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Playing Cards Identification Using Image Processing

https://web.fe.up.pt/~niadr/PUBLICATIONS/LIACC_publications_2011_12/pdf/C62_Poker_Vision_Playing_PM_LPR_LFT.pdf

Introduction

The Casino industry is a widely popular industry and extremely prone to acts of cheating and trickery. A player playing at a casino especially those who are losing create a set of very risky individuals likely to engage in chips theft.

Chips are token money valued at a ratio with real money, with which one can enter a casino and play any game he or she likes. Often players stack up their chips beside them which is referred as that players' stack.

Among a plethora of casino games, Poker is one of the most popular games and the chips used to play them are hence called Poker Chips. Please note Poker Chips is quite a generic term and is often used to refer to normal playing Chips as well.

Playing cards are self-explanatory in what they represent. A deck of 52 cards with four suits (Ace to King). Together the playing cards and the poker chips represent a complete poker player required to analyze.

Playing Cards Analysis

Fig. 1. Detect cards contours algorithm overview

Step 1 - The above figure represents the steps to first and foremost, finding the cards on the poker table. This step relies on the contrast between the poker table color which is dark colored like green and the playing cards mostly white.

"The image captured of the table overview is first submitted to the preprocessing block. This block consists of low level image processing functions, where the image is first converted to gray scale, followed by smoothing with a Gaussian filter and finally the contrast between the card and the poker table is enhanced by a linear stretch to the histogram. "

The Canny Edge detector takes the above generated image as input and the output is scanned for external contours retaining only the first level contour signifying the border between the cards and the table.

At the last step of the above figure, the algorithm selects polygons with four vertices in the shape of trapezoids. Since generally cameras are placed at an angle and not perpendicularly above the poker table, the rectangular playing cards are naturally morphed into trapezoids with inner angles close to 90 degrees.

Step 2 - The next step entails extracting the card depicted in figure 2.

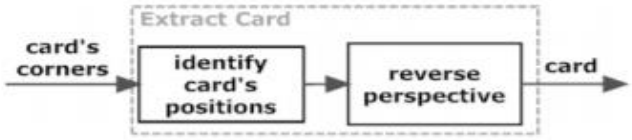

Fig. 2. Cards' extraction algorithm

Since there may be one or more cards on the table at a given instant, all trapezoids are to be investigated. Also since positioning of the camera is highly dynamic in nature, a reversal in perspective is performed to eliminate the perspective view effect and to generate something on the lines of the following figure.

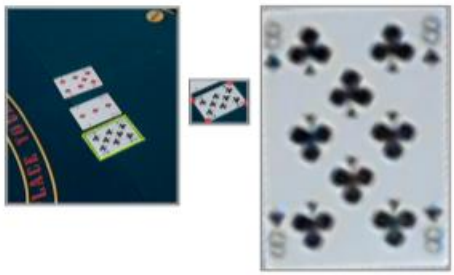

Fig. 3. Extraction of playing card reversing the perspective view

Also note since there is enlargement of the original image, loss of quality is inevitable.

Step 3 – What now remains is the extraction of the rank of the card and the suit. Conveniently we have chosen a design wherein there's a suit underneath every rank enabling us to select a subsample of the image with which we can extract both the rank and the suit. Also we assume the size of the rank is uniform on all 52 cards.

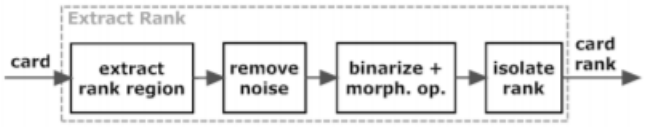

Fig. 4. Rank extraction algorithm overview

"After the region of interest is extracted, the algorithm removes unwanted noise by smoothing it with a Gaussian filter. Thereafter binarizes the resultant image with an Adaptive Threshold. The resulting image after binarization is eroded in order to remove some remaining thin noise. In order to normalize the position of the rank, along with the filtering of remaining noise, the image is submitted to the isolate rank block.

This block was implemented in order to tightly isolate the rank of the card from the rest of the crop. It seeks for all the elements, i.e. contours, present on the binarized image and encloses them in a box. Afterwards, the algorithm analyses the sizes of the enclosed contours as well as its centroids and discards all the contours which feature a non-reasonable size, followed by selecting from the remaining, the one which centroid is the closest to the center of the image. The resulting image is one featuring only the rank tightly isolated. "

The resultant image looks like the following

Fig. 5. Part of the rank extraction process

Step 4 – The last step is identifying the rank of the card.

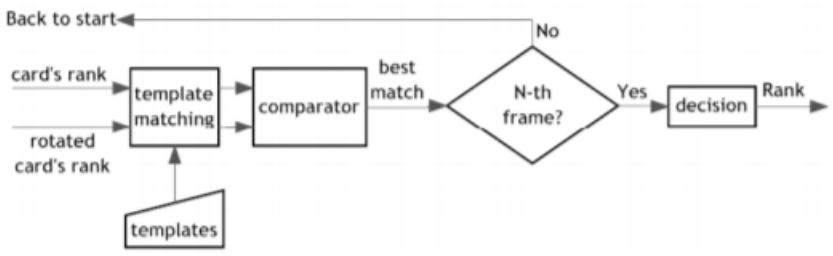

Fig. 6. Card Identification algorithm

The above algorithm used by the author shows how the last step is being conducted.

"The approach used here, template matching , is a pattern recognition technique that allows detecting the presence of a specific object in an image. It can produce reliable results but needs

to know exactly what to look for since it is based on the comparison of the image against a pre-defined template."

Fig. 7. The thirteen templates used

Since each card has four corners all giving us the relevant information individually, it eliminates the case where one corner might not be visible due to reflectance. Hence preceding the template matching, all corners are the subject of recognition.

The normalized square difference between the template and the input image is used as the metric to classify as a valid match. The authors used a ceiling of 0.45 to classify it is a valid match. All scores below the ceiling value constitutes a match and if there are two templates giving a value less than 0.45, the lower value is selected (the best match).

Conclusion

The authors were able to achieve 94.4 % accuracy. They also concluded by saying it's still a challenge to identify between a red and black card since spades were quite often misclassified as diamonds. Also if the video source is one of a higher resolution, it would invariably lead to a higher reliable system.

References

1. https://web.fe.up.pt/~niadr/PUBLICATIONS/LIACC_publications_2011_12/pdf/C62_Poker_Vision_Playing_PM_LPR_LFT.pdf

Note -

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