

List of Assumption:

1. Image of card does not have any glare from nearby light sources.
2. Image of card is taken over a uniformly colored background that is darker (lower intensity) than the white parts of the card.
3. No shadows cast on the image.
4. Standard deck of playing cards is used.
5. RGB or Grayscale input is accepted.

Algorithm Pipeline:

1. Alignment and cropping
 - i. Acquire image and read into a variable
 - ii. If RGB input, convert to grayscale
 - iii. Binarize acquired image using a global threshold generated by Utso's method
 - iv. Apply a gaussian filter on the image
 - v. Extract the gradient direction of the processed image
 - vi. Find the maximum value of the gradient direction
 - vii. Use that maximum value as a rotation angle. Angle is adjusted for imrotate function
 - viii. Rotate the image using imrotate.
 - ix. Binarize rotated image using a threshold of 0.55
 - x. Use regionprops to detect the boundingbox of the processed image.
 - xi. Crop the image according to the derived boundingbox.
2. Suit and Rank Detection
 - Convert the image to the binary with binary factor of 0.5
 - Invert the image and fill in the holes of binary image
 - Remove small objects
 - Measure properties of image regions
 - Sort the areas
 - Region boundaries for the image with removed small objects
 - Region boundaries2 for the image
 - Find number of shapes in the image
 - If number of shapes is greater than 1
 - Center the boundaries for x and y
 - Based on the number of peaks in upper boundaries find Heart, Diamond, Spade, and Club
 - If number of shapes is 1
 - Center the boundaries2 for x and y
 - Based on the number of peaks in upper boundaries2 find Heart, Diamond, Spade, and Club
 - Card number is equal to the number of shapes
 - Define areas for Queen, King, Jack, and Ace

Subset of Results: Attached video

Contribution of group members:

1. Armin Rashvand: Created algorithm for suit and rank detection.
2. Mushfique Khan: Designed algorithm for alignment and cropping and refined suit and rank detection algorithm to detect each individual face card.

List of References:

1. Sari-Sarraf, Hamed, "Image Processing", Texas Tech University, Fall 2020