



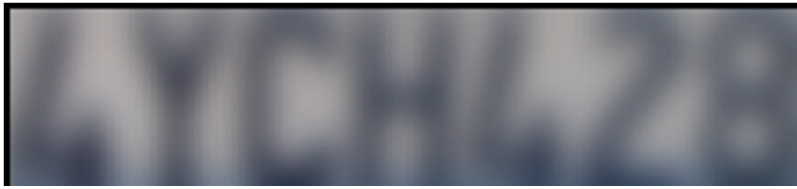
Honors 208W

Fall 2011

Recognizing Cars

- http://vision.ucsd.edu/belongie-grp/research/carRec/car_rec.html

Image Recognition



Honors 208W
Fall 2011

Image Recognition

Image Processing

We have done some exploration of histograms and color manipulation.

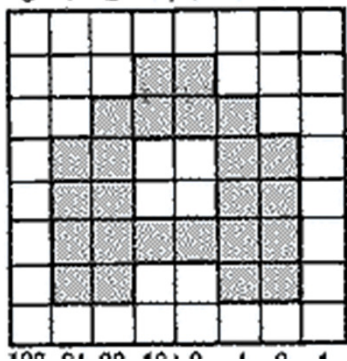
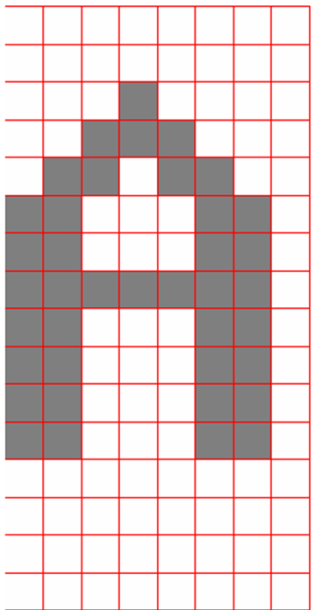
In this slide set we will explore image processing applications such as :

- Optical character recognition
 - Text extracted from scanned documents
 - License plates identified from a police car camera
- Recognizing aspects of people
 - Facial and clothing detection
 - Picasa, iPhoto, Facebook person identification
 - Smile and blink detection in cameras
- Reverse image search
 - TinEye, Google

Optical Character Recognition (OCR)

Taking handwritten or printed or typed text and converting it to character-based machine format.

- For example, the letter **A** in any input form would be stored as the number **65** in ASCII or UNICODE.
- Once it has been stored as **65**, it is easy to use as data.



= 65

Optical Character Recognition (OCR)

Some fonts and printing techniques are designed to make this process easier to perform.

- Consider the font used along the bottom of a check.

This dates back to the late 1950s!

⌚ 1 2 3 4 5 6 7 8 9 0 ⌚ ⌚ 1 2 3 4 5 6 7 8 9 0 ⌚ ⌚ 1 2 3 4 5 6 7 8 9 0 ⌚ ⌚ 1 2 3 4 5 6 7 8 9 0 ⌚

- There are some “non-human” characters there to help but in general it is human-readable too.
- This was originally printed exclusively in metallic ink to make the scanning process even easier.
- There is a font (OCR-A) for this, and also UNICODE values corresponding to the 10 “non-human” characters.

Non-text Printing



Some printed information is meant to be human-readable, some is not. Some printed information is designed to be easy for OCR but not for reading by a human.

- Consider UPC and 2D bar codes. While a UPC code might also have human-readable numbers, a 2D bar code use often provides no such feature.
- Postal tracking codes are sometimes printed onto envelopes by the postal service.

How is OCR done?

Fixed-font OCR

- As a very basic approach, you could “clean up” the image, make it black and white only, use white space and predicted width to identify individual characters, and do a difference check between each individual one and the list of possible ones.

Variable-font/handwritten OCR

- Machine vision.
- Training.
- External tools like spell-checking.

Similar letters – what % is the same?

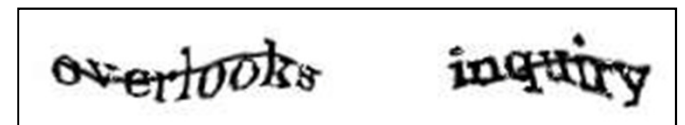
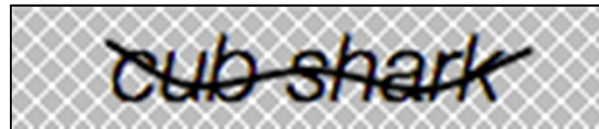
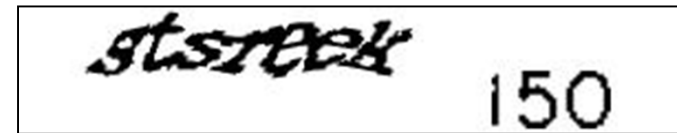
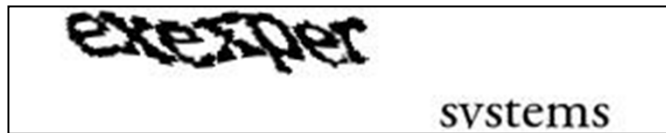
Consider the following letters:

- C G O Q (Times New Roman)
- **C G O Q** (**Courier New Bold**)
- C G O Q (Tahoma)
- C G O Q (Ariel)
- *C G O Q* (Comic Sans)
- C G O Q (OCR-A Extended)

CAPTCHA

If you want to see some examples of text that are challenging to OCR systems, just look at most text-based CAPTCHA systems.

These are designed specifically to be difficult to recognize automatically.



Recognizing People: Faces

Facial Recognition can use the eyes and lips to calibrate on a face and then look for things like:

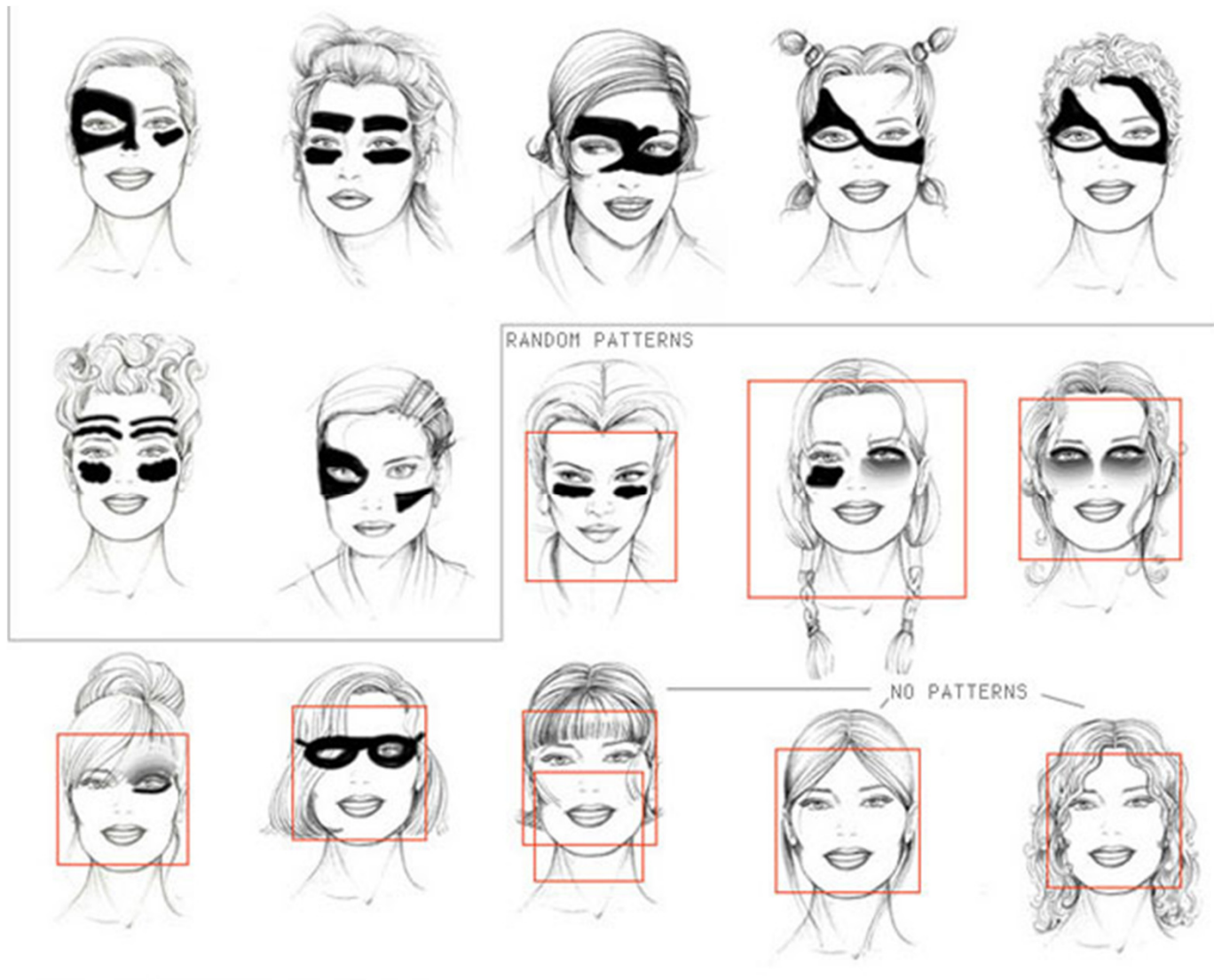
- the structure of your cheeks
- your jaw line
- the width of your nose
- the depth of your eyes

Inspired by a camouflage technique from the first World War, a researcher started to look at ways to use makeup to foil facial recognition.

Foiling Detection Then (1940s USS *Aaron Ward*)



Foiling Detection Now? (CV Dazzle)



Face Recognition: iPhoto and Facebook

For the past several years, Apple's iPhoto software has been able to use your existing tags to try to automatically detect who appears in your untagged photos.

Earlier this year, Facebook announced it would have a new feature where it would use facial recognition to suggest names of people to tag in photos that you upload, based on other existing tagged photos on Facebook.

Recognizing People: Clothing

Clothing recognition has been explored in assisted tagging of photo collections.

The basic assumption is that if you have a group of photos taken on the same day, and you start to tag them manually to identify who is in each photo, then you might be able to automatically tag many people in other photos by recognizing they are wearing the same shirt and pants.

What challenges might you see in this approach?

Recognizing People: Gait

Imagine that rather than a still photograph, that you had video of people to use.

Gait recognition looks for patterns in (for example) arm and leg and torso movement.

<http://www.youtube.com/watch?v=Voygv1uTF7c>

In-Camera “Aspect” Recognition

Facial position(s) for auto-focus.

Blink detection and smile detection for automated shutter release.

Are there others they could and/or should develop?

Reverse-Image Search

- Exact match
- Derived image match

www.tineye.com

images.google.com (click on the camera icon)

- Similar color scheme / layout

labs.systemone.at/retrievr

Some additional resources:

<http://www.debonet.com/jsd.cgi/Research/TextureSynthesis>

<http://www.microscan.com/en-us/trainingandresources/webinars/webinarunderstandingocr.aspx>

http://www.cs.cmu.edu/~biglou/captcha_cacm.pdf

<http://www.theatlantic.com/technology/archive/2010/04/makeup-to-be-surveilled-in/39302/>

<http://blogs.discovermagazine.com/discoblog/2010/04/05/bizarre-makeup-patterns-can-fool-face-recognition-software/>

<http://www.cvdazzle.com/>

<http://www.cs.umd.edu/hcil/saphari/>

<https://blog.facebook.com/blog.php?post=467145887130>

<http://support.apple.com/kb/ht3442>

<http://ocr-a-font.sourceforge.net/>