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CSCI 631: Computer Vision
Final Project Report
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Background

Our task was to take an image of approximately 16 set cards and using our created program, determine the following for each card: the color on the card, how many shapes it contains, what shape it contains, and what was the shading of each shape (solid, lined, no-fill).

Phases

Phase 1

In phase 1, we needed to first find a way to separate the image into a set of 16 images each containing an individual card. This was achieved by converting the image into a black and white image, cleaning the image with morphology, and using regionprops() to determine location of each card.

Figure 1 -- Results of Phase 1

Phase 2

The goal of phase 2 was to fix the distortion on each card such that each card would be approximately the same size and orientation. This was done on the initial image of the 16 cards to create a more uniform fix across the individual cards. We first found reasonable corners such that all cards would remain in the image but not much else. Then we shrank the distance between the lower corners using fitgeotrans() and rectifying the image using imwarp() followed by some cropping.
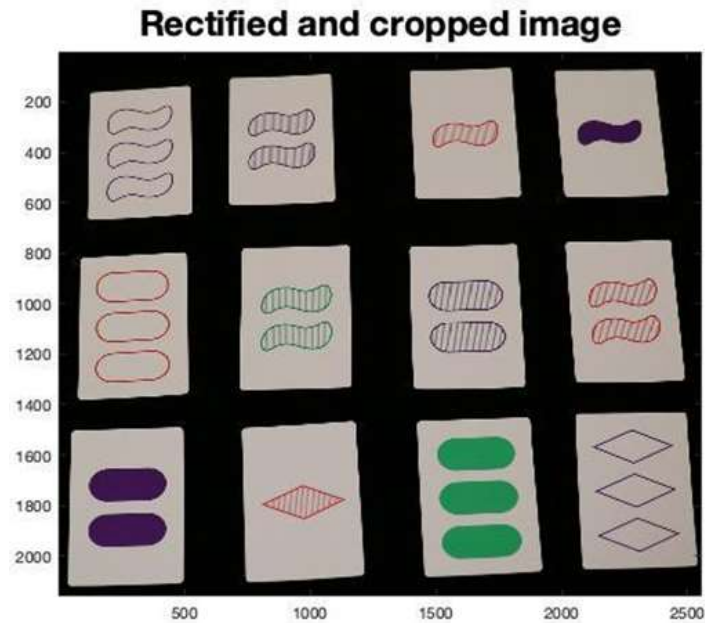
Figure 2 -- Phase 2 Rectified and Cropped Image

During this phase we were also able to determine the color of the shapes on the card. This was performed by converting the image into HSV color space and then using the known thresholds of red, green, and magenta to pick out the color.

Figure 3 -- Phase 2 Color Identification Example

Phase 3
In this phase, all that remained was to determine the shape, shading, and number of shapes on each card. These were not trivial steps but because of phases 1 and 2, we were well posited to complete each of these with only a few extensions.

The shape was determined using FFT to achieve pattern matching. This ... .

The number of shapes was found by taking, ...

The shading of a given card's shapes were determined by taking the center area of a card to focus on a single shape, converting that area into HSV color space, and averaging values column together for a local brightness factor. Then the resulting pixels are binned into colored and uncolored bins. The number of colored pixels are further used to determine whether the card is open, striped or solid.
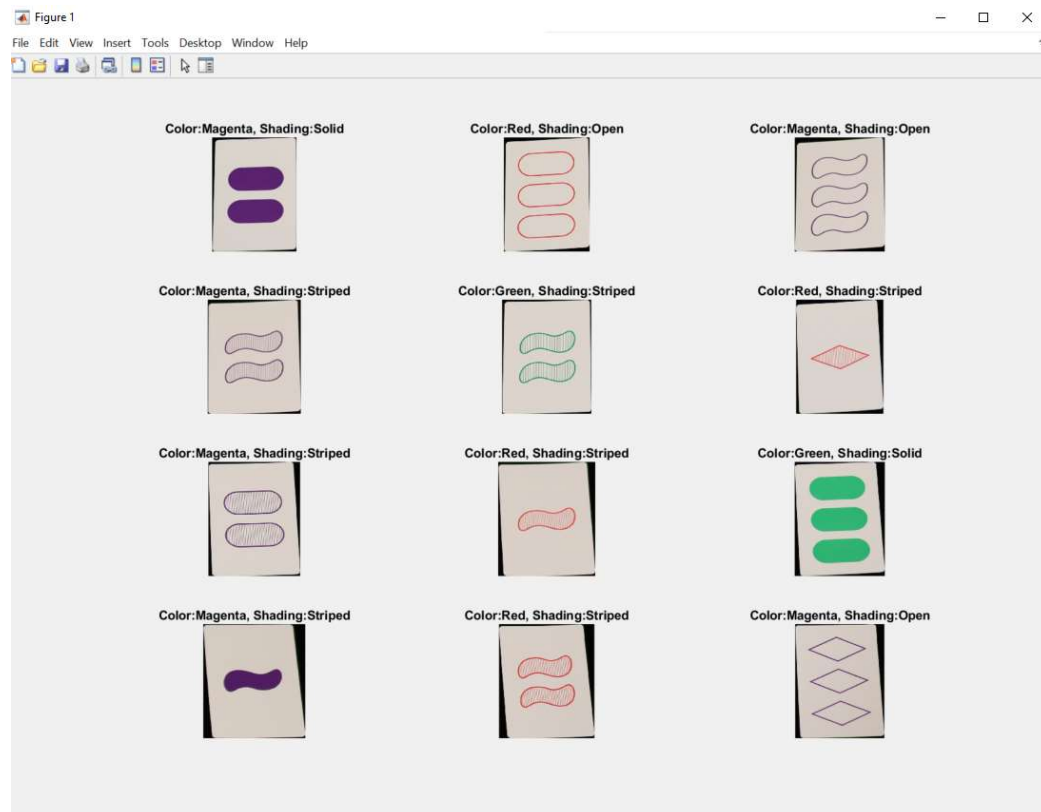

Figure 3 -- Phase 3 Example Shading Identification

Conclusion
We were able to ... .