Thresholding

Examples
Example 1 - Otsu Algorithm

- We test all possible thresholds
- For each threshold $t$,
  - Compute $m_1$, the mean of pixels with value $\leq t$
  - Compute $m_2$, the mean of pixels with value $> t$
  - The “between-class” variance is
    \[
    \sigma_B^2 = P_1 (m_1 - m_G)^2 + P_2 (m_2 - m_G)^2
    \]
    - where $P_1, P_2$ are the probabilities of class 1 and class 2, and $m_G$ is the global mean
- Then pick the threshold that maximizes the between-class variance
Example 1 - Otsu Algorithm

clear all, close all;

I = imread('cameraman.tif');
[H,W] = size(I);
figure, imshow(I);

% Get histogram. hist(i) is the count of pixels with value x(i).
[hist, x] = imhist(I);
figure, imhist(I);

% Convert to probability
p = hist/(H*W);

% Compute mean of entire image
ug = sum( x .* p );
fprintf('Global mean = %f
', ug);

% We will search for a threshold, t between 1..255.
% This array holds the between-class variance for each threshold.
vb = zeros(1,length(x));    % variance for each t

for ix = 1:length(x)-1
    t = x(ix);      % Trial threshold value
    m1 = (x <= t);      % create a logical mask; true where x<=t
    P1 = sum(p(m1));    % total probability for those values
Example 1 (continued)

% Compute mean of group 1
u1 = sum(x(m1) .* p(m1)) / P1;

% Compute mean of Group 2 (all pixels with intensity >t)

% Value of between-group variance
vb(ix) =

end
figure, plot(x, vb);

% Find the maximum between-group variance and the threshold t where it occurs.

% Threshold the image using t.
Iout = I>t;
figure, imshow(Iout,[]);