Pot and bOard Key Elements Recognition (P.O.K.E.R project)

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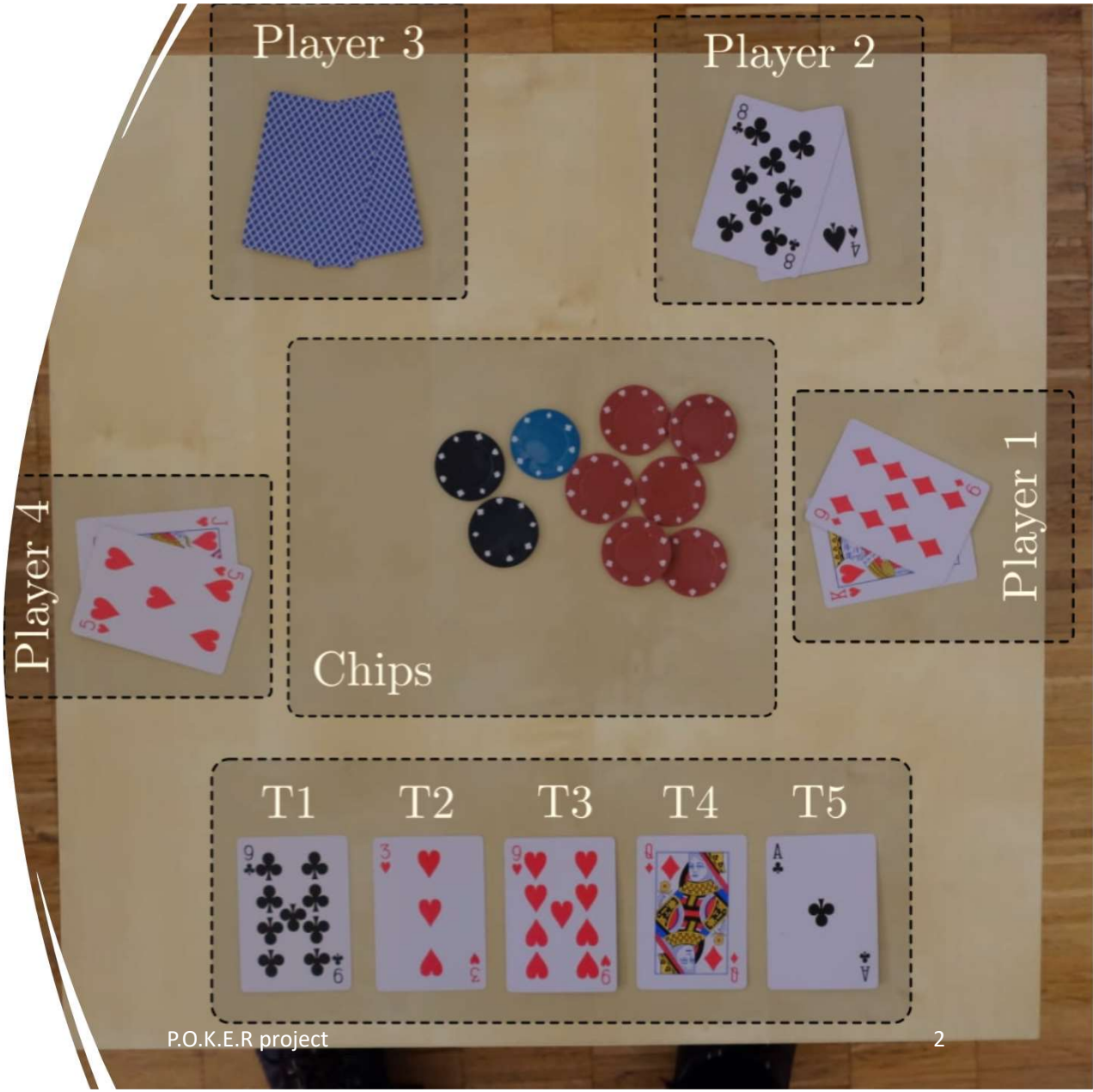
Goal: automatically detect the hands of the players around the table.

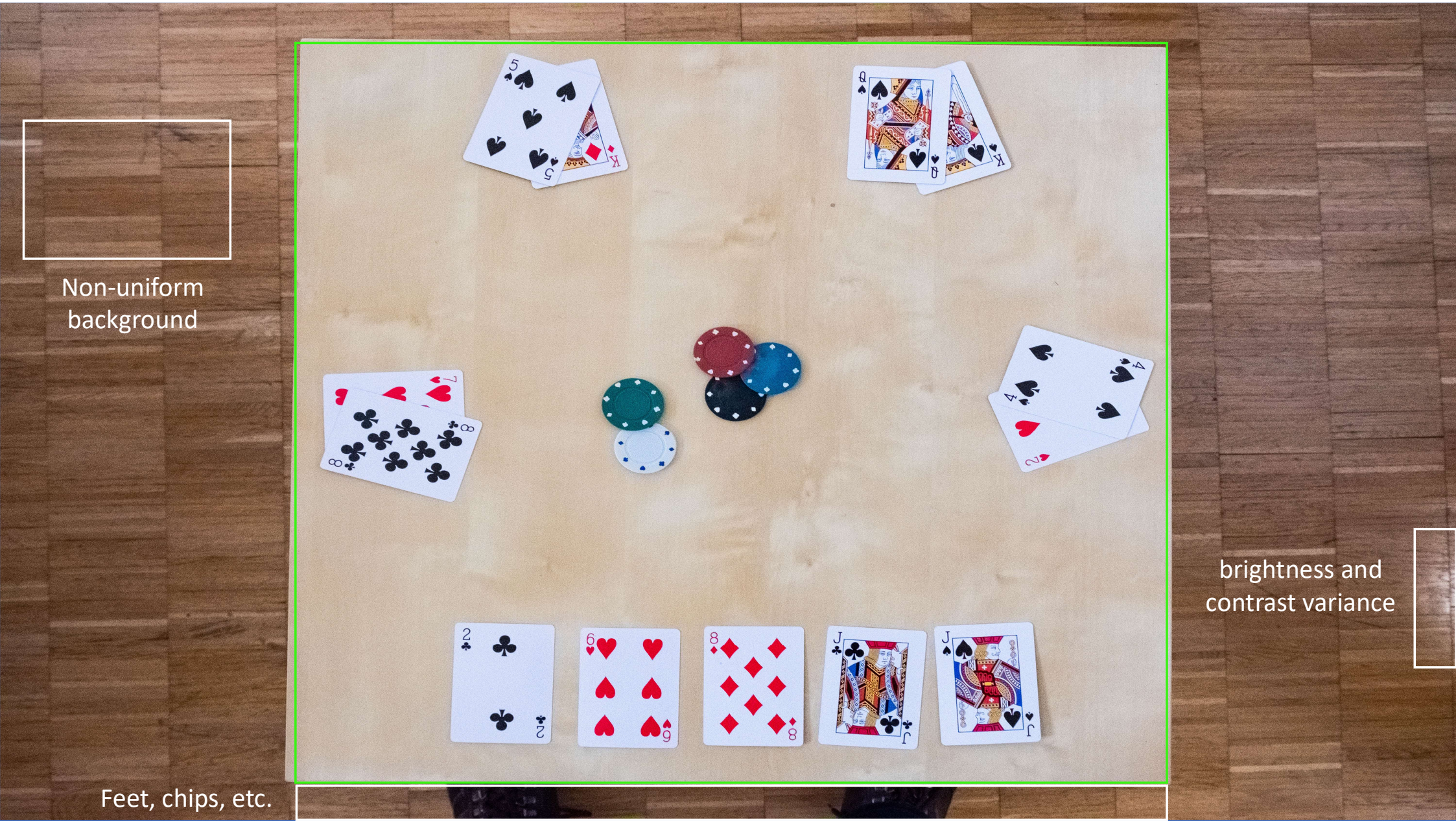
High level pipeline:

1. Table extraction
2. Cards extraction
3. Cards recognition
4. Chips count by color



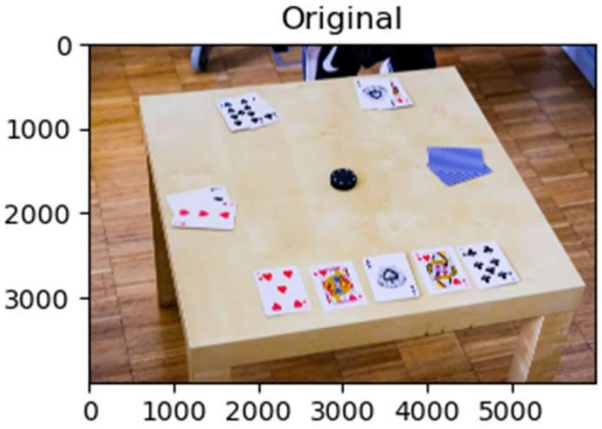
1. Table extraction

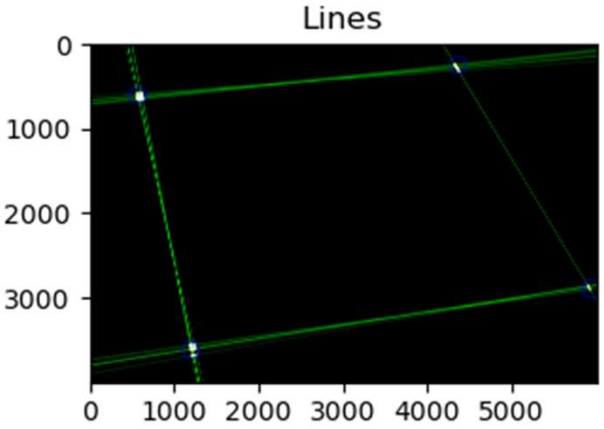
- Goal: extract a top-view of the table to have a controlled environment
- Challenges:
  - High luminosity variance
  - Non-uniform background
  - Object (chips / feets) in the background
  - Different points of view (tilted/ zoomed table)

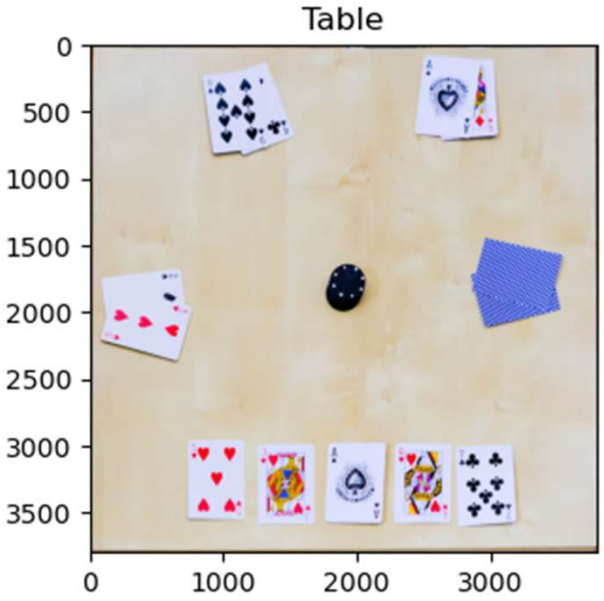

Non-uniform background
brightness and contrast variance
Feet, chips, etc.

1. Table extraction

- Preprocessing: blurring (median filter)
- Edges detection
- Hough lines
- Intersection points
- Intersection points clustering (top cluster separated by some given width)
- Perspective transformation based on 4 selected cluster centers

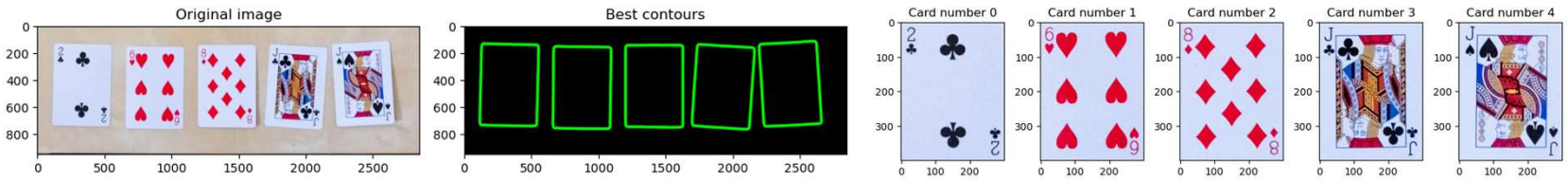






2.1 Table cards extraction

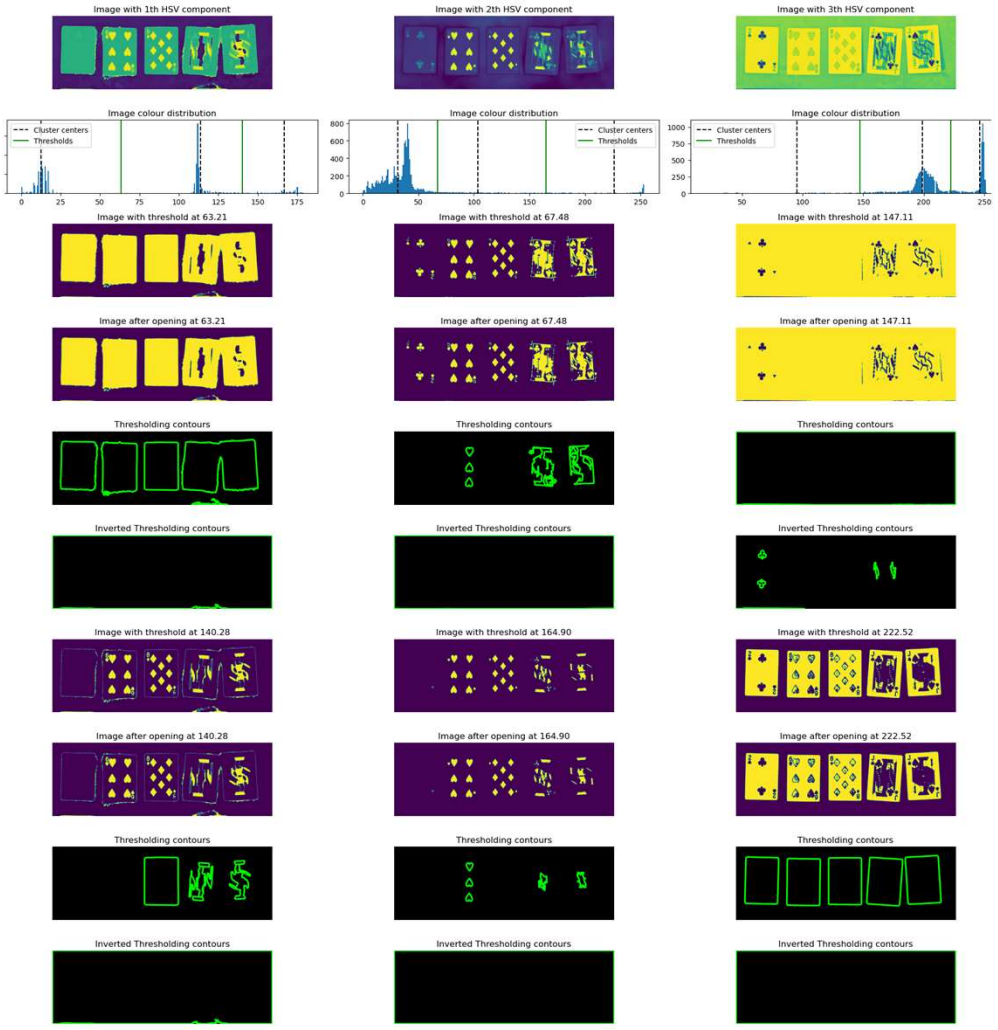
- Zone extraction (assume same location)
- Contours extraction (see next slide)
- Polynomial approximation on contours
- Perspective transformation based on approximated corners



2.1.2 Smart contours extraction

- On every HSV channel:
  - k-means on intensity histogram (k=3)
  - Thresholding with every cluster mean
  - Contours extraction
  - Selection of the contours between cluster / channel

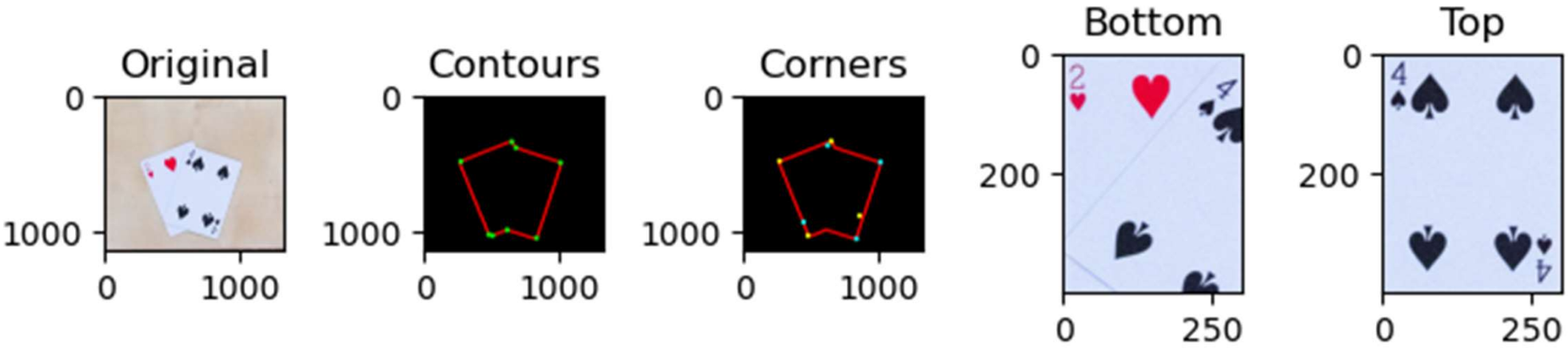
  (smallest variance of perimeter of the 5 largest detected objects)



2.2 Players cards extraction

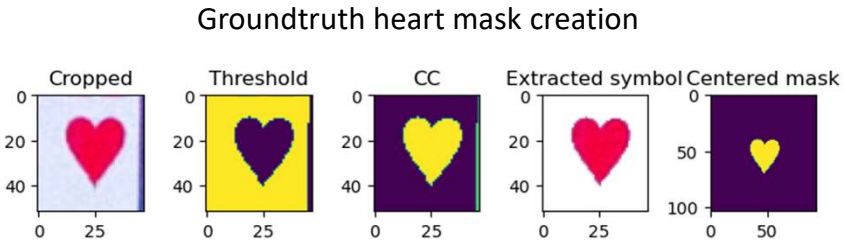
- Zone extraction (assume same location)
- Rotation based on player
- Otsu thresholding
- Contours extraction
- Corners extraction (polynomial approximation)
- Side identification (assume similar card size)
- Opposite corners estimation
- Perspective transformation based on estimated corners

(bottom / top based on corners position towards mean of points)



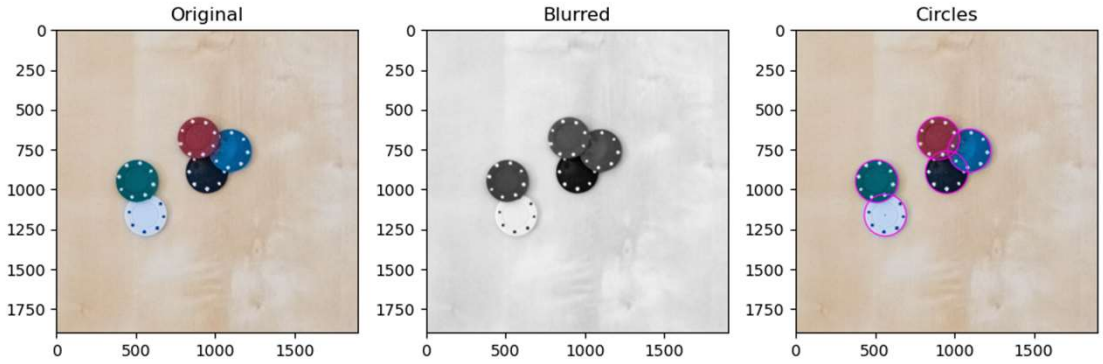
3. Cards recognition

- Check if card is face down
  (high number of connected components)
- Crop symbol zone (assume same location on card)
- Extract symbol (largest connected component)
- Identify color (red or black, based on mean symbol color)
- Create a binary centered mask
- Compare it to labeled masks with (intersection / union) score
- Assign it the label of the mask with highest score
- Similar pipeline for number/letter recognition



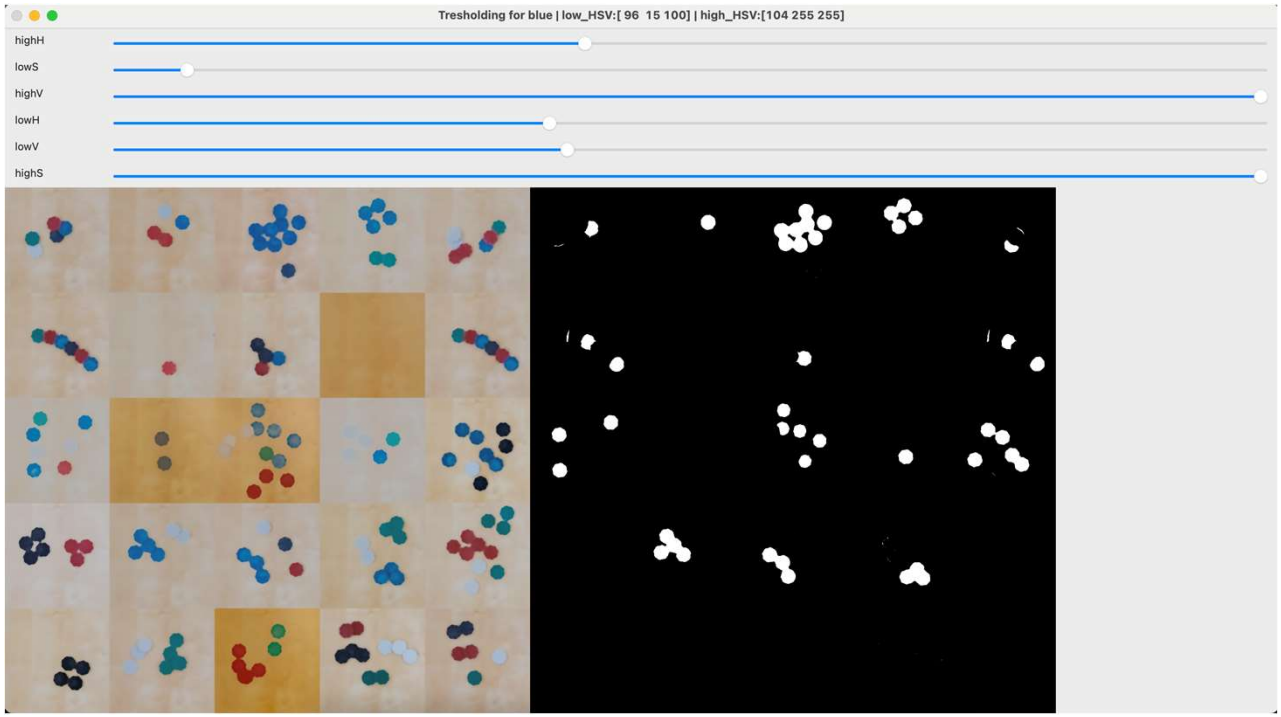
4. Chips count by color

- Hough circles on blurred gray image
- For each circle, select color with largest number of pixel in the circle
  - Brightness equalisation and median blurring
  - For each color: Binary HSV thresholding using finetuned threshold
  - Intersection of binary mask between circle mask and color mask
- If no intersection with any color, assign color of closest color center (precomputed using k-means k=5)



4.1 Color thresholding

- Preprocessing: median blurring, brightness equalisation
- Manual HSV tresholding (with our interface on 27 training samples)



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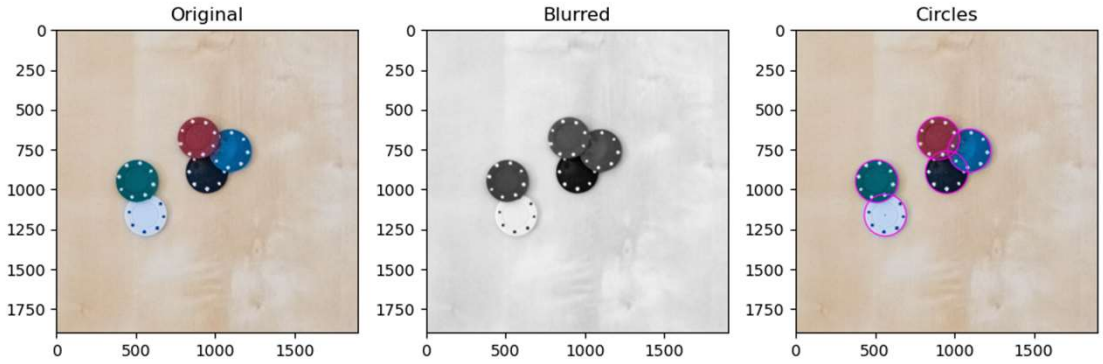
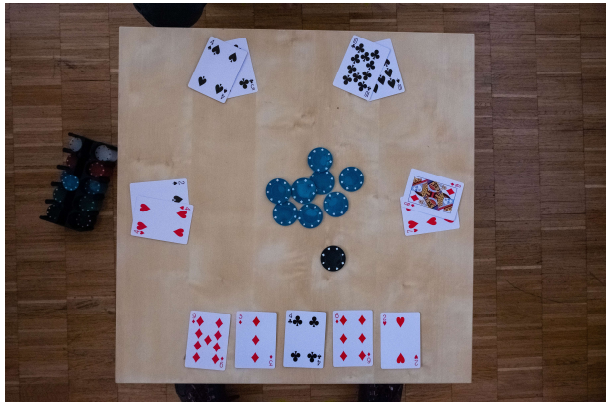
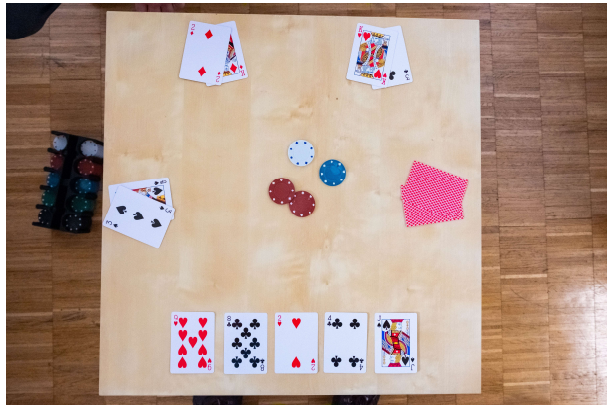


Results on training set





The training set is composed of 28 images of poker hands with different illuminations

- 94.7 % of accuracy on the rank of the cards
- 92.5 % of accuracy on the suits of the cards
- 99.0 % of accuracy on the number of chips for each color

Note: We used the images on the training set in order to calibrate constants such as:

- the position of the cards
- color tresholding for the chips
- filters strength (blurring etc)
- stats for brightness calibration of chips

We thank you for your attention.

Do you have any question?

Appendix

Transformation matrix for perspective transformation