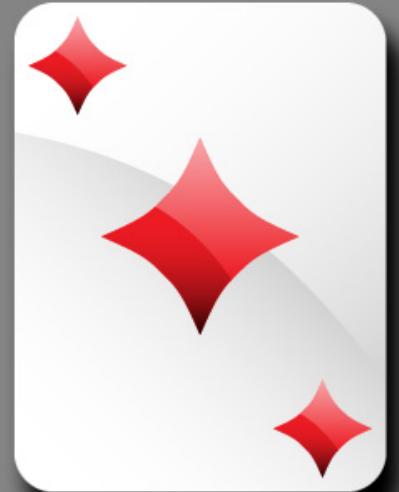
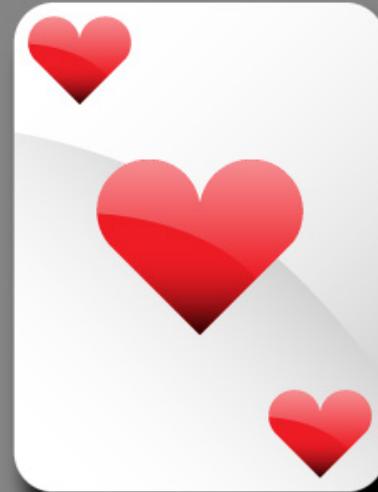
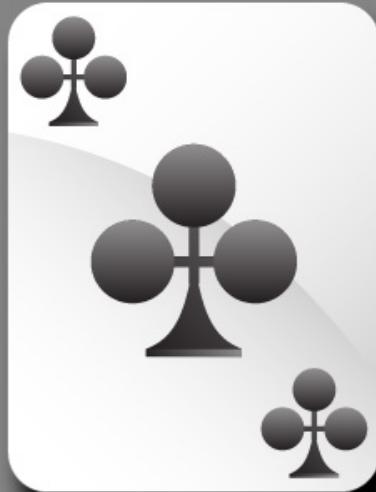


OpenCV for Python

Image Recognition and Card Detection

Hasan Haq





What is OpenCV?



- Open Source Computer Vision
- Created by Intel R&D in Russia (1999)
- Written in C++
 - Ported to Python, Java, MATLAB, C#, Perl, Ruby, and more
 - Current stable release: 3.2



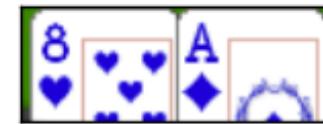
What Does OpenCV Do?

- Image processing (pixel level)
- Feature detection and matching
- Object detection (cascade classifiers)
- Video analysis
- Support Vector Machines (SVM)
- And more!



What's in an image?

- Numpy array with shape x, y (pixels)
- Value corresponding to pixel intensity or RGB scale



```
In [17]: im.shape
```

```
Out[17]: (38, 105, 3)
```

```
In [23]: gray = cv2.cvtColor(im, cv2.COLOR_BGR2GRAY)  
gray.shape
```

```
Out[23]: (38, 105)
```

```
In [24]: gray
```

```
Out[24]: array([[79, 79, 79, ..., 79, 79, 80],  
                 [79, 79, 78, ..., 79, 79, 79],  
                 [80, 79, 78, ..., 80, 80, 79],  
                 ...,  
                 [54, 54, 54, ..., 54, 54, 54],  
                 [54, 54, 54, ..., 54, 54, 54],  
                 [48, 48, 48, ..., 54, 54, 54]], dtype=uint8)
```

Thanks, Arnab!



- absdiff() “algorithm”
- Very simple script
- Used blurring techniques

Not quite...



Perfecto!

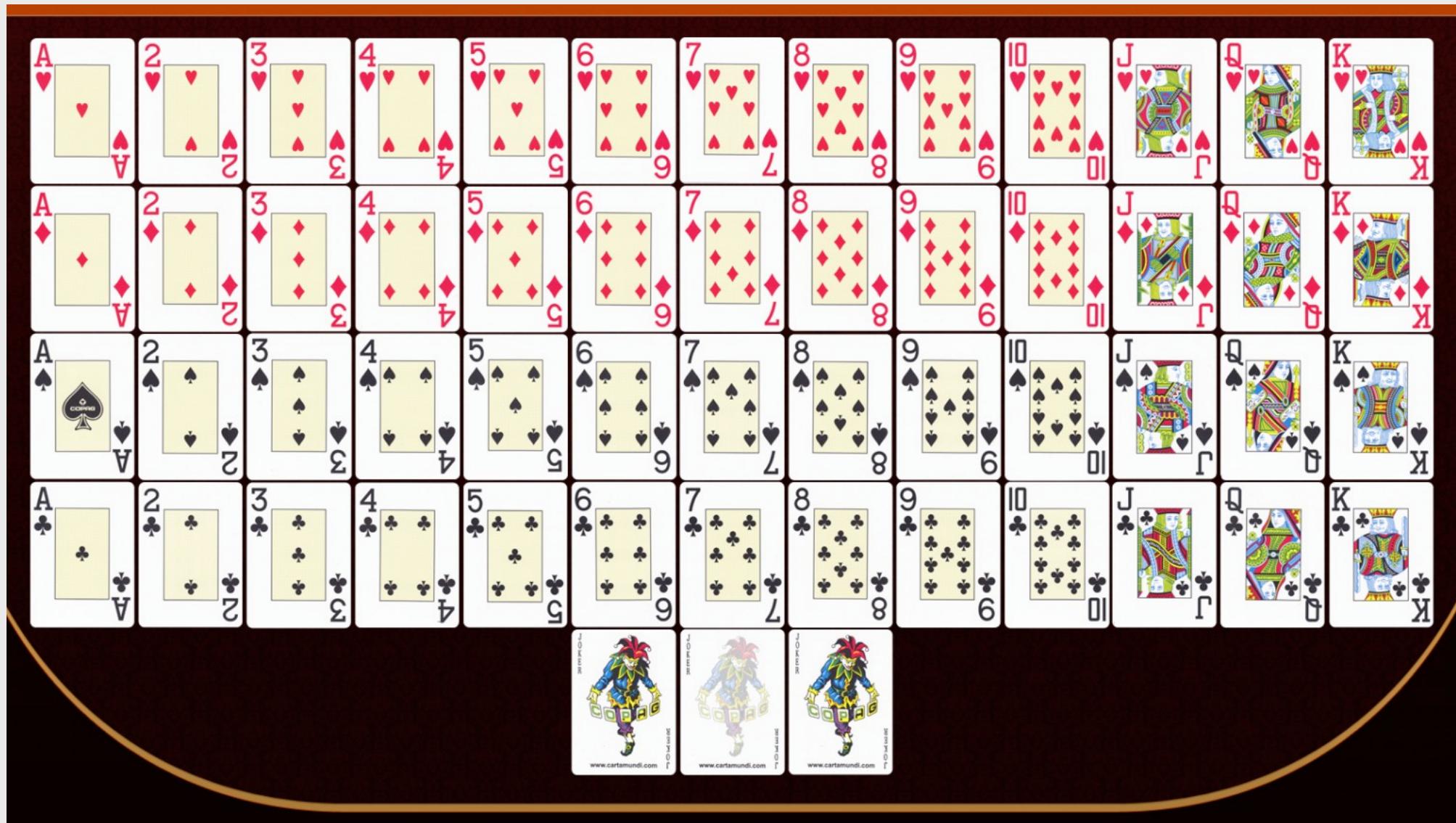


```
def imgdiff(img1,img2):  
    img1 = cv2.GaussianBlur(img1,(5,5),5)  
    img2 = cv2.GaussianBlur(img2,(5,5),5)  
    diff = cv2.absdiff(img1,img2)  
    diff = cv2.GaussianBlur(diff,(5,5),5)  
    flag, diff = cv2.threshold(diff, 200, 255, cv2.THRESH_BINARY)  
    return np.sum(diff)
```

Test Set...



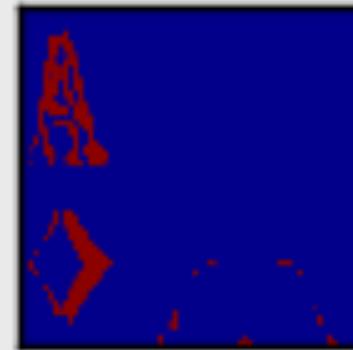
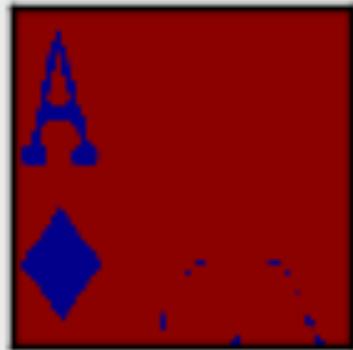
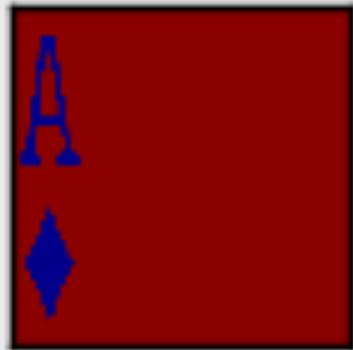
Training Set...



Huh??

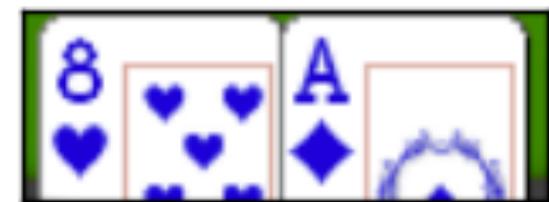


Imgdiff() Calculation

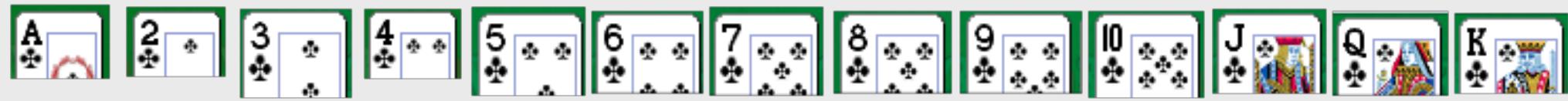
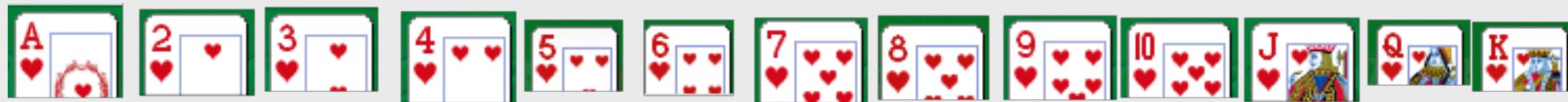


Result

```
[('K', 'c'), ('K', 'c')]
```

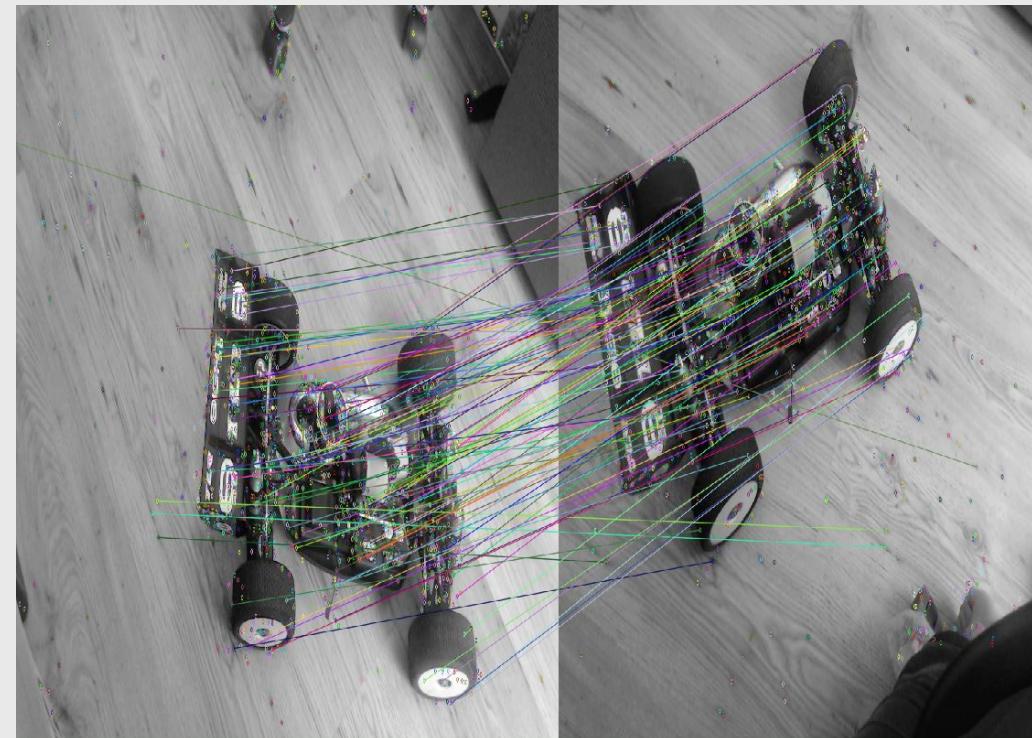
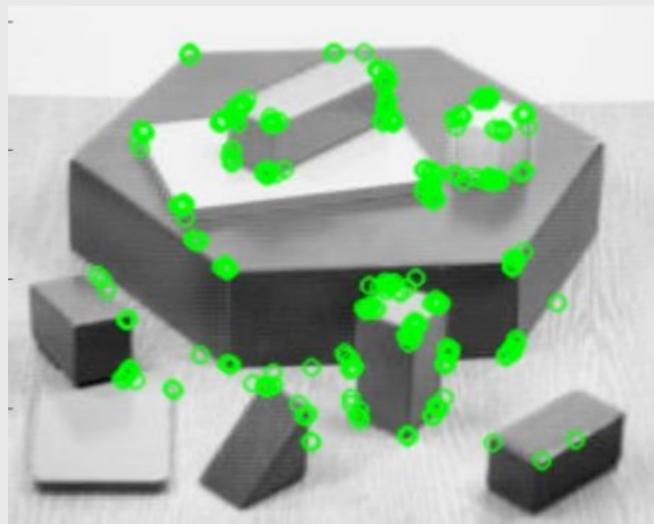


Try Again...



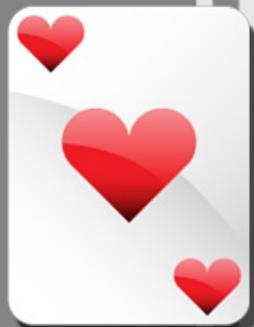
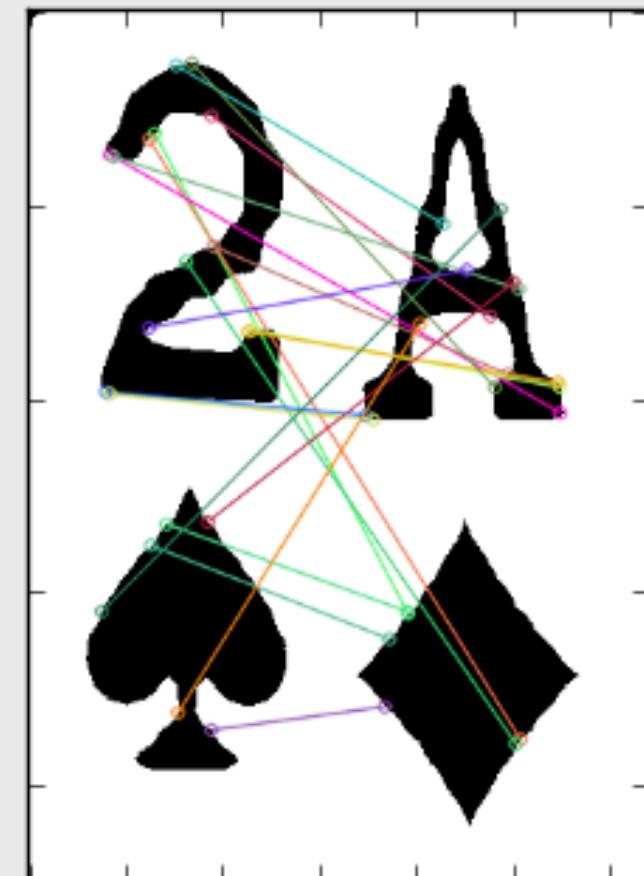
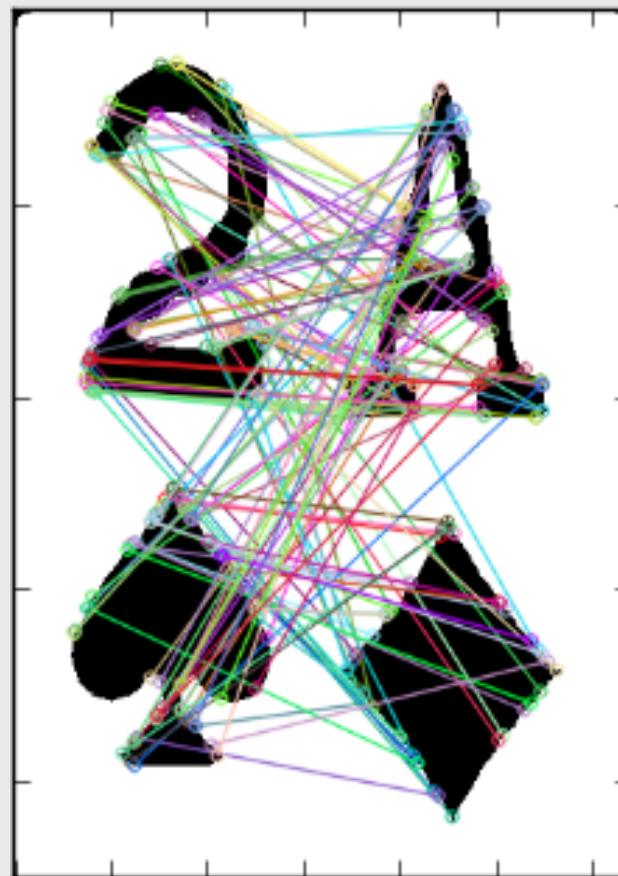
Feature Matching

- SIFT, SURF, ORB
- Scale and rotation invariant

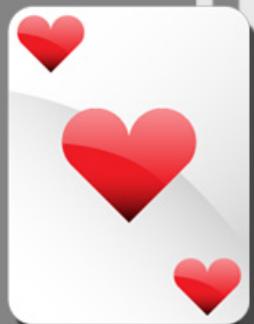


Feature Matching

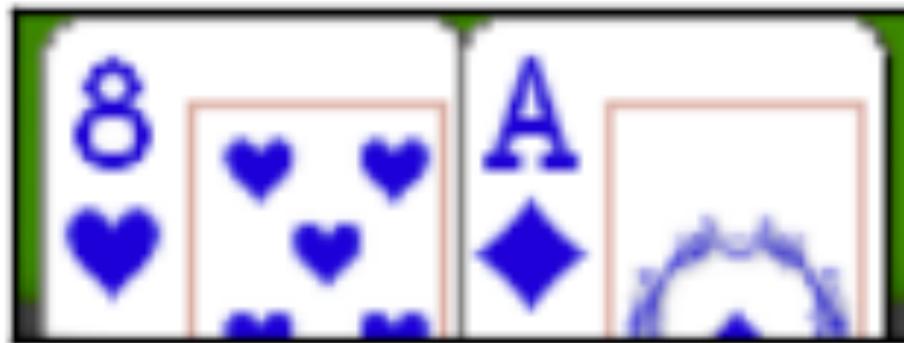
- Distances
- Thresholds
- # of pyramid levels
- # of matches



Success! (Kinda)

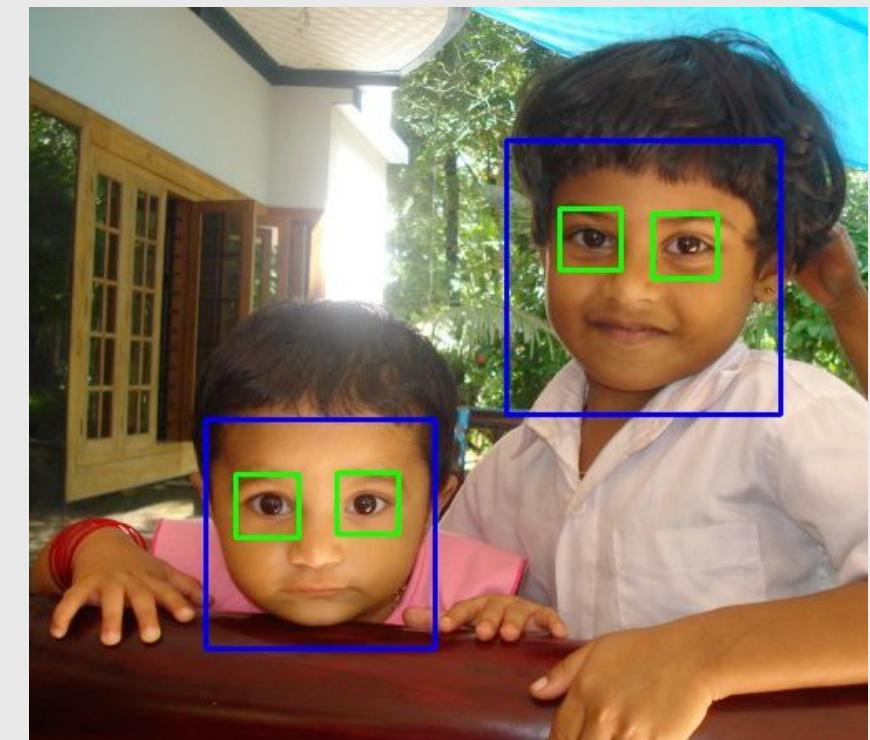
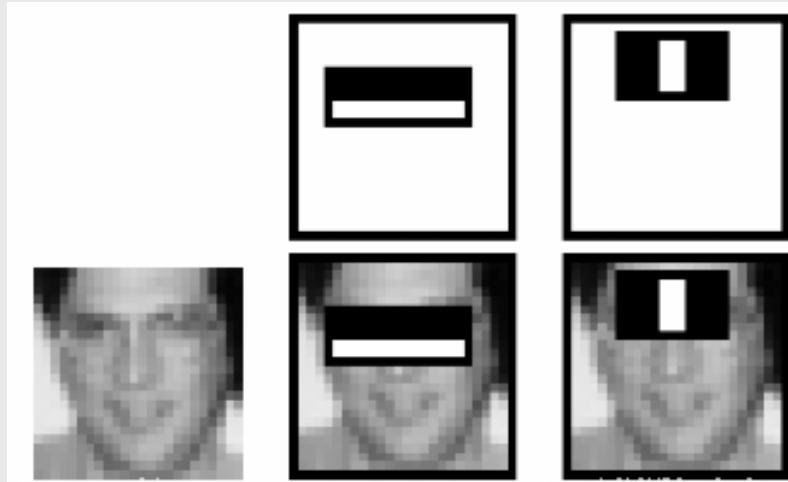


```
[('A', 'd'), ('8', 'h')]
```



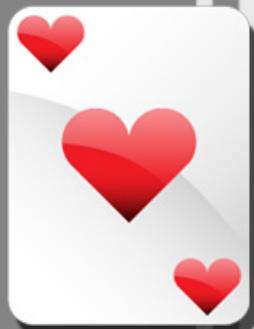
Object Detection

- Haar Cascade Classifiers
- Requires large (?) training sample
- Not scale/rotation invariant



Poker Applications

- Almost there!



Questions?

