

BSB663

Image Processing

Pinar Duygulu

Image Representation

- Digital Images are 2D arrays (matrices) of numbers
- Each pixel is a measure of the brightness (intensity of light)
 - that falls on an area of an sensor (typically a CCD chip)

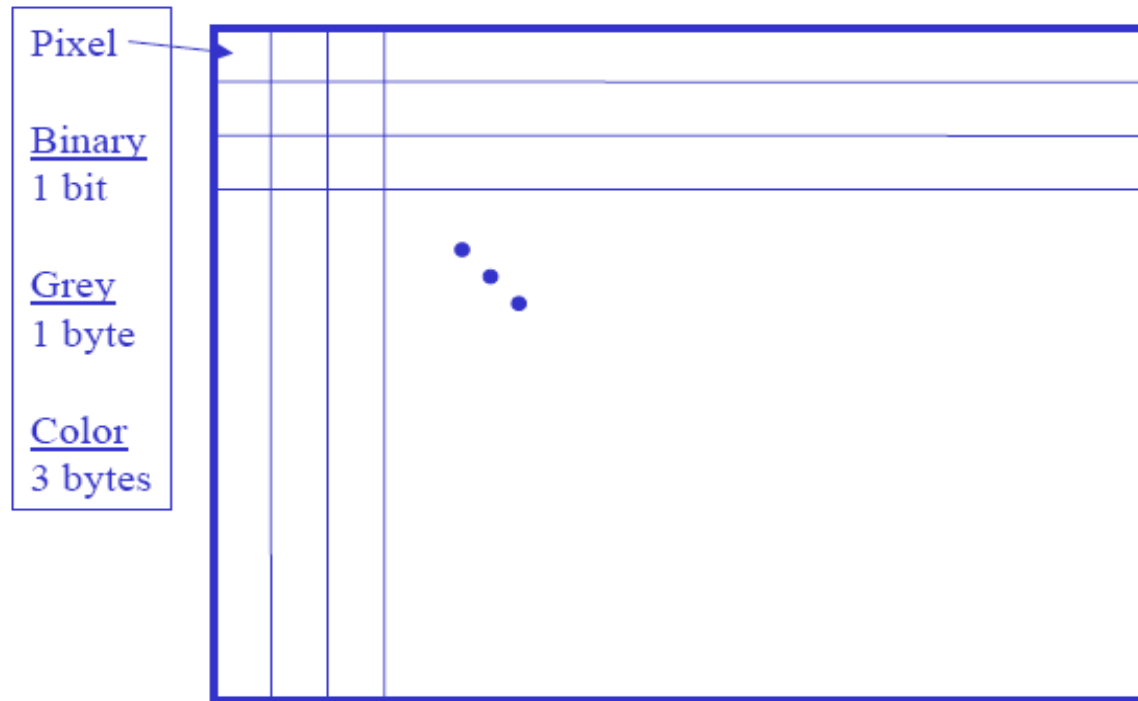
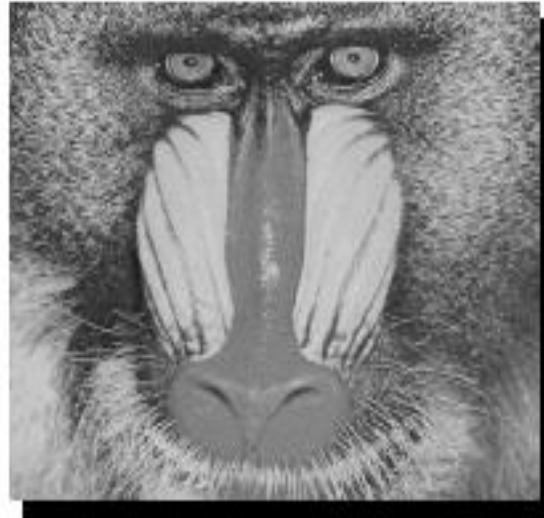


Image Representation



RGB



Greyscale



Binary

Introduction to Matlab

One kind of object – a rectangular numerical matrix

Scalars : 1x1 matrices

Vectors : matrices with only one row or one column

a 3x3 matrix

$A = [1 \ 2 \ 3; 4 \ 5 \ 6; 7 \ 8 \ 9]$

is equal to

$A = [1 \ 2 \ 3$
 $4 \ 5 \ 6$
 $7 \ 8 \ 9]$

Introduction to Matlab

```
A = [1 2; 3 4]    % creates a 2x2 matrix
N = 5            % a scalar
v = [1 0 0]      % a row vector
V = [1; 2; 3]    % a column vector
v = v'           % transpose of a vector
v = 1:2:7        % [start:stepsize:end] v = [1 3 5 7]
v = []          % empty vector
```

Introduction to Matlab

```
m = zeros(2,3) % creates a 2x3 matrix of zeros
v = ones(1,3)  % creates a 1x3 matrix (row vector) of ones
m = eye(3)     % identity matrix
v = rand(3,1)  % randomly filled matrix
m = zeros(3)   % 3x3 matrix of zeros

d = diag(a)    % diagonal of matrix a
```

Introduction to Matlab

```
v = [1 2 3]
```

```
v(3)           % access a vector element
```

```
m = [1 2 3 4; 5 6 7 8; 9 10 11 12; 13 14 15 16]
```

```
m(1,3)        % access a matrix element (row #, column #)
```

```
m(2,:)        % access a whole matrix row
```

```
m(:,1)        % access a whole matrix column
```

```
m(1,1:3)      % access elements 1 through 3 of 1st row
```

```
m(2:end, 3)
```

Introduction to Matlab

```
m = [1 2 3; 4 5 6]
```

```
size(m)           % returns the size of a matrix
```

```
m1 = zeros(size(m))
```

```
a = [1 2 3 4]'
```

```
2 * a
```

```
a / 4
```

```
b = [5 6 7 8]'
```

```
a + b
```

```
a - b
```

```
a.^2
```


Introduction to Matlab

```
a = [1 4 6 3]
```

```
sum(a)      % sum of vector elements
```

```
mean(a)     % mean
```

```
var(a)      % variance
```

```
std(a)      % standard deviation
```

```
max(a)      % maximum
```

```
min(a)      % minimum
```

```
a = [1 2 3; 4 5 6]
```

```
mean(a)     % mean of each column
```

```
mean(a,2)   % mean of each row
```

```
max(max(a)) % maximum value of the matrix
```

Introduction to Matlab

```
a = [1 2 3; 4 5 6; 7 8 9]
```

```
inv(a)    % matrix inverse
```

```
eig(a)    % vector of eigenvalues of a
```

```
[V, D] = eig(a)
```

```
% D:eigenvalues on diagonal
```

```
%V :matrix of eigenvectors
```

```
[U,S,V] = svd(a) % singular value decomposition of a
```

```
% a = U * S * V'
```

Introduction to Matlab

```
B = zeros(m,n)
for i=1:m
    for j=1:n
        if A(i,j) > 0
            B(i,j) = A(i,j)
        end
    end
end
end
```

```
B = zeros(m,n)
ind = find(A>0)
B(ind) = A(ind)
```

Introduction to Matlab

```
x = [0 1 2 3 4]  
plot(x, 2*x)  
xlabel('x')  
ylabel('2*x')  
title('dummy')  
bar(x)
```

Introduction to Matlab

myfunction.m

```
function y = myfunction(x)
```

```
a = [-2 -1 0 1]
```

```
y = a + x;
```

Handling Images in Matlab

```
I = imread('img.jpg');    % read a jpg image  
imshow(I)                % shows an image  
imwrite(I, filename)     % writes an image to file
```



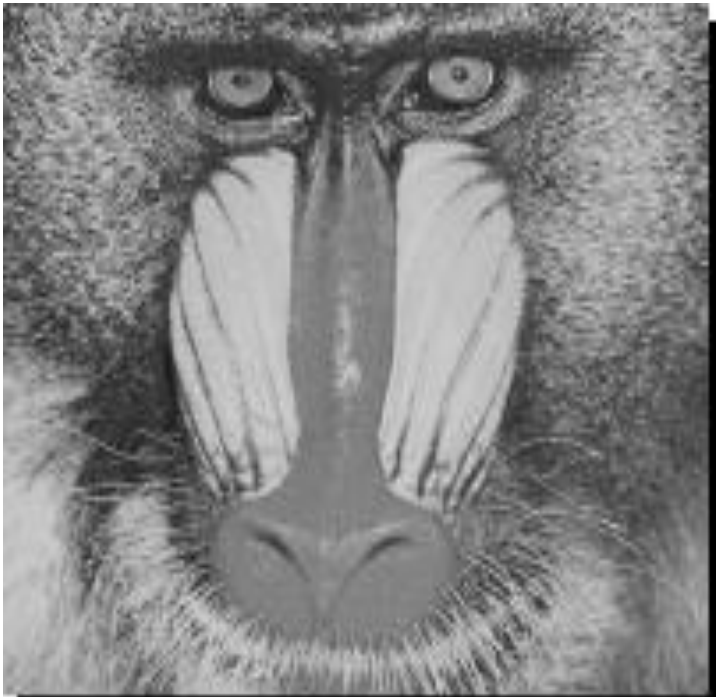
Handling Images in Matlab

figure

imagesc(I)

colormap gray;

% display it as gray level image



Handling Images in Matlab



```
size(img)  
90 150 3
```


Handling Images in Matlab

```
R = img(:,:,1)
```

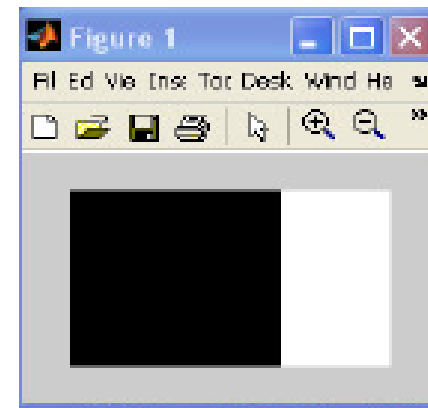
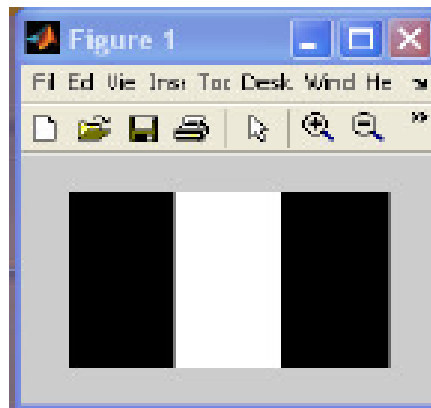
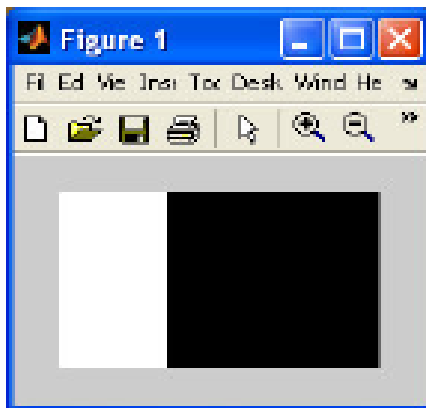
```
G = img(:,:,2)
```

```
B = img(:,:,3)
```

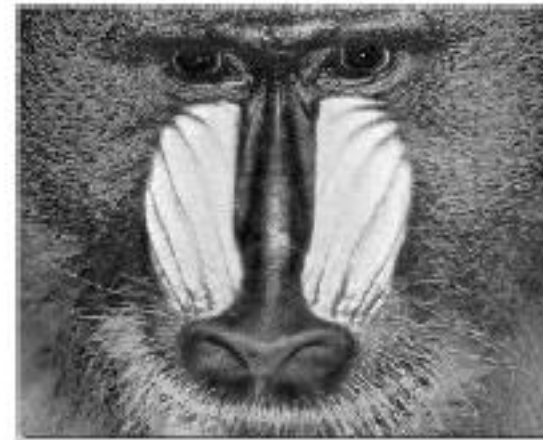
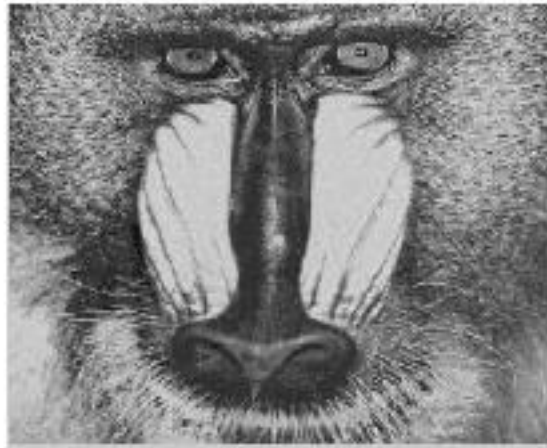
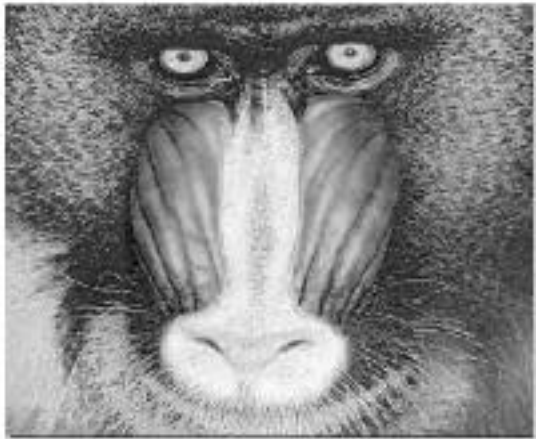
```
imshow(R)
```

```
imshow(G)
```

```
imshow(B)
```

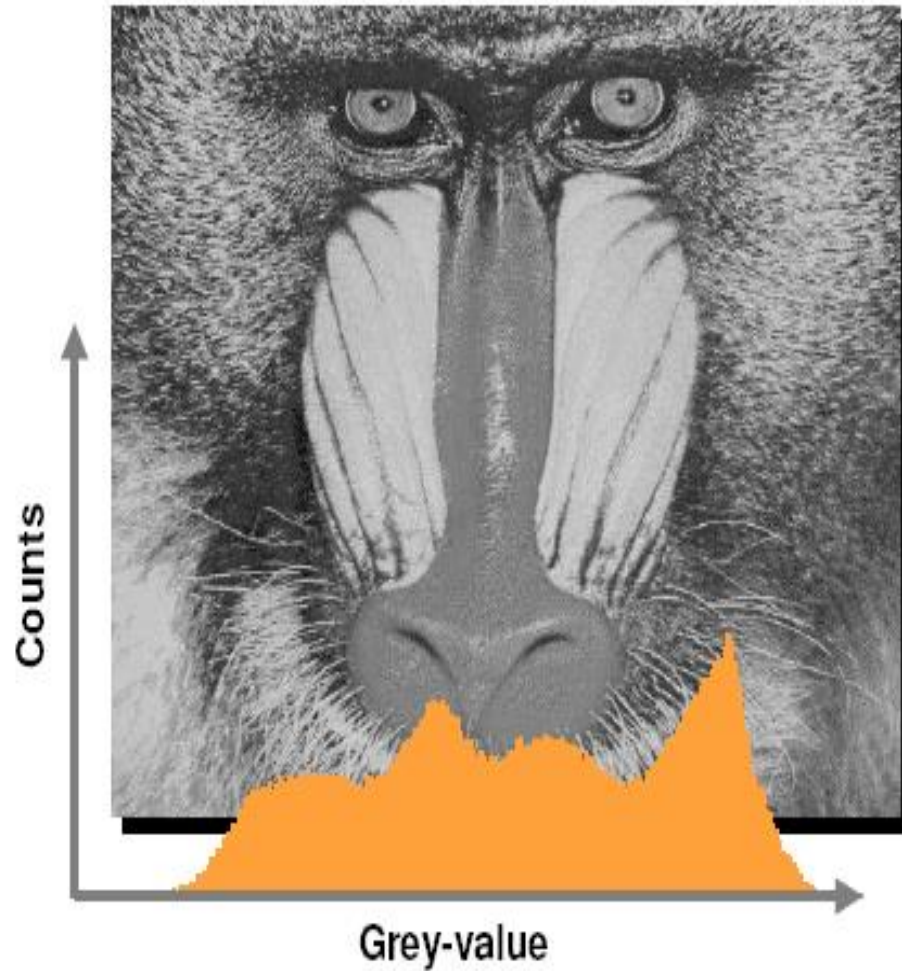


Handling Images in Matlab



Handling Images in Matlab

Histograms



Handling Images in Matlab

Histograms



```
h = imhist(R)
```

```
bar(h)
```

