Playing Card Detection and Identification

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Abstract— **In this report I present an algorithm for playing card detection and identification. This algorithm is able to detect and identify playing cards. This algorithm is implemented in MATLAB.**

Keywords-playing card detection; image processing; template matching;

I.   INTRODUCTION

The intention of this project is to build a playing card recognition system just for fun. The system has the capability to recognize a standard deck of playing cards, with both ranks and suits. This algorithm involves contrast enhancement, region detection, orientation determination and template matching.

The accuracy of the algorithm is about 96 percent in given dataset. It may vary depending on card size, lighting, and different card deck that used.

II.   ALGORITHM

A.   Contrast Enhancement

Contrast is the difference in luminance or color that makes an object distinguishable. Contrast Enhancement refers to the sharpening of image features to remove the noisy feature such as edges and contrast boundaries. There are different types of contrast enhancement algorithms but in this project only Histogram Equalization used. Histogram equalization is an image processing technique that adjusts image intensities to improve contrast. This technique is used to distinguish between background and foreground.

B.   Binary Image Thresholding

Thresholding is the simplest method of segmenting images. This method replaces each pixel in an image with a black pixel if the intensity is less than some constant or a white pixel if the intensity is greater than that constant. In this project thresholding is performed using Otsu's method.

C.   Region Detection

Region detection is a method that relies on the assumption that the neighboring pixels within one region have similar values. The common procedure is to compare one pixel with its neighbors. If a similarity criterion is satisfied, the pixel can be set to belong to the same cluster as one or more of its neighbors. In this project bwlabeln function used to partition an image into regions where each region represents a card.

D.   Image Transformation

Image transformation helps us to rotate card to vertical orientation by using orientation of the captured image. This technique handles variations of playing cards where are not centered and are rotated.

E.   Template Matching

Template matching is a technique in image processing for finding small parts of image which match a template image. In this project, normxcorr2 function used to compute normalized cross-correlation of given template and image that is corner of the captured image of card.

III.   IMPLEMENTATION

The process used in this project for identifying cards in image can be divided into two main parts. The first part is extracting position of the corner of the card in image and the second part is template matching with templates and the corner of the card. The template matching process separated into two parts as rank matching and suit matching. Also, MATLAB used to implement this project.

This project follows the steps listed below.

Fig. 1 Original Image

A.   Contrast Enhancement and Binary Thresholding

In this part, imadjust function was used for histogram equalization. The image following contrast enhancement and binary thresholding is shown in Fig. 2.
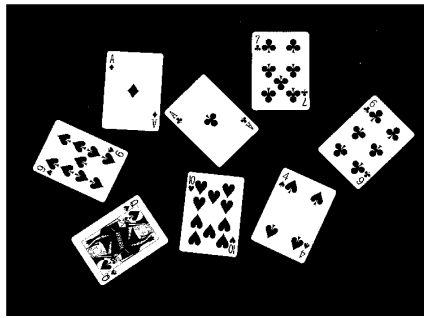
Fig. 2. Image after Contrast Enhancement and

Binary Thresholding

B. Region Detection and Transformation

In this point, binary image labeled using bwlabeln function. Next, all regions that less than two hundred and fifty thousand pixels are ignored. After this step, all regions are cropped to process one by one.

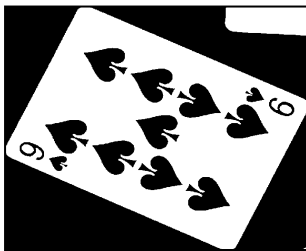This cropped image rotated to vertical by using orientation of the region.
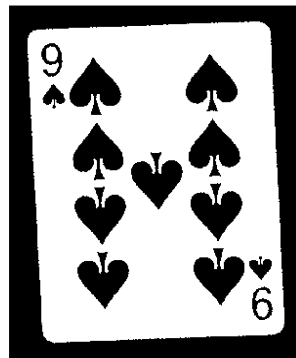

Fig. 3. Image After Cropping

Fig. 4 Image After Rotating

C. Template Matching

To recognize the rank and the suit of the card, 17 templates generated as 13 ranks and 4 suits.

Fig. 5. Templates

Then, for the best matching, the corner of the card was used to template matching by using normxcorr2 function.
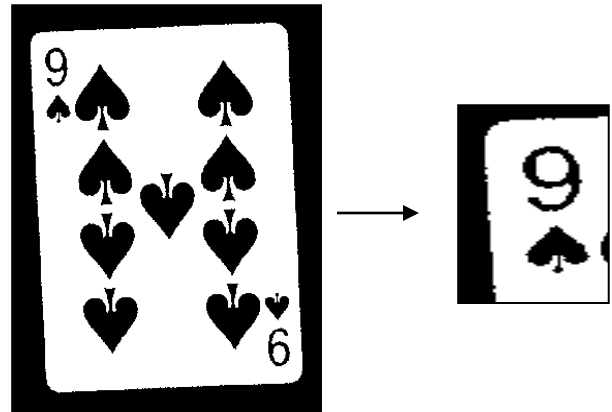

Fig. 6 Cropping Corner

IV. RESULTS

A. Accuracy

This algorithm can detect and identify the rank and the suit of the card. However, this project is only reliable when cards are pictured from top and are separated.

For overall accuracy in identification both suit and rank is 90,3%. Rank is correctly determined 92% and suit is determined 89%.

Fig. 7. Confusion Matrix base on Suits

Heart, Diamond, Spade, Club – 1, 2, 3, 4 respectively

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