

# Character Recognition

A Computer Vision Application  
by Aditya Wikan M

# Character Recognition

- A type of pattern recognition
- Old name: Optical Character Recognition
- Recognise characters obtained from scanning devices: scanner, scan plates, etc. which provides a flat image (non-depth perception)
- Could be printed materials or handwriting.

# Character Recognition Flow

# Preprocessing

- Thresholding to binary (usually)
- Geometry correction: rotation, scaling
- Line detection: finding character lines, non-character objects → can be done statistically
- Character detection within lines, resulting in isolated character segment
- Preprocessing is followed by **feature extraction**

# Recognition

- Before recognition can commence, save training data from several “standard” (model) characters. What to save? Features extracted
- Match input features with saved features. Can be done statistically (using distance or similarity), or approached structurally or neurally (Schalkoff, 1992)

# Result

- Digitally storable characters
- ASCII or formatted characters, not images
- We can say that it's a **DIGITAL TEXT DOCUMENT**

# Example

- See the presented program

# How to do it? Preprocessing

- Line detection, character detection and correction can be done interchangeably
- Example in one case: detect the line, detect the char, then correct it (example: captcha or handwriting)
- In other case: correct first, detect the lines, then the characters (example: printed legal documents, books)



# Printed document - Correction

July 14, 2008

Dear Parent,

Thank you for participating in the summer Stroke and Conditioning competitive swim clinic. On Friday, July 18th, we will hold a mini swim meet for the preliminary for the program. All swimmers should come to the pool at 10:00am. The meet will begin at 11:00am and should last about an hour. This meet is just for fun so please will be kept and everyone will get a ribbon for every event they swim. We will need parent volunteers to help run the meet. Please fill out the form below and return it to the teacher as soon as possible. It will help the planning of the event go more smoothly. Thank you so much.

We hope that your swimmer(s) enjoyed their swimming experience with us. This program will continue in the fall under the name Stroke and Conditioning Clinic. The program starts in September and we run two, five week sessions. Monday thru Thursday. Not one, three or five days a week, or all four. We also have a break for the holidays and then start again in January. If you are interested in any of these programs please check at the Activities Desk in August or July from us call one at (912) 465-2822, ext. 458.

Again, many thanks for your participation. If you have any further questions please do not hesitate to talk to me directly or call one of the above numbers.

See you at the pool.

Crystal Hernandez  
Coordinator

\_\_\_\_\_ YES, my child will be participating in the meet.

\_\_\_\_\_ YES, I am willing to be a volunteer.

\_\_\_\_\_ NO, my child will not be participating in the meet.

\_\_\_\_\_  
(Parent's Name)

\_\_\_\_\_  
(Child's Name)

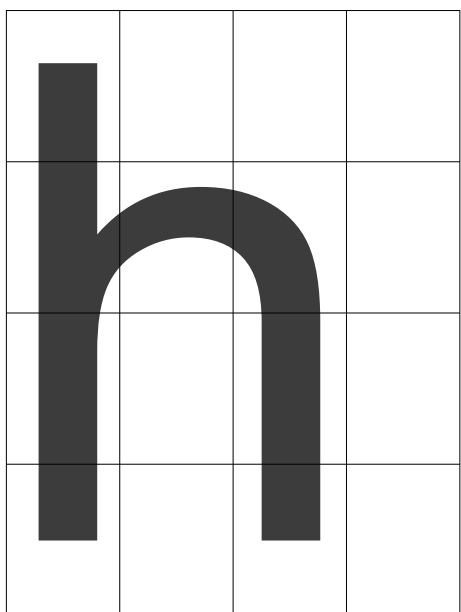
Get the angle,  
then rotate necessarily

# Printed document: line detection

# Printed document: character detection

# Printed document: feature extraction

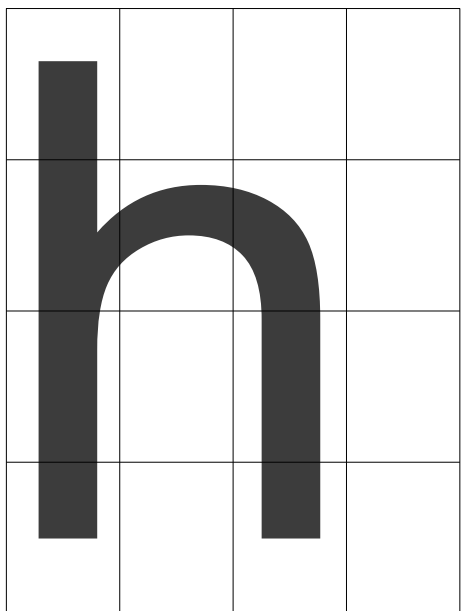
- Example: statistical feature, black pixels inside the segment



3 0 0 0  
7 4 4 0  
5 0 5 0  
2 0 2 0

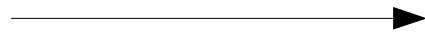
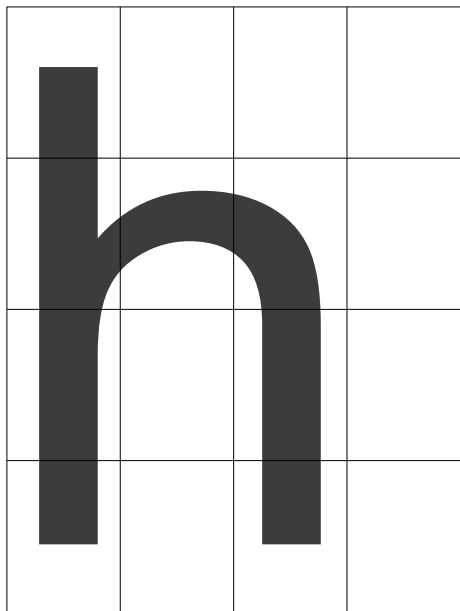
# Printed document: feature extraction

- Example: add shape feature, line ends detected



1	0	0	0
0	0	0	0
0	0	0	0
1	0	1	0

# Printed document: matching



3 0 0 0

7 4 4 0

5 0 5 0

2 0 2 0

vs

0 0 0 0

4 4 4 0

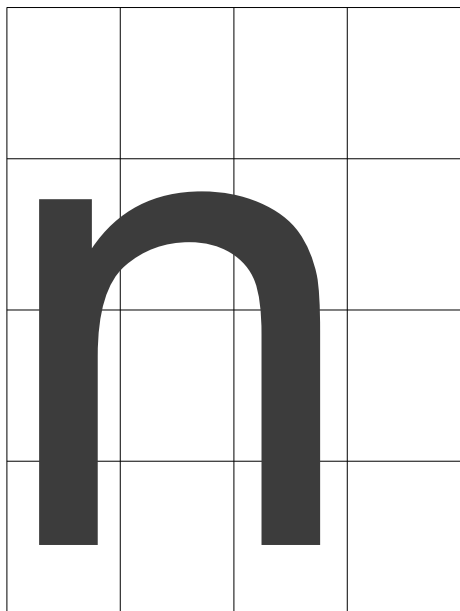
5 0 5 0

2 0 2 0

% matched?

Distance?

Threshold?



# Captcha? Ideas?

Gmail

clati

amso

omictiu

Yahoo!

sl8FLny

7levMF

7pAL5n

Hotmail

GHJH6CTN

EXXTENVHK

XYHIXCIR

# Handwriting?

- *Character Recognition Systems*: Mohamed Cheriet, Nawwaf Kharma, Cheng-Lin Liu, Ching Y. Suen. 2007: Wiley





# Handwriting

- Similar: MyScript Calculator in Android (free)

The image shows a screenshot of the MyScript Calculator application. The interface includes a menu bar at the top with 'History', 'Options', and 'Help' options, and 'Del' and 'Enter' buttons. The main display area is divided into two sections: a top section with a typed mathematical formula and a bottom section with a handwritten version of the same formula on a yellow grid background. The typed formula is  $f(z) = \frac{1}{2\pi} \int_0^{2\pi} u(e^{i\psi}) \frac{e^{i\psi} + z}{e^{i\psi} - z} d\psi, |z| < 1$ . The handwritten formula is  $f(z) = \frac{1}{2\pi} \int_0^{2\pi} u(e^{i\psi}) \frac{e^{i\psi} + z}{e^{i\psi} - z} d\psi, |z| < 1$ . On the right side, there is a vertical toolbar with buttons for 'Write', 'Erase', 'Select and Correct', 'Undo', 'Redo', and 'Clear'. An 'Insert' button is located at the bottom right of the interface.