Study on Automatic Recognition of Fabric Color and Matching to Standard Color Chip by Computer Vision and Image Analysis Technology

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Abstract

The Artificial visual approach to detect fabric color is easy to be affected by light and experience. In order to overcome the shortcomings of errors, this paper presents a new method for matching between textile fabric color and standard color card automatically, and establishes the automatic matching system for 1925 kinds of Pantone TCX color swatches by using computer vision and image analysis. First, the scan images of Pantone TCX color were acquired, then we extracted effective color characteristic information from the images, and constructed the database of color features. Furthermore, we designed color layered model and matching model which based on 'one to one' Support Vector Machine (SVM). Through parameter optimization and identify training for SVM model, the accuracy of color identifying is 96.89%. Finally, we used 296 unknown color samples for verification, the accuracy is 98.85%. The results show that the research provides an effective auxiliary tool objectively and quickly for color measurement.

Keywords: Fabric Color; Color Matching; Image Processing; Support Vector Machine (SVM); Pantone Color Swatches

1   Introduction

The analysis of structure parameters and color is essential for imitation of dyeing cloth and yarn-dyed fabric. At present, the color analysis is performed artificially comparing the sample and textile standard card by means of visual observation, then finds the most matching card with the sample. The procedures are usually tedious and time-consuming, and it is easily affected by light and experience to cause errors. Although there are many color measurement instruments, such as spectrophotometer, which can determine the spectral power distribution of the reflection of objects, according to the spectral measurement data to calculate the three stimulus values X, Y, Z of the CIEXYZ space in all kinds of standard illuminations. But the three stimulus values of color description is different from standard color card, which makes the technical personnel who are familiar with using standard color card to determine the color scheme should conduct additional data selection and analysis, and it is contrary to the habit of most trading companies

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and factories. From then on, we think the fabric color analysis technology should be upgraded, and it should be based on the principle of objectivity and practicality. Traditional fabric surface quality inspection is time-consuming, laborious manual inspection, which restricts the textile industry to being upgraded. Many scholars transform fabric surface to digital image by using machine vision, and get information on it, then they use the digital image analysis technology to replace manual analysis. For example, there are many researchers devoted to fabric structure analysis by computer aided [1-3], computer color classification [4], calculation of color difference [5], color fastness evaluation [6], it is expected to break through the traditional detection.

This paper presents a new method developed for automatic analysis of fabric colors by an image analysis system. We applied the color - Pantone textile color card widely used at home and abroad as reference, and captured images from Pantone TCX color, then according to the brightness level of images, we put the color images segmentation into layers based on the gray model, which imitate the physical layer principle of Pantone color card. According to the development and application of color recognition algorithm, we construct a kind of color recognition model that can map matching the unknown color with known color by introducing the Support Vector Machine (SVM, hereinafter referred to as SVM) machine learning methods. Meanwhile, we have developed a color recognition system that can make samples matching to Pantone color card accurately. The recognition system has higher correct rate, which provides an auxiliary tool for the exploration of the color measurement objectively and quickly.

2 System Set-up

Hardware system uses CanoScan 8800F color scanner with a resolution of 600 dpi. The scan images of Pantone TCX color and test samples were acquired and saved as a 24 bit true color images. Based on MatlabR2010b programming language, the software system is developed to realize the image preprocessing, feature extraction and color intelligentized matching. Fig. 1 is the working flow diagram of the system.
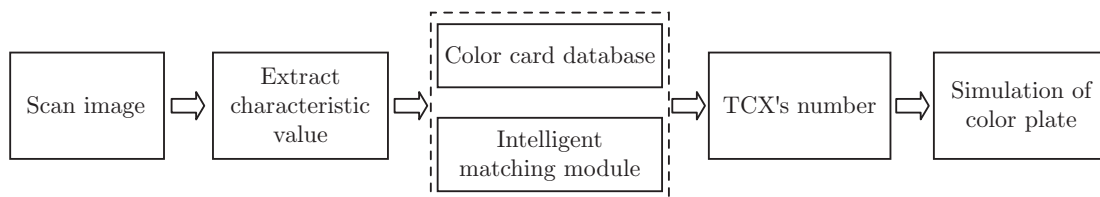

Fig. 1: Working flow diagram of the system

The task of the soft system is to set up the mapping relationship table of color characteristic value between the fabric image and standard color card image. The key task of the soft system is the development of 'Standard sample database' and 'Intelligent matching module'. Firstly, 1925 kinds of Pantone TCX color swatches are scanned, the effective color features are extracted from the scan images, and then according to the range of lightness, we construct standard sample database with 29 layers. Finally, we establish 29 SVM model. The color feature data of standard samples are input to training for each SVM model, and we use cross validation method to obtain the best parameter c, g for each SVM classifier, so 29 SVM models are optimized. And the intelligent matching module is composed of the 29 color classifiers and 29 trained SVM classifiers.