Assignment #5

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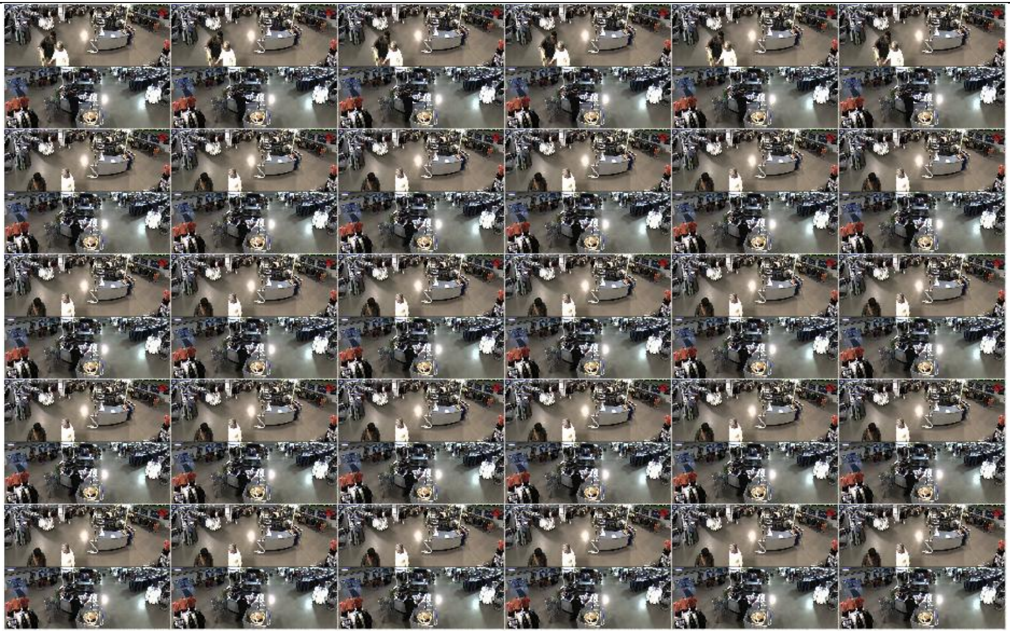
Question 1

Analysis:

1) The video used for this question was ‘store1(1).mp4’, as given with the assignment.
2) Using read function, the first 30 frames of the video was retrieved and stored in a matrix.
3) To make an image with 30 thumbnails, in an arrangement of 5*6, the horzat and vertcat functions were utilized.
4) With horzcat, rows of 6 thumbnails were made. And with vertcat, the 5 rows were made into a column.

Results:



Thumbnails of 30 frames concatenated into one picture

Matlab Code:

```
obj=VideoReader('store1(1).mp4');% read a video file
n=obj.NumberOfFrames;
objHeight=obj.Height;
objWidth=obj.Width;
for i=1:30% retrieve 30 frames from the video
    img(i).cdata=read(obj,i);
end
```

```
imshow(img(1).cdata);

for i=1:6% concatenate a 6*5 matrix of images using horzcat and vertcat

image1=horzcat(img(1).cdata,img(2).cdata,img(3).cdata,img(4).cdata,img(
5).cdata,img(6).cdata);
end
for i=1:6

image2=horzcat(img(7).cdata,img(8).cdata,img(9).cdata,img(10).cdata,img
(11).cdata,img(12).cdata);
end
for i=1:6

image3=horzcat(img(13).cdata,img(14).cdata,img(15).cdata,img(16).cdata,
img(17).cdata,img(18).cdata);
end
for i=1:6

image4=horzcat(img(19).cdata,img(20).cdata,img(21).cdata,img(22).cdata,
img(23).cdata,img(24).cdata);
end
for i=1:6

image5=horzcat(img(25).cdata,img(26).cdata,img(27).cdata,img(28).cdata,
img(29).cdata,img(30).cdata);
end
image_final=vertcat(image1,image2,image3,image4,image5);
imshow(image_final);
```

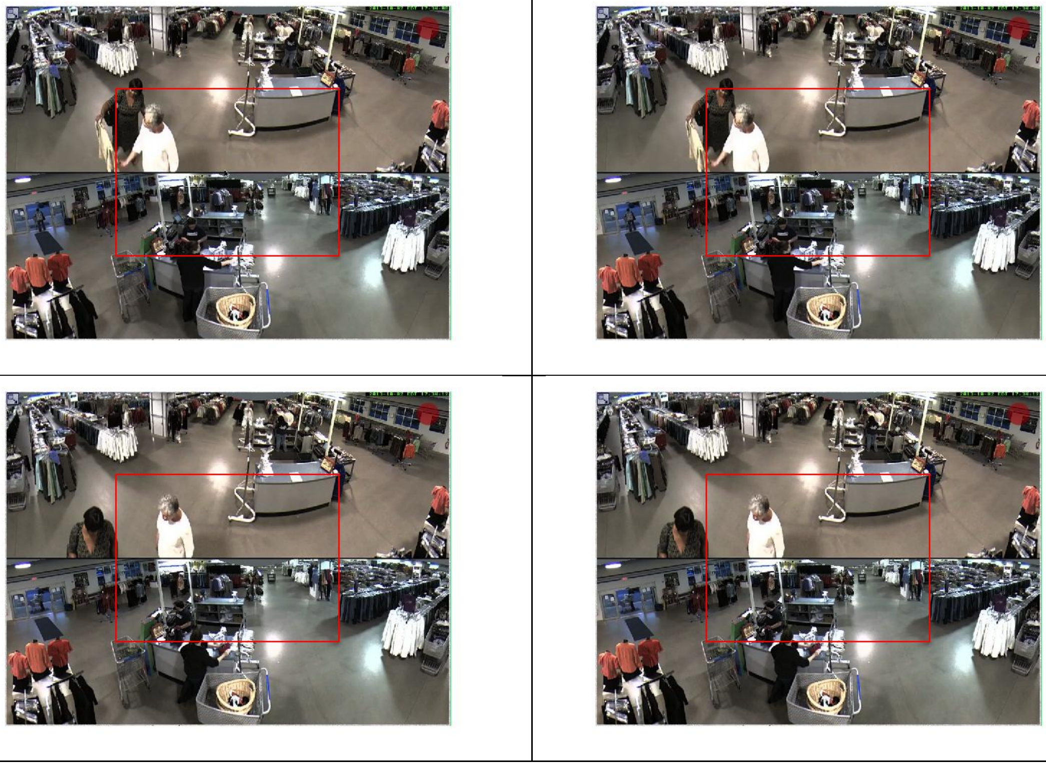
Question 2

Analysis:

1) To obtain a sequence of images, the given video file was used to retrieve the consecutive frames.
2) Once the frames were retrieved, a set of 4 consecutive images were obtained.
3) To each of those images, a red rectangular box of the dimensions 'framewidth/4' * 'frameheight/4' was added.
4) Now these images were now written into a video format as shown in the matlab code.

Results:

The sequence of images used is shown below.



Sequence of Images used to form the video

Matlab Code:

```
obj=VideoReader('store1(1).mp4');% read a video file
n=obj.NumberOfFrames;
objHeight=obj.Height;
objWidth=obj.Width;
for i=1:30% read a sequence of images
    img(i).cdata=read(obj,i);
end
```

```
imshow(img(1).cdata)
rectangle('position',[objWidth/4,objHeight/4,objWidth/2,objHeight/2],'LineWidth',2,'EdgeColor','r');% a red rectangle box is added to each of the 30 images

workingDir = pwd;
imageNames = dir(fullfile(workingDir, 'images', '*.jpg'));
imageNames = {imageNames.name}';
% Set up output video
outputVideo = VideoWriter(fullfile(workingDir,'newvideo'));
outputVideo.FrameRate = 4;
open(outputVideo);
for ii = 1:length(imageNames)
 img = imread(fullfile(workingDir,'images',imageNames{ii})); % read the image
 writeVideo(outputVideo,img); % Write to video
end
close(outputVideo);
```

NOTE: The code snippet to write a set of frames into a video was taken from ‘10-Video Basics/Video Reading and Writing Sample Code.pdf’, page 4.

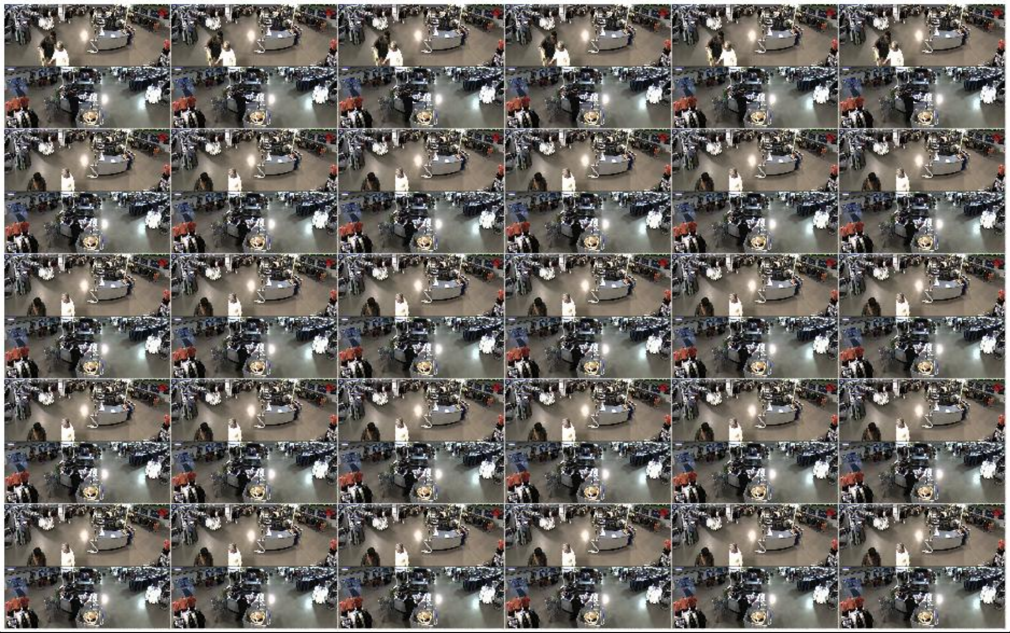
Question 3

Analysis:

1) The sample video given was used and 30 images were extracted from it and stored in a folder.
2) The images were now arranged and made as sequential frames to form a video file.
3) The frame rate was altered and the differences were observed.

Result:

The images used are shown below.



Sequence of 30 images

Matlab Code:

```
workingDir = pwd;
imageNames = dir(fullfile(workingDir, 'images', '*.jpg'));
imageNames = {imageNames.name}';
% Set up output video
outputVideo = VideoWriter(fullfile(workingDir,'newvideo2'));
outputVideo.FrameRate = 15;
open(outputVideo);
for ii = 1:length(imageNames)
 img = imread(fullfile(workingDir,'images',imageNames{ii})); % read the
image
 writeVideo(outputVideo,img); % Write to video
end
close(outputVideo);
```

Question 4

Analysis:

1) The video given ‘store1.mov’ was used to extract the number of frames.
2) The first frame was retrieved and used as background.
3) The background was converted to gray scale and the frame size was computed.
4) Each frame was read and converted to gray scale.
5) On converting to gray scale, the corresponding pixel values were compared with the threshold value.
6) Based on the comparison and difference, the foreground pixel values were altered.
7) These frames were written into a video.
8) Between the Approximate Filter and the Frame Difference filter methods, the alterations in the foreground pixel values vary. This results in the change in precision of the formed objects.
9) This can be seen from the formed video.

Results:

The difference between the Approximate Filter and Frame Difference filter methods are evident from the videos formed.

Matlab Code:

```
% Approximate Median filter method
obj = VideoReader('/Users/Adwaith/18-798/asgn5/Q4/store1(1).mov');
no_frames = get(obj, 'numberOfframes');
obj2 = VideoWriter('/Users/Adwaith/18-798/asgn5/Q4/q4_video');
obj2.FrameRate = 5;

open(obj2);
threshold = 25;
background = read(obj,1);% The first frame of the movie is read as the
background
background_bw = double(rgb2gray(background));% the background is
converted to grayscale
frame_size = size(background);
objwidth = frame_size(2);
objheight = frame_size(1);
foreground = zeros(objheight, objwidth);

for i = 2:no_frames
    frame = read(obj,i);% every frame of the movie is read
    frame_bw = rgb2gray(frame);% each frame is converted to grayscale

    frame_difference = abs(double(frame_bw) - double(background_bw));%
negative values are prevented by taking the absolute

    for j=1:objwidth% checking if frame_difference > threshold pixel in
foreground
         for k=1:objheight
```

```
             if ((frame_difference(k,j) > threshold))
                 foreground(k,j) = frame_bw(k,j);
             else
                 foreground(k,j) = 0;
             end

             if (frame_bw(k,j) > background_bw(k,j))
                 background_bw(k,j) = background_bw(k,j) + 1;
             elseif (frame_bw(k,j) < background_bw(k,j))
                 background_bw(k,j) = background_bw(k,j) - 1;
             end

         end
    end

     writeVideo(obj2,uint8(foreground));% the resultant set of frames
are written into a video format

end
title('Contour of extracted objects using Approximate median filter');
imcontour(foreground);
hold on;
close(obj2);

% Frame difference method
obj = VideoReader('/Users/Adwaith/18-798/asgn5/Q4/store1(1).mov');
no_frames = get(obj, 'numberOfFrames');
obj2 = VideoWriter('/Users/Adwaith/18-798/asgn5/Q4/q4_video1');
obj2.FrameRate = 5;

open(obj2);
threshold = 10;
background = read(obj,1);% The first frame of the movie is read as the
background
background_bw = rgb2gray(background);% the background is converted to
grayscale
frame_size = size(background);
objwidth = frame_size(2);
objheight = frame_size(1);
foreground = zeros(objheight, objwidth);

for i = 2:no_frames

    fr = read(obj,i);% every frame of the movie is read
    frame_bw = rgb2gray(fr);% each frame is converted to grayscale

    frame_diff = abs(double(frame_bw) - double(background_bw));%
negative values are prevented by taking the absolute

    for j=1:objwidth% checking if frame_difference > threshold pixel in
foreground
        for k=1:objheight
            if ((frame_diff(k,j) > threshold))
                foreground(k,j) = frame_bw(k,j);
            else
```

```
                foreground(k,j) = 0;
            end
        end
    end

    background_bw = frame_bw;

    writeVideo(obj2,uint8(foreground));% the resultant set of frames
are written into a video format

end
close(obj2);
```

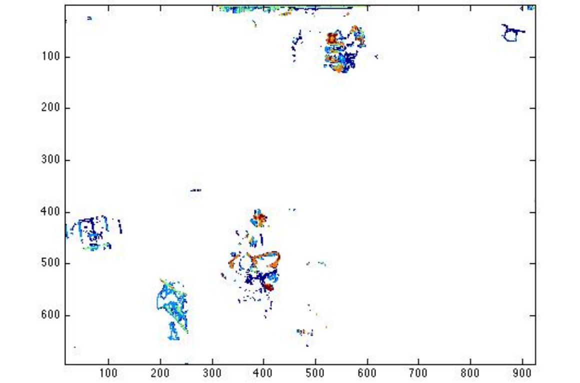
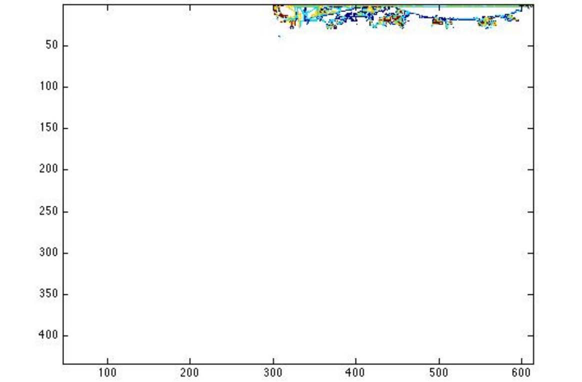
Question 5

Analysis:

1) From the foreground images, using the imcontour function plots the contour.

Results:

The contour for the Approximate Median filter and the Frame Difference filter methods are shown below.

	
Approximate Median filter Contour	Frame Difference filter Contour

Matlab Code:

```
% Approximate Median filter method
obj = VideoReader('/Users/Adwaith/18-798/asgn5/Q4/store1(1).mov');
no_frames = get(obj, 'numberOfframes');
obj2 = VideoWriter('/Users/Adwaith/18-798/asgn5/Q4/q4_video');
obj2.FrameRate = 5;

open(obj2);
threshold = 25;
background = read(obj,1);% The first frame of the movie is read as the
background
background_bw = double(rgb2gray(background));% the background is
converted to grayscale
frame_size = size(background);
objwidth = frame_size(2);
objheight = frame_size(1);
foreground = zeros(objheight, objwidth);

for i = 2:no_frames
    frame = read(obj,i);% every frame of the movie is read
    frame_bw = rgb2gray(frame);% each frame is converted to grayscale

    frame_difference = abs(double(frame_bw) - double(background_bw));%
negative values are prevented by taking the absolute

    for j=1:objwidth% checking if frame_difference > threshold pixel in
```

```
foreground
         for k=1:objheight

             if ((frame_difference(k,j) > threshold))
                 foreground(k,j) = frame_bw(k,j);
             else
                 foreground(k,j) = 0;
             end

             if (frame_bw(k,j) > background_bw(k,j))
                 background_bw(k,j) = background_bw(k,j) + 1;
             elseif (frame_bw(k,j) < background_bw(k,j))
                 background_bw(k,j) = background_bw(k,j) - 1;
             end

         end
    end

     writeVideo(obj2,uint8(foreground));% the resultant set of frames
are written into a video format

end
title('Contour of extracted objects using Approximate median filter');
imcontour(foreground);
hold on;
close(obj2);

% Frame difference method
obj = VideoReader('/Users/Adwaith/18-798/asgn5/Q4/store1(1).mov');
no_frames = get(obj, 'numberOfFrames');
obj2 = VideoWriter('/Users/Adwaith/18-798/asgn5/Q4/q4_video1');
obj2.FrameRate = 5;

open(obj2);
threshold = 10;
background = read(obj,1);% The first frame of the movie is read as the
background
background_bw = rgb2gray(background);% the background is converted to
grayscale
frame_size = size(background);
objwidth = frame_size(2);
objheight = frame_size(1);
foreground = zeros(objheight, objwidth);

for i = 2:no_frames

    fr = read(obj,i);% every frame of the movie is read
    frame_bw = rgb2gray(fr);% each frame is converted to grayscale

    frame_diff = abs(double(frame_bw) - double(background_bw));%
negative values are prevented by taking the absolute

    for j=1:objwidth% checking if frame_difference > threshold pixel in
foreground
        for k=1:objheight
            if ((frame_diff(k,j) > threshold))
```

```
                foreground(k,j) = frame_bw(k,j);
            else
                foreground(k,j) = 0;
            end
        end
    end

    background_bw = frame_bw;

    writeVideo(obj2,uint8(foreground));% the resultant set of frames
are written into a video format

end
figure, title('Contour of extracted objects using Frame difference
filter');
imcontour(foreground);
hold on;
close(obj2);
```