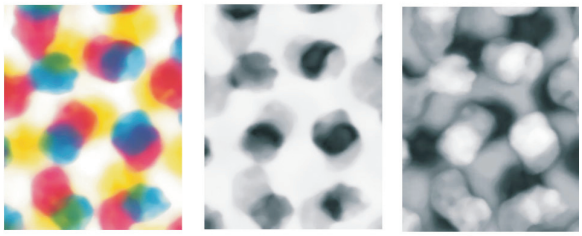

Fig.1 Separations of blue and yellow

A method of combination the thresholding and edge detection is based on an assumption that the border of the particular colour region lies in the middle of the edge of colour change-over from the first to the second colour. We can calculate significant edges of the colour region, which are to be segmented, with help of some edge detector.

The co-ordinates of edge pixels are the pointers to grey-level separated image and determine a set of threshold values. The average of these thresholds is the optimal threshold for the segmentation of the colour region.

3. Edge detection of colour regions

The edge detection method used in this work is based on the colour differences appearing in the pixel neighbourhood. The statistical parameter variance of the colour values in this neighbourhood indicates the edge size.

The variance of the component *hue* from HSB colour space as the edge detector was used in this work. The main advantage of this approach is smoothing of the colour image simultaneously with the edge detection. This is because *saturation* and *brightness* components include the major portion of the image noise in halftoned printing images.

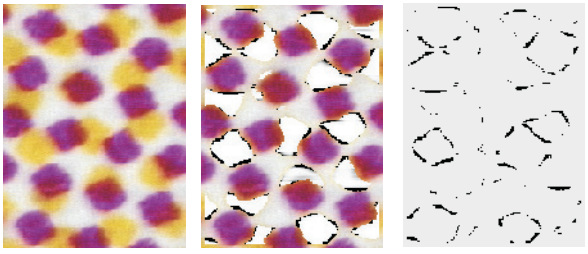

Fig.2 Edges of yellow regions

On the fig.2 see the original colour image and the images with significant edges of yellow colour between yellow-magenta and yellow-white regions.

4. Results

Many two-color samples were processed with described method. The average of segmentation error, evaluated as the difference between area value of all color regions included in the sample and 100 percent, was approximately 6 percent.

On the fig.3 see the example of cyan-magenta sample, the image of magenta edges and the image of magenta segmentation.

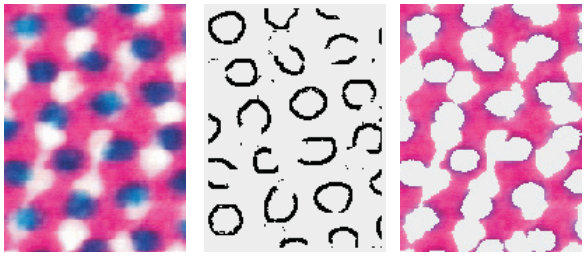

Fig.3 Segmentation of magenta regions

Improving the segmentation accuracy has the positive effect on the successful evaluation of print characteristics. The contemporary production press needs to measure, evaluate and control the print characteristics with sufficient accuracy. The method described in this work can benefit to this purpose.

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