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ECE 5367 – 001: Image Processing

Project 4

List of Assumptions:

- The image of the playing card should have a dark, plain background
- The image should be of high resolution (at least 1080p)
- There should not be any glare
- The camera should have been parallel to the image when taking the image
- The playing card should be under uniform illumination
- The playing card should be Bicycle format
- The camera should be at a distance of 10-15 inches away from the playing card
- The following Python Libraries must be installed: pickle, tensforflow, cv2, numpy, matplotlib, pathlib

These Python Packages can be installed with running this command in the terminal "pip install -r requirements.txt". This command must be run from the zip file where requirement.txt is located.

Link to the Video:

https://youtu.be/VZxMpqG1hoY

Script Usage Guide:

The script prompt users with 4 options:

- Option 1 : Open the camera and wait for the user to press enter. Processes the Last frame shown.
- Option 2 : Prompt user to input path to read one image
- Option 3 : Prompt user to read all the images in a folder
- Option 4 : Exit the Script

Description of contributions of each member:

Joseph Palacios : Write code for cropping the number and suit of the playing card

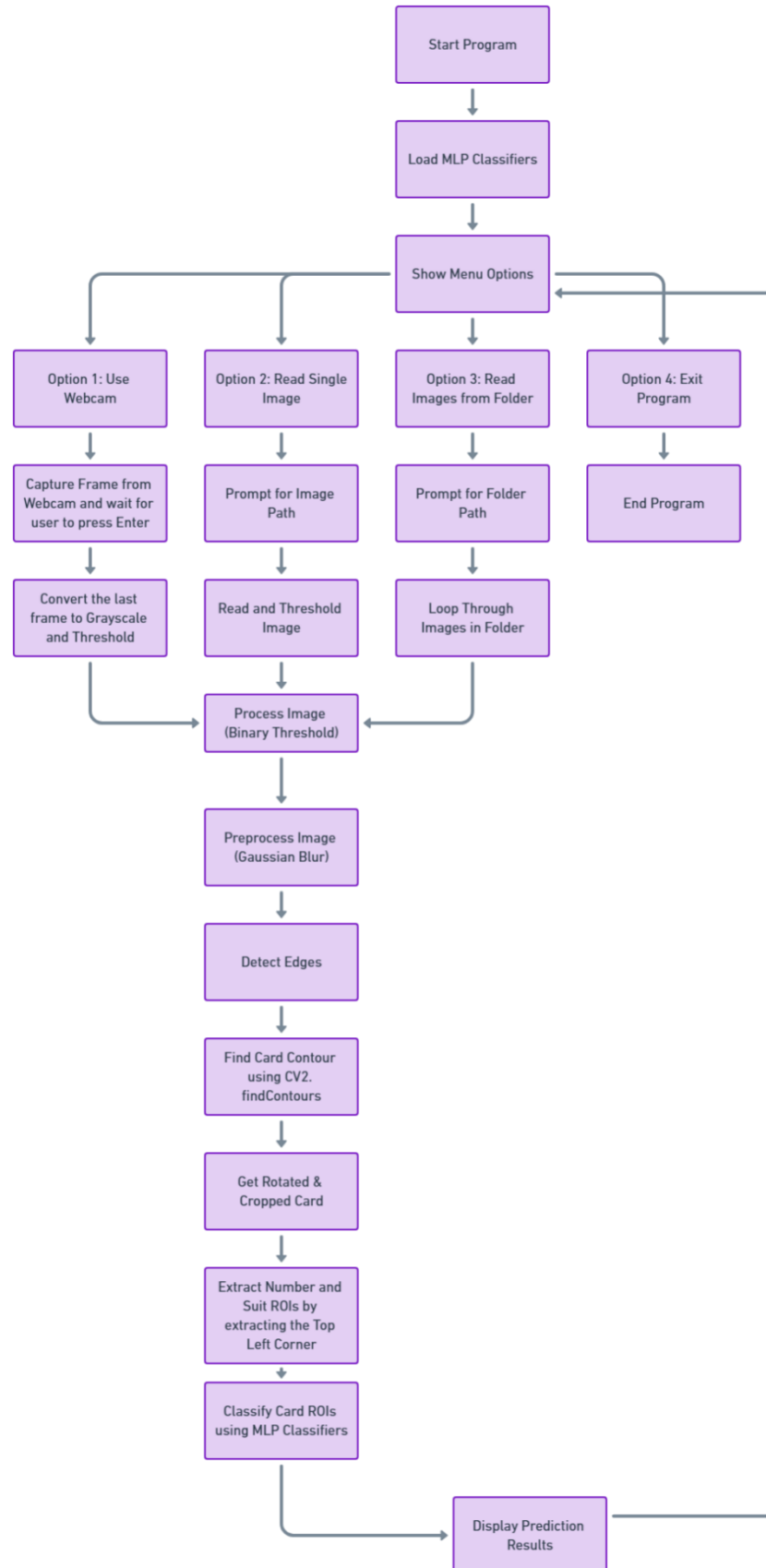Worked on Template Matching but the results were not optimal

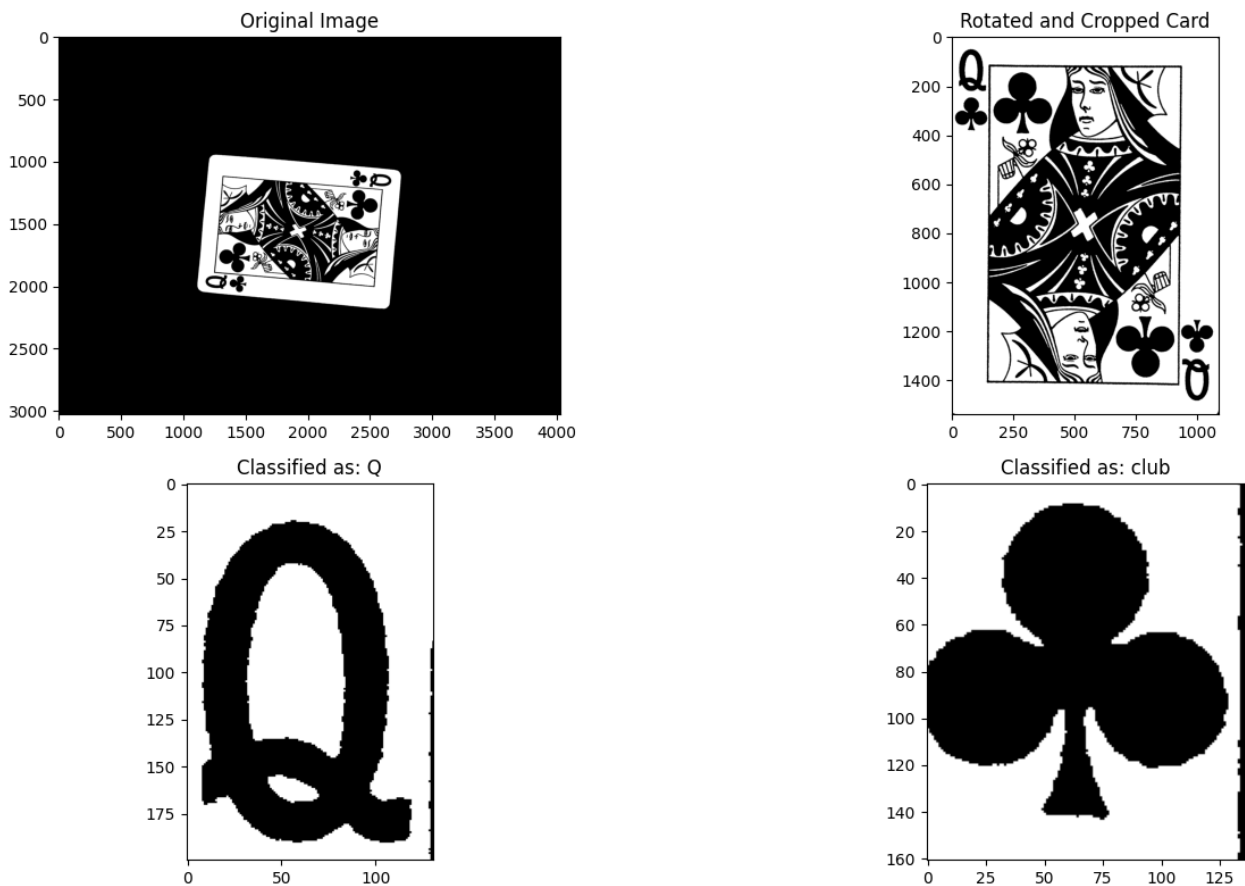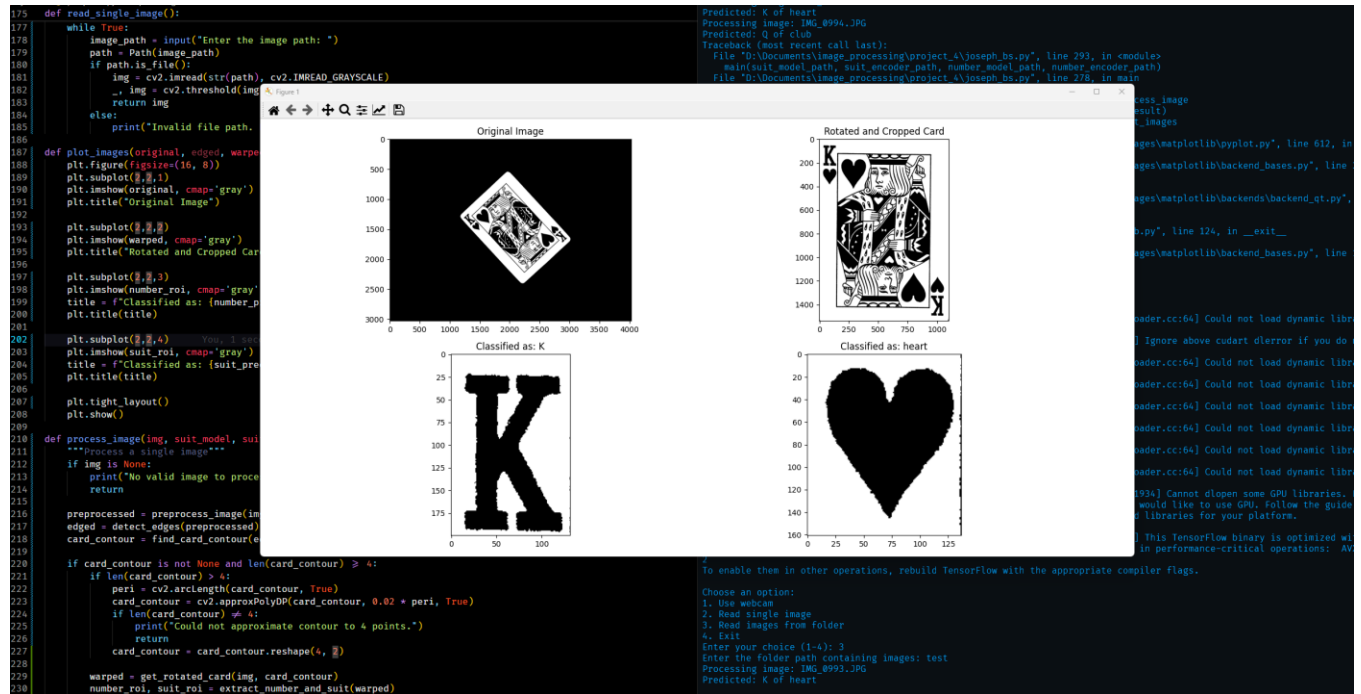Generate dataset for MLP classification model training

Pre-process the dataset
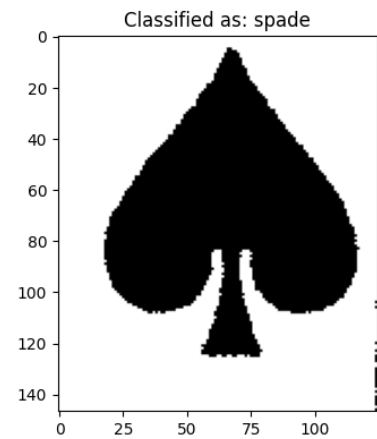

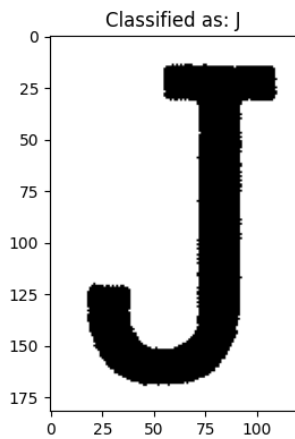Rishikesh: Write code for training an MLP classifier

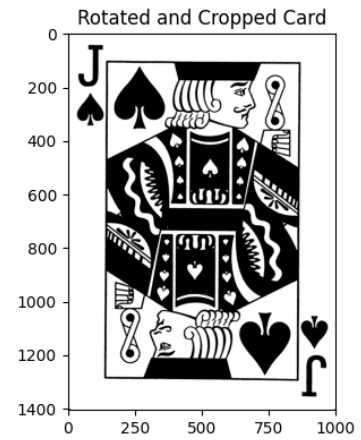Write code for implementing classifier to classify card number and suit

Algorithm Pipeline:

```
Start Program
    ↓
Load MLP Classifiers
    ↓
Show Menu Options
    ├──────────────┬──────────────┬──────────────┐
    ↓              ↓              ↓              ↓
Option 1: Use   Option 2: Read  Option 3: Read  Option 4: Exit
Webcam          Single Image    Images from     Program
    ↓              ↓            Folder             ↓
Capture Frame   Prompt for      ↓              End Program
from Webcam     Image Path      Prompt for
and wait for       ↓            Folder Path
user to press   Read and           ↓
Enter           Threshold       Loop Through
    ↓           Image           Images in Folder
Convert the        ↓               ↓
last frame to   → Process Image ←
Grayscale and     (Binary Threshold)
Threshold             ↓
                  Preprocess Image
                  (Gaussian Blur)
                      ↓
                  Detect Edges
                      ↓
                  Find Card Contour
                  using CV2.findContours
                      ↓
                  Get Rotated &
                  Cropped Card
                      ↓
                  Extract Number and
                  Suit ROIs by
                  extracting the Top
                  Left Corner
                      ↓
                  Classify Card ROIs
                  using MLP Classifiers
                      ↓
                  Display Prediction
                  Results
```

Subset of results:

Original Image

Rotated and Cropped Card

Classified as: J

Classified as: spade

List of References:

https://docs.opencv.org/4.x/d0/dce/classcv_1_1ml_1_1ANN__MLP.html

https://docs.opencv.org/3.4/d4/d73/tutorial_py_contours_begin.html

https://notebook.community/mbeyeler/opencv-machine-learning/notebooks/09.02-Implementing-a-Multi-Layer-Perceptron-in-OpenCV