
Is this your card?
The Magic of Computer Vision

IANADS

- @guyroyse (probably)

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"Getting someone to pick a card is almost impossible. Go to a party, fan out a deck of cards, and ask someone to pick a card. Everyone will say no."

–Penn Jillette


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Every magic trick consists of three parts, or acts.

–The Prestige

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The first part is called the pledge, the magician shows you something ordinary.

–The Prestige

The second act is called the turn, the magician takes the ordinary something and makes it into something extraordinary.

–The Prestige

...making something disappear isn't enough; you have to bring it back. That's why every magic trick has a third act, the hardest part, the part we call "The Prestige".

–The Prestige

Where is the real magic?

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Computer Vision aims to train computers to understand the visual world.

We're going to aim to answer two questions.

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Where is the card in the video?

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Which card is it?

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```
import cv2
import imutils

def main():
    cap = cv2.VideoCapture(1)
    while True:
        ret, frame = cap.read()
        frame = imutils.resize(frame, 640)
        cv2.imshow("Image", frame)

        if cv2.waitKey(1) & 0xFF == ord('q'):
            break

    cap.release()
    cv2.destroyAllWindows()

main()
```

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```
import cv2
import imutils

def main():
    cap = cv2.VideoCapture(0)
    while True:
        ret, frame = cap.read()
        frame = imutils.resize(frame, 640)
        cv2.imshow("image", frame)
        if cv2.waitKey(1) & 0xFF == ord('q'):
            break
    cv2.destroyAllWindows()

main()
```

Open Computer Vision Library

Convenience functions for basic image processing.

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Capture the video

```
cap = cv2.VideoCapture(1)
    while True:
        ret, frame = cap.read()
        frame = imutils.resize(frame, 640)
        cv2.imshow("Image", frame)
```

Display each frame as a continuous video loop.

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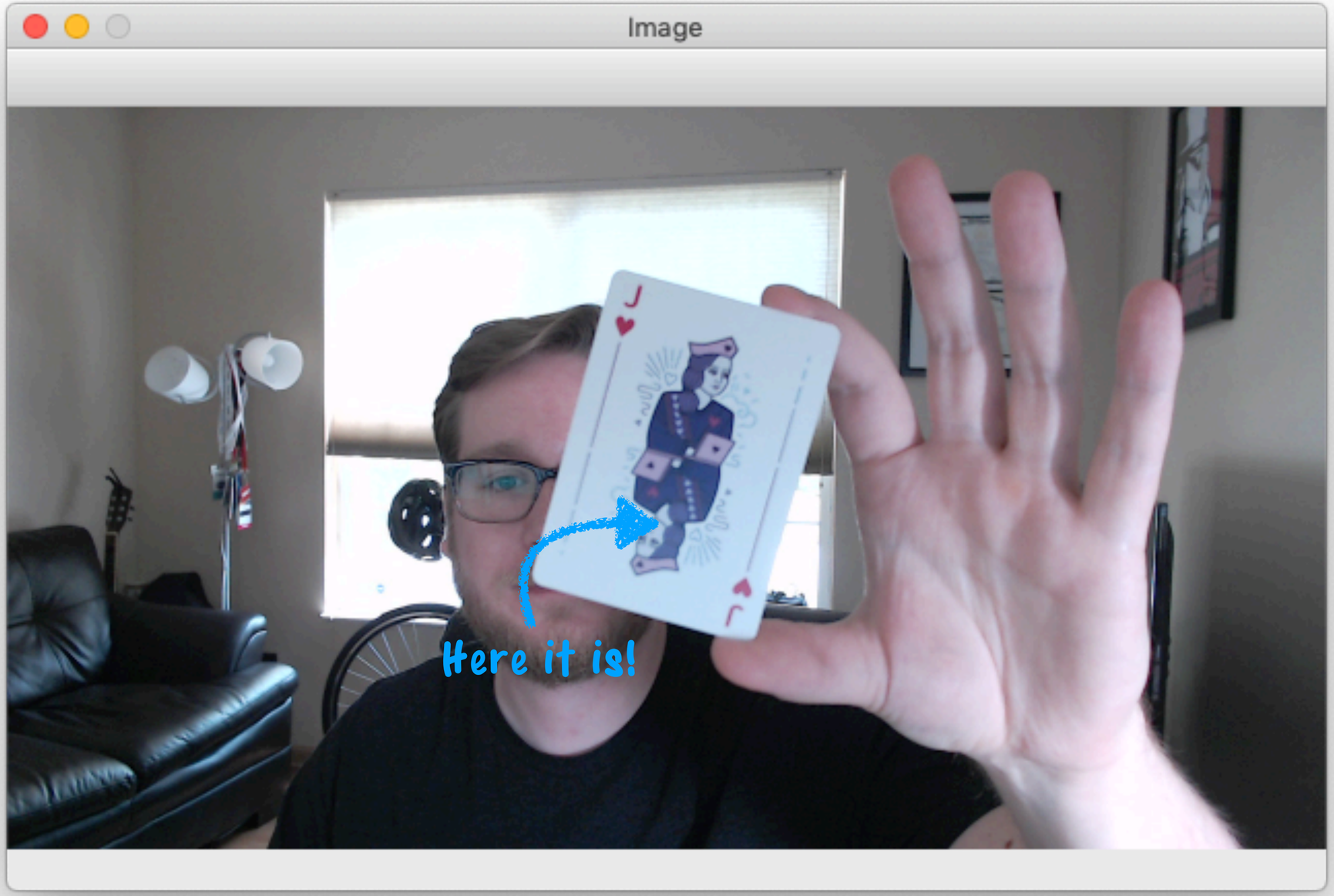

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Computers need help.

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```python
import numpy as np

def normalize(frame):
    frame = imutils.resize(frame, 640)
    gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)
    blur = cv2.bilateralFilter(gray, 10, 15, 15)

    edges = cv2.Canny(blur, 50, 150, True)
    kernel = np.ones((5, 5), np.uint8)
    dilate = cv2.dilate(edges, kernel, iterations=1)

    return dilate
```

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```
import numpy as np

def normalize(frame):
    frame = imutils.resize(frame, 640)
    gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)
    blur = cv2.bilateralFilter(gray, 10, 15, 15)
    edges = cv2.Canny(blur, 50, 150, True)
    kernel = np.ones((5, 5), np.uint8)
    dilate = cv2.dilate(edges, kernel, iterations=1)
```

Adds arrays, matrices, large number support, and math functions.

```
gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)
```

This flag is the type of conversion

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```
import numpy as np

def normalize(frame):
    frame = imutils.resize(frame, 640)
    gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)
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    kernel = np.ones((5, 5), np.uint8)
    dilate = cv2.dilate(edges, kernel, iterations=1)

    return dilate
```

This is the sigma space

```
blur = cv2.bilateralFilter(gray, 10, 15, 15)
```

This is the size of the filter

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```
edges = cv2.Canny(blur, 50, 150, True)
```

Maximum Threshold

Minimum Threshold

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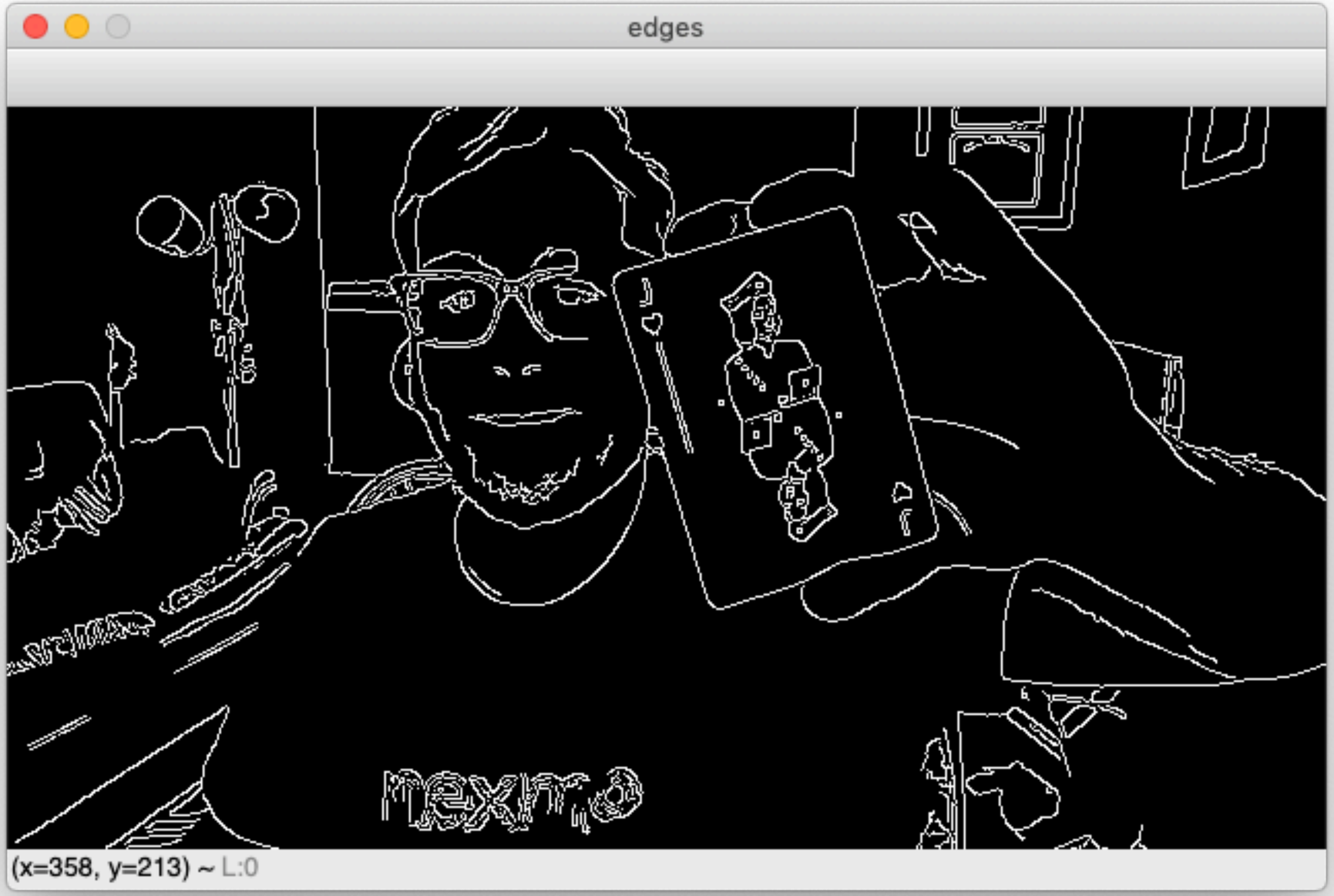

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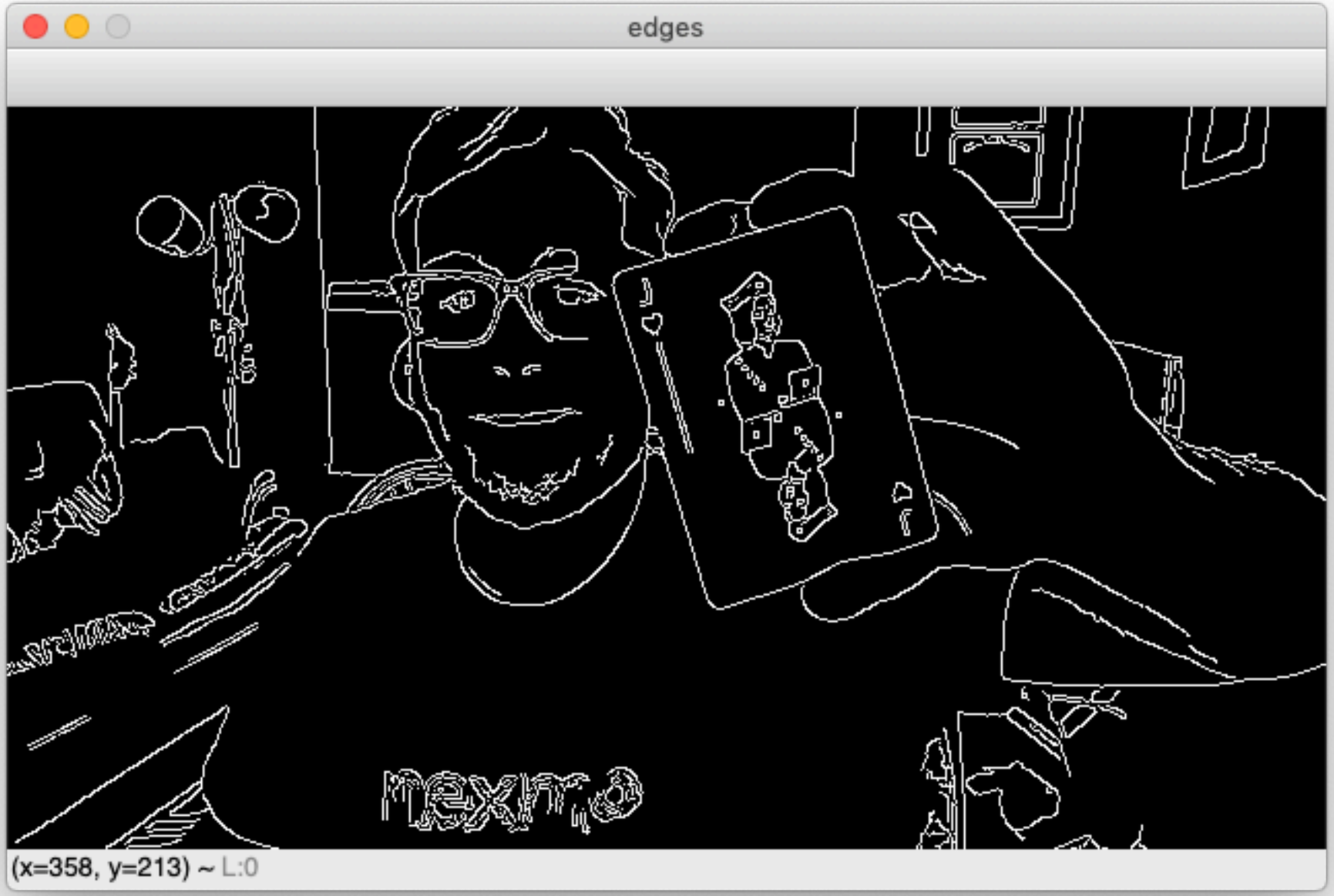
Why Canny Edge Detection?



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```
kernel = np.ones((5, 5), np.uint8)
dilate = cv2.dilate(edges, kernel, iterations=1)
```

How many times to dilate

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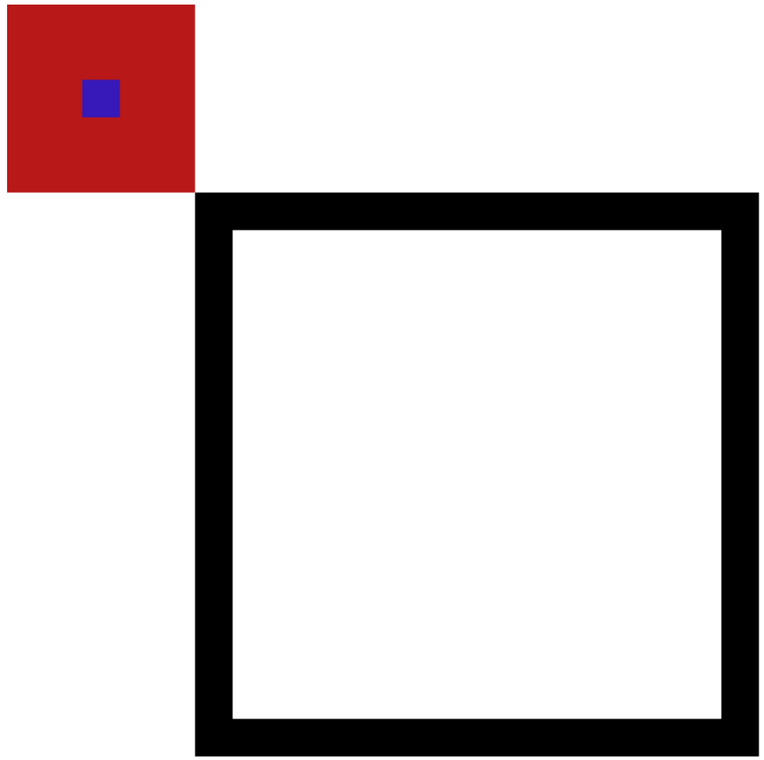

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Cards are kind of rectangular

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```
def get_contours(dilate):
    contours = cv2.findContours(dilate, cv2.RETR_LIST, cv2.CHAIN_APPROX_SIMPLE)
    contours = imutils.grab_contours(contours)
    return sorted(contours, key=cv2.contourArea, reverse=True)
```

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The approximation algorithm. This has to do with how the points are stored.

```
contours = cv2.findContours(dilate, cv2.RETR_LIST, cv2.CHAIN_APPROX_SIMPLE)
```

The retrieval mode. This has to do with edge hierarchies.

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```
sorted(contours, key=cv2.contourArea, reverse=True)
```

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Remember, rectangles are what we want.

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```
def process(frame):
    image = frame.copy()
    dilate = normalize(frame)
    contours = get_contours(dilate)

    for c in contours:
        rect = cv2.minAreaRect(c)
        box = cv2.boxPoints(rect)
        box = np.int0(box)

        cv2.drawContours(image, [box], -1, (0, 255, 0), 3)
```

```
def process(frame):
    image = frame.copy()
    dilate = normalize(frame)
    contours = get_contours(dilate)

    for c in contours:
        rect = cv2.minAreaRect(c)
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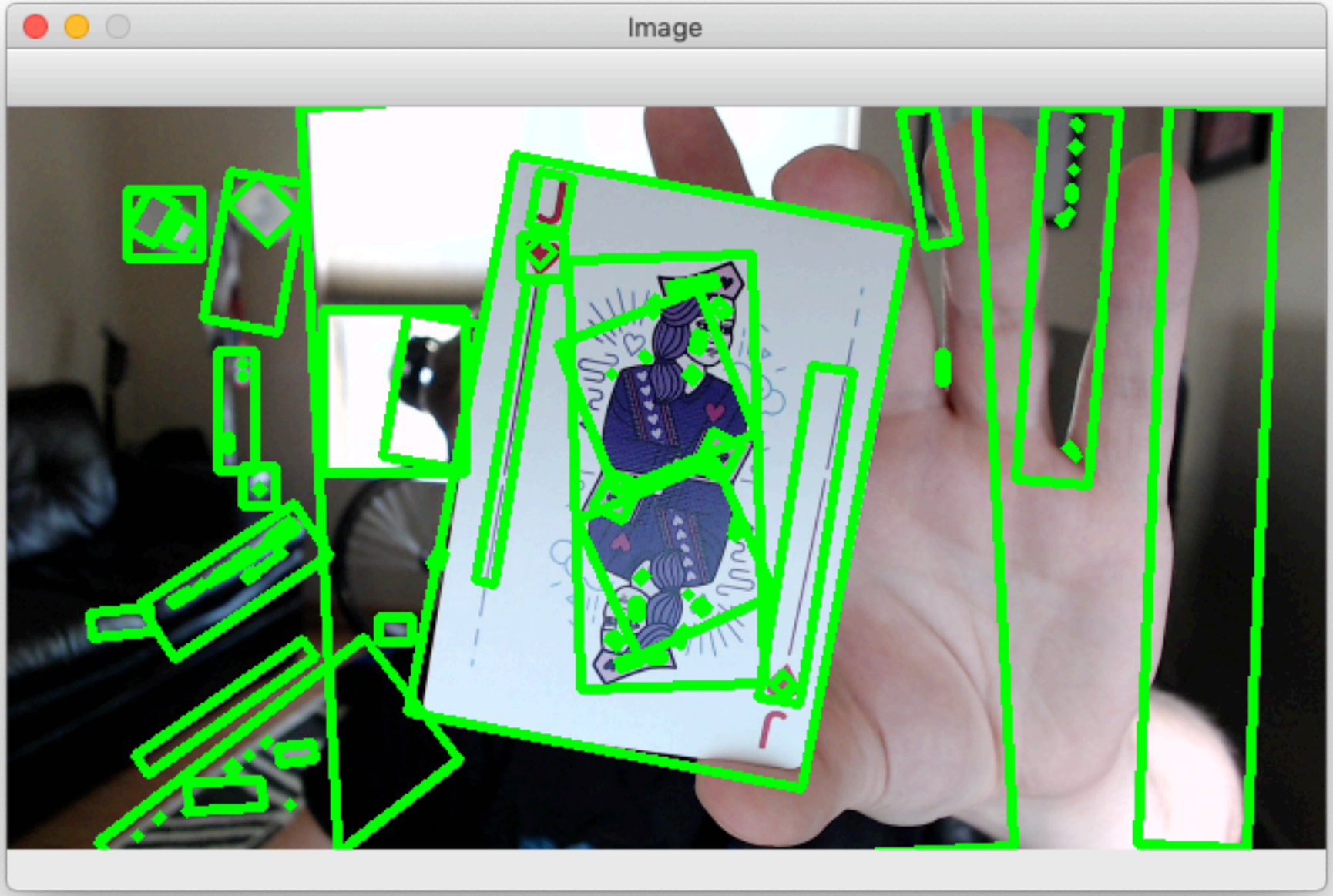

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My playing cards have an aspect ratio of around 1.43

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```
((x, y), (w, h), a) = rect = cv2.minAreaRect(c)
box = cv2.boxPoints(rect)
box = np.int0(box)

# sometimes w and h are reversed for turned images
ar = w / float(h) if w > h > 0 else h / float(w)
if 1.40 <= ar <= 1.45:
    cv2.drawContours(image, [box], -1, (0, 255, 0), 3)
```

```
((x, y), (w, h), a) = rect = cv2.minAreaRect(c)
```

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```
# sometimes w and h are reversed for turned images
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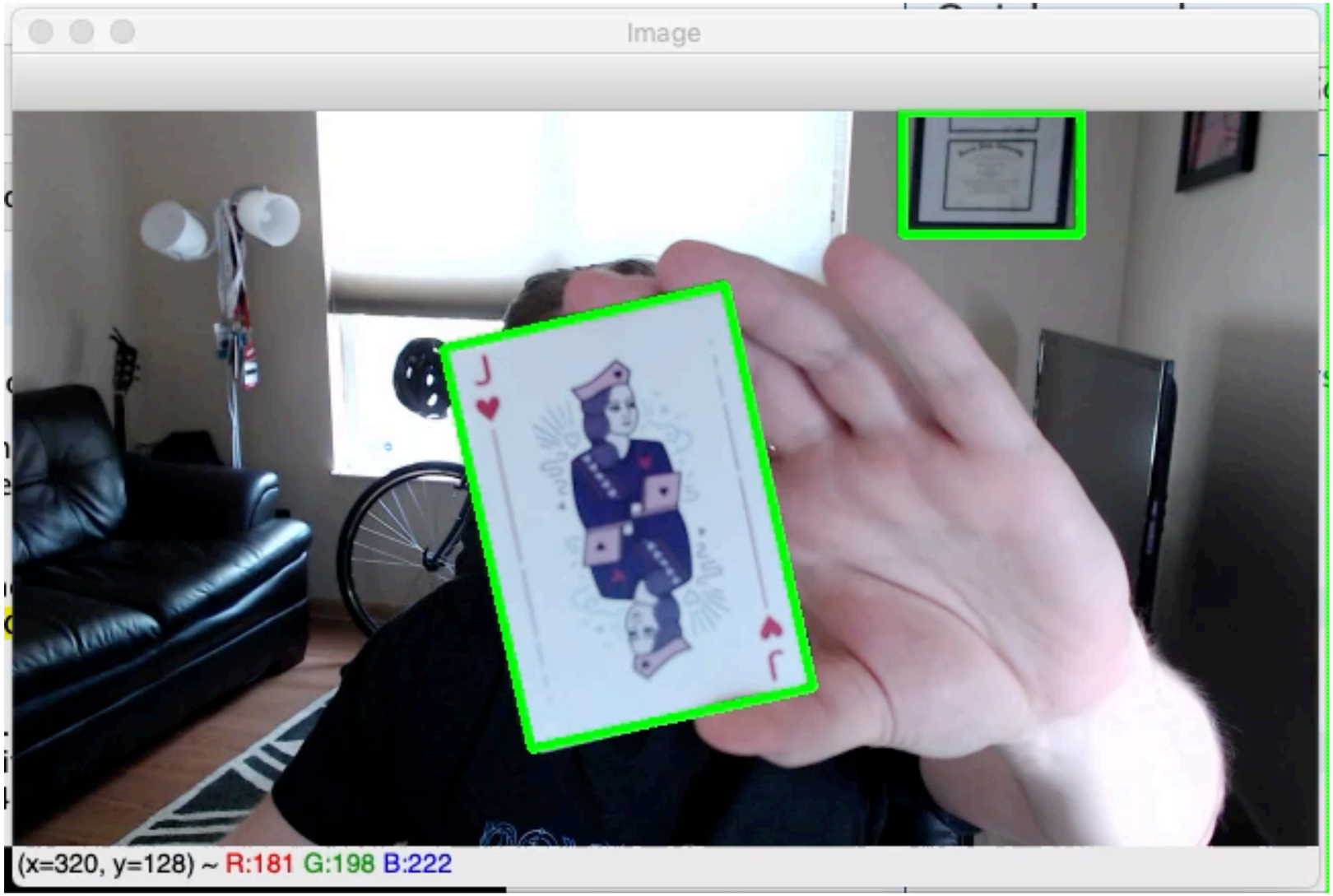

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```
for c in contours[:2]:
    ((x, y), (w, h), a) = rect = cv2.minAreaRect(c)
    box = cv2.boxPoints(rect)
    box = np.int0(box)

    ar = w / float(h) if w > h > 0 else h / float(w)
    if 1.40 <= ar <= 1.45:
        cv2.drawContours(image, [box], -1, (0, 255, 0), 3)

    cv2.imshow("Image", image)
```

```
for c in contours[:2]:
    ((x, y), (w, h), a) = rect = cv2.minAreaRect(c)
    box = cv2.boxPoints(rect)
    box = np.int0(box)
    ar = w / float(h) if w > h > 0 else h / float(w)
    if 1.40 <= ar <= 1.45:
        cv2.drawContours(image, [box], -1, (0, 255, 0), 3)

cv2.imshow("Image", image)
```

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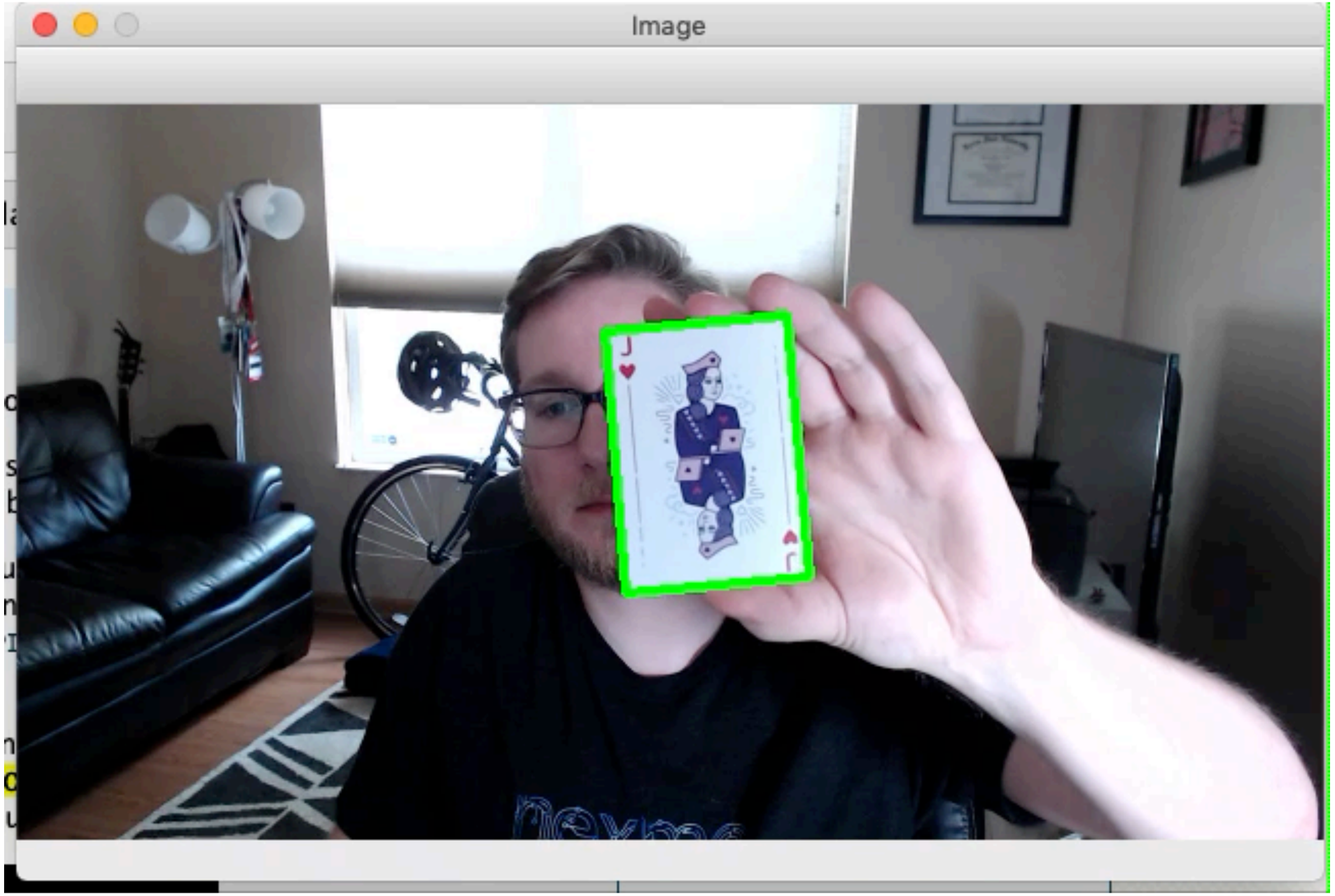

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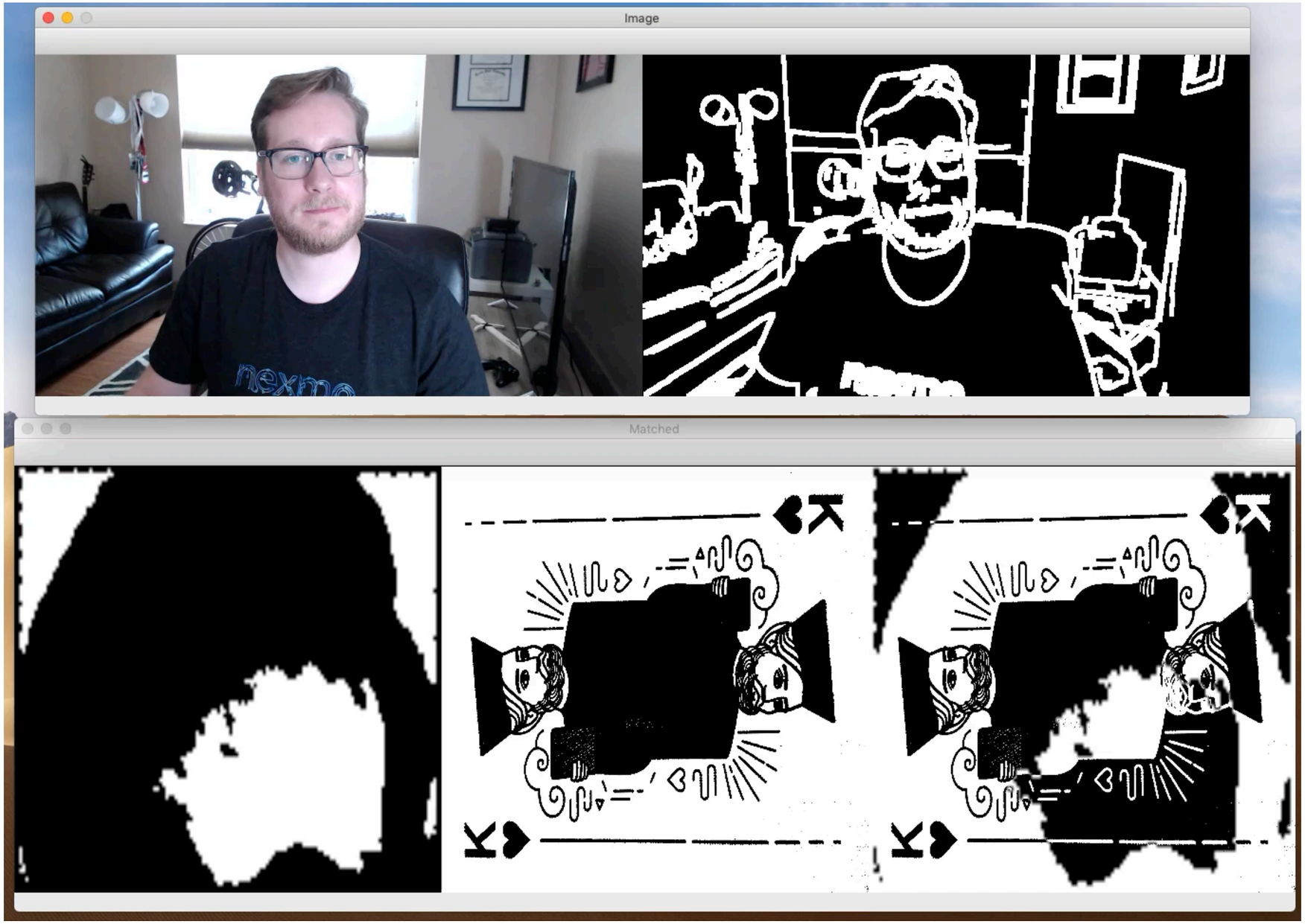

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Simplify when possible.

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Dive in

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I'm Steve!

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That's a zero

steve@smcrow.net

https://cr0w.st/cardvision

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