EP375 Computational Physics

Topic 14

VIDEO PROCESSING

Department of Engineering Physics

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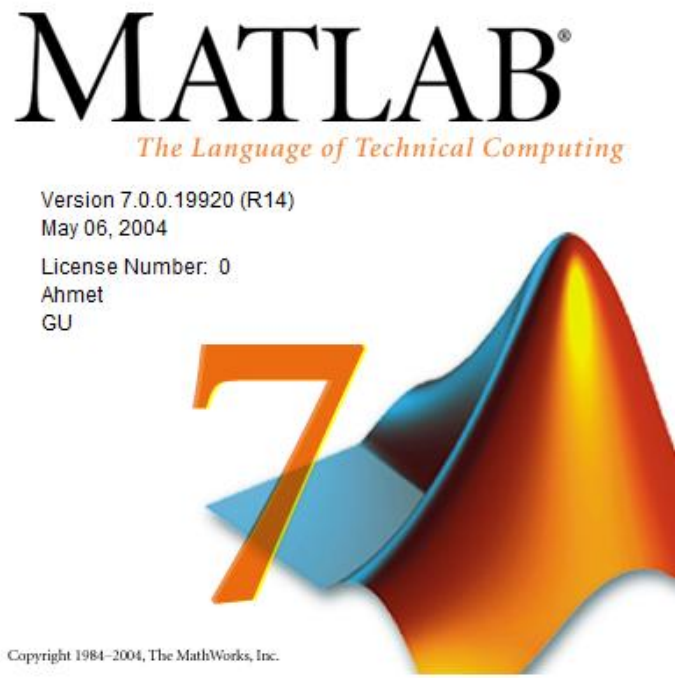
Content



1. **Example Applications**

Functions to be used:

```
VideoReader()
read()
rgb2gray()
im2bw()
imshow()
regionprops()
```

Introduction

- We have seen 2D or 3D plots of basic data.

- In this chapter we will discus some of the elementary processes that can be applied to images.

```
% vp0.m
% frames to movie
% get 1.bmp, 2.bmp and 3.bmp from course web page
% http://www1.gantep.edu.tr/~bingul/ep375/
clear; clc;
count = 0; Nframe = 3; Dframe = 5;
mov = avifile('example.avi','compression','None');
for i=1:Nframe
     name = strcat(num2str(i),'.bmp');
     v = imread(name);
     while count<Dframe
        count = count + 1;
        imshow(v);
        F = getframe(gca);
        mov = addframe(mov, F);
     end
     count = 0;
end
mov = close(mov);
```

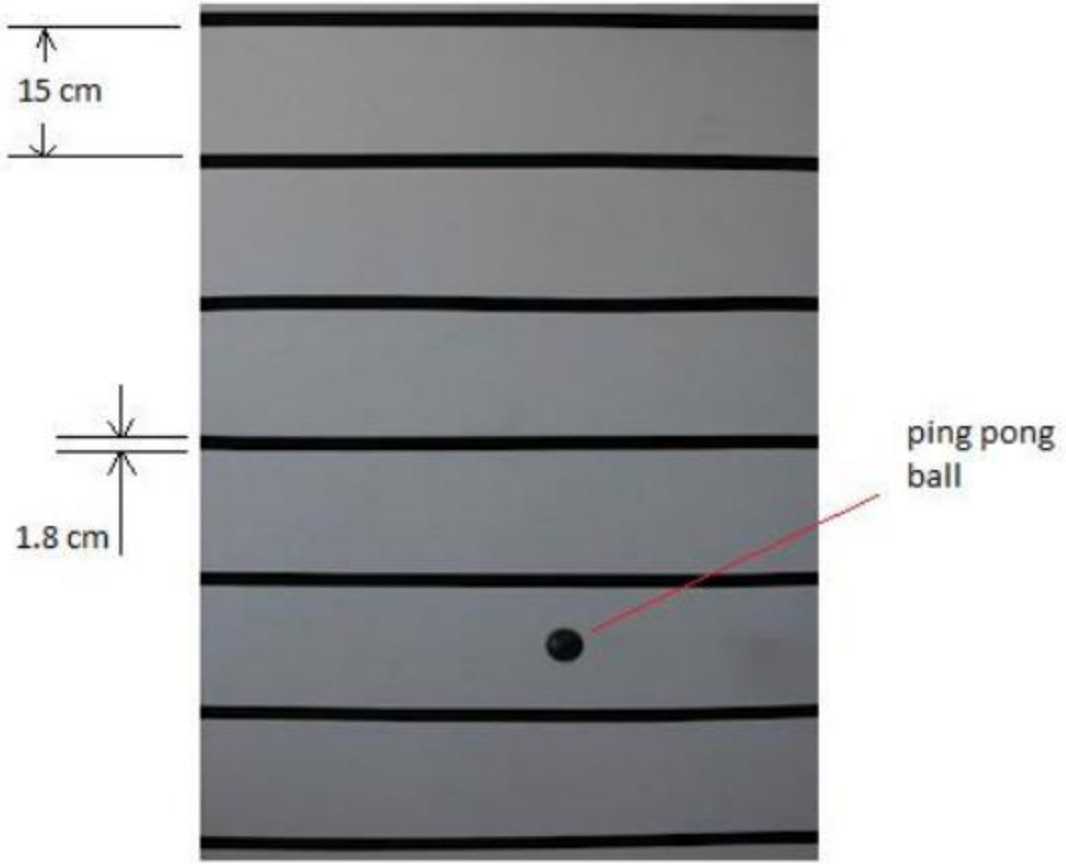
```
% vp1.m
% reading video info
clc; clear
v  = VideoReader('laser.avi');
t  = v.Duration
fr = v.FrameRate
nFrame = uint32(t * fr)
v1 = read(v,30); % get 30th frame
imshow(v1)       % diplay
```

```
% vp2.m
% reading video info

clc; clear
v  = VideoReader('freefall.avi');
t  = v.Duration
fr = v.FrameRate
nFrame = uint32(t * fr)

for i=1:nFrame
  v1 = read(v,i); % get ith frame
  imshow(v1)      % diplay
end
```

Falling Ping Pong Ball Videos

Distance between paralel strips = 15 cm

Thicknes of a strip = 1.8 cm



Get the videos from

http://www1.gantep.edu.tr/~bingul/ep375/

```
% vp3.m
% reading video
clc; clear
%v  = VideoReader('laser.avi');
v  = VideoReader('fallingball3.avi');
t  = v.Duration;
fr = v.FrameRate;
nFrame = uint32(t * fr);

for i=1:nFrame
  A = read(v, i);  % get ith frame
  B = rgb2gray(A); % convert to gray scale
  C = B>175;       % convert to black-white
  subplot(2,2,1); imshow(A)
  subplot(2,2,2); imshow(B);
  subplot(2,2,3); imshow(C)
  pause(1/fr);
end
```

```
% vp4.m
% ccd
clc; clear
v  = VideoReader('laser.avi');
t  = v.Duration;
fr = v.FrameRate;
nFrame = uint32(t * fr);

v1 = rgb2gray(read(v,1)); % get 1st frame
v3 = rgb2gray(read(v,1)); % get 1st frame

for i=2:nFrame
    v2 = rgb2gray(read(v,i));
    v3 = v3 + imabsdiff(v1,v2);
    imshow(v3)
end
```

```
% vp5.m
% circles

a = imread('circles.png');
g = rgb2gray(a);
bw = g > 100;
imshow(bw)

stats = regionprops('table',bw,'Centroid',...
    'MajorAxisLength','MinorAxisLength')
centers = stats.Centroid;
diameters = mean([stats.MajorAxisLength ...
                  stats.MinorAxisLength],2);
radii = diameters/2;
hold on
viscircles(centers,radii);
hold off
```

```
% vp6.m
% tracker
clear; clc;
v = VideoReader('laser.mp4');
t = v.Duration;
fr  = v.FrameRate;
nFrame = uint16(t * fr);

newvid = VideoWriter('newfile');
newvid.FrameRate=8;
open(newvid)

for k = 50:200
 v1 = read(v,k);
 imshow(v1)
 v2 = im2bw(v1,0.8);
 stat = regionprops(v2);
 [w, h] = size(stat);
 if size(stat) > 0
    rectangle('Position', stat(1).BoundingBox, 'EdgeColor', 'b');
    cX = stat(1).Centroid(1);
    cY = stat(1).Centroid(2);
    fprintf('%d %d\n',cX,cY);
 end
 frame = getframe;
 writeVideo(newvid,frame);
end
close(newvid)
```

```
% vp7.m
% measurement of gravitational acceleration from video
clear; clc;
v = VideoReader('fallingball7.avi');
nFrame = uint16(v.Duuration * v.FrameRate);

v1 = read(v,1); % get first frame
for k = 2:nFrame
  v2 = read(v,k);
  v3 = imabsdiff(v1,v2);
  v4 = im2bw(v3,0.2);
  imshow(v4);

  stat = regionprops(v4);
  if size(stat) > 0
    rectangle('Position', stat(1).BoundingBox,'EdgeColor', 'g');
    cX = stat(1).Centroid(1);
    cY = stat(1).Centroid(2);
    fprintf('%d -> %d %d\n',k,cX,cY);
    T(k) = double(k)/fr;
    y(k) = cY;
  end
  frame = getframe;
end
% size of ping ball is 42mm which corresponds 15px in the video
t = T(2:end);
y = (v.Height-y(2:end)) * 42e-3/15;
plot(t,y,'*')
```

References:

[1]. Numerical Methods for Engineers, 6th Ed.
S.C. Chapra, Mc Graw Hill (2010)

[2]. http://www.mathworks.com/products/matlab

[3]. Numerical Methods in Engineering with MATLAB,
J. Kiusalaas, Cambridge University Press (2005)

[4]. Essential MATLAB for Engineers and Scientist, 3rd Ed
Hahn B., Valentine D.T. (2007)

[5]. Computational Physics,
Giordano J.N. Prentice Hall (1997)