

# Optical Character Recognition

## Lecture 4



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## Binarization

- Binarization
  - Conversion of gray scale images into black and white format
  - Find a threshold to decide whether a gray scale pixel in an image should be converted to black or white value.
- Categories of Binarization Algorithms
  - Global Binarization
  - Local Binarization
  - Hybrid Binarization

## Global Binarization

$$\sigma_w^2(t) = w_1(t)\sigma_1^2(t) + w_2(t)\sigma_2^2(t) \quad (1)$$

- $w_1(t)$  : sum of all intensity values below the threshold  $t$  for foreground
- $w_2(t)$  : sum of all intensity values from  $t$  to maximum intensity value in an image (which is normally 255 for gray scale) for background.
- $\sigma_1^2(t)$  and  $\sigma_2^2(t)$  are variances of foreground and background classes
- For different values of  $t$  which range from 0-255,  $\sigma_w^2(t)$  is computed and the best value of  $t$  is selected which has minimum value of  $\sigma_w^2(t)$

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3

## Local Binarization

- $k(x,y) = 0.05$  if any ridge is present in the local neighborhood window centered around the pixel  $(x,y)$  otherwise  $0.2$
- $m(x,y)$  is mean
- $\sigma(x,y)$  is standard deviation

$$t(x,y) = m(x,y) \left[ 1 + k(x,y) \left( \frac{\sigma(x,y)}{R} - 1 \right) \right]$$

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4

## Hybrid Binarization

- $R$  is dynamic range of standard deviation calculated for the document and has value 125.
- $m(x,y)$  is mean of the intensity values of local window
- $s(x,y)$  is standard deviation
- $k$  is constant value ranges between 0 to 1 which determines how effectively an edge of an object is retained

Code is given

$$t(x, y) = m(x, y) * (1 + k(\frac{s(x,y)}{R} - 1))$$

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5

## Project Discussion

- Creation of synthesized document images using selected real shapes

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6

## Project Discussion

Line segmentation  
using horizontal  
histogram

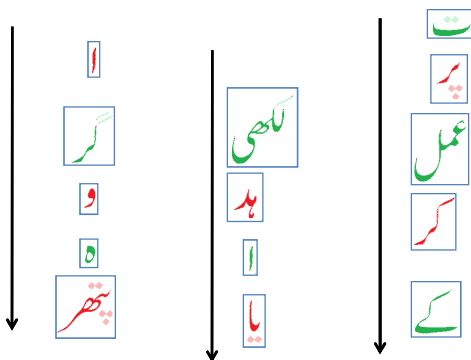


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7

## Syllable segmentation (using vertical histogram profile) and sequencing

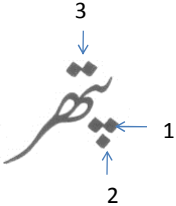
Right to Left Reading Order



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8

## Main body and Diacritics Sequencing






3  
↓  
1 ←  
↑  
2

Main Body



↓  
1 ↑ 2 ↑ 3 ↑

**Shape IDs:**

 200  
 02  
 01

**Lookup Table Entry** (Without positional Information)

200 02 01 02      پتھر

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## Project Deliverables

Deliverable	Urd Group	Nep Group	Sin Group	Sin Group 2	Snd Group	Tam Group
Data Preparation 1. Document Image 2. MBs Real Data 3. Diacritics Real Data						
Binarization						
Line Segmentation						
Ligature/Syllable Segmentation						
Ligature/Syllable Segmentation						
Diacritics Training and recognition						
Main Body Classification and Recognition						
Syllable String Creation						

ISSALE 2014 10